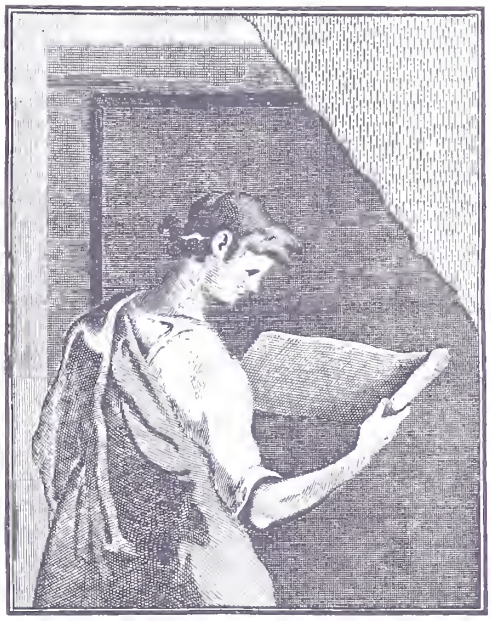


THE GETTY CENTER LIBRARY

Digitized by the Internet Archive
in 2017 with funding from
Getty Research Institute

https://archive.org/details/work1890unse

WORK

An Illustrated Magazine of Practice and Theory

FOR

ALL WORKMEN, PROFESSIONAL AND AMATEUR.

EDITED BY

FRANCIS YOUNG,

AUTHOR OF "EVERY MAN HIS OWN MECHANIC."

FROM MARCH 22, 1890, TO MARCH 14, 1891.

CASSELL & COMPANY, LIMITED:

LONDON, PARIS & MELBOURNE.

[ALL RIGHTS RESERVED.]

GETTY CENTER LIBRARY

INDEX.

LIST OF ILLUSTRATIONS.

ALARUM, ELECTRIC TIME, 157, 175, 226, 416, 582, 699, 723
Arches in Bricklaying, 364; Plan, 844
Armature, The Gramme, Parts, 725
Armchair, 409, 410, 411, 481 [596
Armchair, Designs for Turned Work,
Axles, Cap, 454

BALLOON, TOY, 245, 472, 763
Banjo Bridge, 669
Barometer, 420
Barrow, Child's, 471; Garden, 248
Baskets, Sussex Trug, 524
Battery, Gassner Dry, 497
Bedstead Hangings, 699
Bed Tray, Invalid's, 13, 175
Beehives (*see* "Hives")
Bellows, Plan to hang Forge, 57
Bench, Parts of, 471, 566, 647
Billiard Chalk Holder, 630
Bird-Cages, 21; Japanese, 445, 446
Blowpipe, Home-Made, 213
Boat, Designs, 297; Floor, 230
Boiler for Steam Launch, 569
Bookbinding, 321; Designs for Hand-Tooling, 449; Frame, 43; Imposition of Pages, 135; Machines, 136, 201, 268, 599; Ornamentation of Bible in Morocco, 69; Tools, 448, 823
Boomerang, 669
Boot Making, Last and Hook, 570; Lasting, 717; Patterns, 845; Soling and Welting, 733; Tools, etc., 796
Boot Mending, 535, 568
Box, Play, 843
Bracket in Bent Iron, 316
Bracket, Wall, 320
Brazing Band Saw, 20
Brazing Machine, 354
Bricklaying, 184, 364, 428; Tools, 120
Bridges, Rustic, 149 [304
Brushes, Preserving, 243; Sculpture,
Building, Construction, 404, 684, 685; Timbers with Brickwork, 653
Bunsen Burner, 615
Burnishing Tools, 412
Button, A Metal Screw, 242

CAB, MODEL HANSOM, 567
Camera Obscura, 403
Canoe, A Canvas, 452
Canoe Building, 5, 85, 156
Canopy for Bedstead, 541, 542
Carpenter's Bench, 471, 566, 647
Carriage, Cricket Seat for, 171; Cushions, 436
Cart Wheel, 225
Carts, Donkey, 658; Hand, 717
Cartridge Case, Ellicott's Patent, 274
Carved Panels, 125
Carved Wood Cover for WORK, 25
Case for Stuffed Birds, 60
Catamaran, 670
Catch for Drawers, etc., 306
Ceiling, Decoration in Stencil, 132
Chair, Child's, 104; Child's Rocking, 617; for Church, 584; Folding, 241, 260, 537; Oak, 811; Stanley's Coventry, 646
Chapel, Design for, 504
Child's Reins and Braces, 568
Chimney, Pot, 683; Section of Furnace, 517; Stack and Flue, 252
China and Glass Riveting, 4
Chip Carving Designs, 352, 353
Chucks, for Brace-Bit, 442; Elliptic, 429, 468, 548, 612; Oval, 28, 176
Churn, 356
Cigarette Machine, 243, 307
Cinder Sifter, 670, 797
Circles, Cutting Cardboard, 13
Class Room, Design for, 504
Clock, Grandfather's Chiming, 18th Century, 580; without Visible Works, 723; Parts of, 340, 421, 456, 487, 580, 632, 654, 665, 666, 723, 777
Clock Cases, 329, 330
Coal Saver, 471
Coffee Stall, 160
Coil, Galvanic, 358
Compasses, How to hold, 186
Copper Sulph. Precip., Ignition of, 368
Cornice Colourings, 387
Cot, A Child's, 59, 137
Cottages, Designs for, 289 [307
Cowl for Chimney, 502; Lobster Back,
Cramp, 730; A Screw, 372
Cress Block and Parts, 781
Cricket Ball, How to Make a, 152
Crucibles, 293
Crutches, Indiarubber Shoe for, 386
Cupboard Flap, 785, 786
Cupola, 227
Curtain Rod, Door, Self-Acting, 26
Cushions for Carriages, 436
Cycle Chair, Stanley's Coventry, 646
Cycles, Chain for, 535; Crank, 292; House for, 181, 182; Tyre Splicing, 98, 292; Wheel Spoking, 702; Bicycles:—Parts, 584; Bull Steering Head, 650; Interchangeable Handle-Bars, 621, 622
Cycling, Positions of Rider, 213; Pedals and Pedalling, 532
Cylinder, Parts of, 14

DADO FOR WALL, 749
Decoration of Building, Interior, Designs for, 509, 511, 512, 561
Design for Decorative Window, 689, 690, 691
Design for Fretwork, 433
Designing for WORK, Example in, 33
Design Sheet for Wood Carving, Art Supplement, 2
Designs for Wood Carving, 599
Desk for Lantern Reading, 489
Dialling, The Art and Construction of Sundials, 17; Adjustable Sundial, 566; Vertical N and S, 105; E and W, 140
Door Curtain Rod, Self-Acting, 26
Doors, 385; Draught Board for, 826; Splay for Middle Rail, 456
Dovetailing Machine, 11
Drain Pipes, 184
Drawer Supporter, 660
Drawing-Board and Instruments, 259; Table, 266; Cross-Staff, Trammel Rod, etc., 332
Drawing Ovals, 230, 419, 519, 765; Ellipse, 332, 765, 822
Dresser, Kitchen, 117, 118
Dulcimer, 13, 388, 615 [757
Dynamos, Parts, 677; The Manchester,

EASEL, A PAINTER'S, 229, 453
Egg-Cup, Holdfast, 781
Egg Mounting, 569
Egg-Shell as Flower Vase, 581
Elbow Making, 570
Electric Alarum Switch, 226
Electric Bell, Jensen, 227
Electric Bells, Connecting, 275
Electric Connection for Clock, 157, 175, 416 (*see also* "Alarum")
Electric Light Appliances, 593, 644, 725, 791, 836, 837
Electric Testing Apparatus, 402
Electrical Induction Machine, 573
Electro-Plate, Repairing, 766
Engine, Governor, 294, 683; Indicator, 77, 275; for Mine, 833; Parts, 553
Engineers' Dividing Appliance, 206
Enlarging Diagrams, Mode of, 106
Etching, 514
Exhaust Fan, 130

FAIRY BELLS, 209
Fan Blowers, 474
Fans, Japanese, 89 [178
Filings, Separating Iron and Brass,
Fire-Extinguishing Apparatus, 550
Firelighter, 699
Fireplace, 651
Fireplace Tiles, Fitting, 113
Fishing Rods, Splicing Wood, 802
Flower Vase, An Egg-Shell as, 581
Foot Warmer, Tin, 17
Forge Bellows, Plan to hang, 57
Forge Parts, A Small, 243
Forging Tools and Appliances, 168, 220, 281, 336, 397, 464, 545, 608, 609, 709, 805
Fountain, Self-Acting, 265, 455
Fret Lead Glazing, 92
Fret Machines, 91, 259, 355, 455, 701, 846; Sewing Mach. adapted as, 58, 128
Fret Saws, 191, 207, 323
Fretwork, Album Case, 737; Case to hold WORK, 9, 10; Circular Panels, 108, 109; Hanging Cabinet, 769, 770; Designs for Blotting-Book Cover, 72; Bracket, 433; Finger Plates, 337; Photo Frame, 533; Panel for Spoon Box, 749; Monogram, 843
Furnace, A Cupola, 227
Furniture:—Armchair, 409, 410, 411, 596; Bookcase, 361, 362, 529, 701; Bookcase and Wardrobe, 146; Portable Folding Bookcase, 217; Bric-à-Brac Table, 501; Chest of Drawers, 488; Chiffonier, 701, 798; Coal or Coke Box, 81, 83, 731; Commode, 733; Corner Cupboard, 484; Cupboard Bedstead, 56; Cupboard Flap, 785, 786; Dining Table, 194; Dressing Table, 325, 753, 754; Escritoire, 339, and Work Table combined, 49, 53; Fender, 651; Gipsy Table, 616; Hall Settle, 345; Medicine Chest, 668; Mirror, Carved, 668, Hanging, with Brush Box, 597; Music Cabinet, 461, 462; Music Stand, 228, 261; Music or Newspaper Easel, 613; Ottoman Couch, 729; Overmantel, 223, 377, 457, 651, 667, 829; Press Bed, 749; Table for Chess, Backgammon, and Cards, 605, 606; Sideboard, 801; Toilette and Writing Table, 400, 401; Towel Horse, 73; Umbrella Stand, 455; Wardrobe, 440; Wardrobe and Bookcase, 146; Washstand, 325; Washstand, Bamboo, 438; Work Table, Automatic Enlarging, 236; Writing Table, 669, 813; Work Table and Escritoire, 49, 53

GARDEN, CHAIR, 96, 323; Frame, 277, 797; Roller, 221; Rustic Furniture, 101; Seat, 489
Gas Engine, "Seal," 568
Gas-Fitting Syphon, 244
Gas Regulator, 454, 746
Glass, Boring Holes in, 171; Riveting, etc., 4; Painting, Designs for, 204, 205
Glass Papering, Rubber for, 27
Glazier's Diamond, 244
Glue Test Machine, 193 [825
Graining, 40, 153, 272, 381, 516, 664, 773,
Grindstone and Circular Saw, Fitting to Lathe, 513
Gun, Carriage, 569; Sling Hook, 450; Walking-Stick Air, 749
Gutter Angle, 307

HALL LAMP, 208
Hammock Making, 425 [lian, 37, 95
Harp, "Prince of Wales'," 275; Æo-
Hat Shaper, 242
Hingeing Panels, 29
Hingeing for Screens, 76
Hinges, Continuous, 487
Hives, etc., 8, 52, 121, 188, 237, 285, 333, 396, 465, 577, 693, 756, 820
Hooks for Shoe Laces, 653
Hot-Air Fittings, 43
Hot Water Connection, 308 [of, 653
Hot Water, Perkins' System, Parts
House, Wooden, 406

INCUBATORS, 59, 113, 158, 589
Indiarubber Felloe-Rims, 543
Inlay for Table, 277

JACK, A CARRIAGE, 386

KENNEL, 617
Kettle Spout, 715
Kettle Suspender, 486
Kitchen Dresser, 117, 118

LACQUERING BRASSWORK, HOOKS AND HOLDERS FOR USE IN, 36
Lamp for Hall, 208; Lantern-Reading, 489; the Moderator, 845; the Paquelin, 78; Pocket, 342
Lamp Stand in Wood, 565
Lamps, Paraffin (*see* "Paraffin")
Landscape on Spoilt Negative, 398
Lantern, Triunial Optical, 493, 563, 564, 624, 708, 776
Lathes, Attachment for, 583; Back-Gear Spindle and Headstock, 262; Carrier for, 246, 276; Eccentrics, etc., 276; Fittings, 617; Lapidary's, 473; Overhead for, 365; Wooden Rest for, 562
Leads for Painted Glass, 254
Looking-Glass, 223

MACHINE BELT, REPAIRING, 519
Machines and Appliances:—Agricultural, 534; Band-Saw, 673, 789; Beetroot from Sugar, 112; for Bending Tubes, 654; for Bookbinding, 136, 201, 268, 599; Dovetailing, 11; Drilling, 222, 557; for Metal Work, 240; Milling, 206, 222, 253; Mitreing, 90; Morticing and Boring, 90; for Polishing, 324, 338; Ruling, 527, 528; Saw and Drill, 557; Screwing, 206; for
Mandoline, 229 [Wood Bungs, 261
Mantelpiece, A Fancy, 372
Mantelpiece, with Renaissance Carving, 313, 317, 369, 370, 417
Map Holder, 169
Marbling Trough, 366; Comb, 366
Matchboarding, Application of, 628, 629, 712, 713
Measures, French and English, 309
Meat Safes, 389
Mechanical Movements, 216, 269
Melting Gold, Arrangement for, 648
Metal Sunflower, 28
Metal Work, 240, 301, 413, 469, 661
Microscopical Work, 681
Milling Machine, 222; Appliance for Sharpening Cutters, 206; Milling
Mitre Cramp, 111 [Cutters, 253
Mitre Shoot, Hodge's, 26
Models, Hansom Cab, 567; Water Gauge, 261; Yacht, 652
Mounts, Bask Mat, 841
Musical Box, 24 [Banjos, etc., 546
Musical Strings, Division of, for
Music Stand, 161; Holder, etc., 242

NEST BASKET FOR BIRDS, 699
Netting Needle, 551

OILSTONES AND MOUNTING, 549
Opals, Cutting and Polishing, 111
Operating Table for Animals, 629
Organ, Parts of, American, 633; Pipes, Connecting Action, 97
Ovals, from Circular Board, 106

PACK-SADDLES, 393
Packing-Case, 496
Paint Strainer, 434 [for, 634, 734
Painting Venetian Blinds, Trough
Panels, for Cabinet, 305; Carved, 125, 273; Design for Painting, 172, 173; Fretwork, Circular, 108, 109;
Paquelin Lamp, 78 [Hingeing, 29
Paraffin Lamp, 480, 576, 667, 696, 760, 804, 840 [187
Patterns, Mode of Setting out, 186,
Paving, Wood, 819
Pedestal, 727
Phonograph Needles, 96
Photo Frame, 680 [Metal, 141
Photo Mount, for Engravers on Soft
Photographic:—Camera, 281; Camera Bellows, 145, 764; Camera Stand, 258; Dark Room and Backgrounds, 485; Exposure Meter, 274; Furniture, 110; Instantaneous Shutter, Roller-Blind, 745; Lenses, 348; Platt's "Simplex" Repeating Flash Lamp, 810; Plate Rocker, 550; Stand Holder, 550; Tent, 683; Utilising Dry Plate Boxes, 761; View Finder, 388 [ing, 288
Picture Frames, Mouldings, 748; Nail-
Plane Sharpener, 602
Plant-Heating Case, 731
Play Box, 843
Polishing Head, 442
Polishing Machines, 324, 338
Portfolio, 454, 474
Portière, The Patent, 26
Puff, Tait's Sulphur, 158

QUILL CUT FOR BRUSH-RULING, 488

RAIN GAUGE, 278
Rat Trap, 300
Razor, How to Set, 782
Reading Desk, Adjustable, 744
Reading Desk for Bed, 259
Reading Stand, 437
Reed, Oboe, 748
Repoussé Work, Examples of and Tools for, 637, 638, 639 ["Glass")
Riveting China and Glass, 4 (*see also*
Rocking-Boat for Children, 809
Ruling Covers, 569; Machine, 527, 528; Pens, 528
Rustic, Bridge, 149; Furniture, 101

SASH MAKING, 192; Hanging, 405 [191
Saw, Band, 673, 789; Brazing a Band,
Saw Bench, Circular, 177, 206
Saw and Drill, 557
Saw Hammering, 568, 747, 827
Saw, Scroll, 13; "Gem" Portable, 746; Stanley's Portable, 502
Saw Sharpening, 701
Saw Teeth, 403
Scale, Mode of Setting out, 40
Scene Painting, Tools and Appliances, 641; Shadows and
Screen, 618, 705 [Leaves, 821
Sculpture, Mechanical Processes of, 123, 124, 189, 349, 399, 500, 501, 579
Sewing Machine adapted as Fret-Saw Machine, 58

Sewing Machine Star Discs, 432
Sharpening a Pencil, 697
Sharpening Machine for Plane Iron, Chisel, etc., 126
Shelf, Fixing, 732
Shooting Board, 165
Signalling, Apparatus for, 331
Silk Winder, 380
Sketching Outline of Subject on Cloth, 721, 793, 794
Slating, 193, 419
Slide-Rest, 174, 206
Slide-Rest Tools, Making, 28
Slide-Valve, 717, 812
Soap-Making Appliances, 817
Soldering-Bit, Support for, 714
Soldering-Bolt, 566
Soldering-Lamp, A Spirit, 763
Spectacles, More's Adjustable, 110
Spirit-Level Tubes, 44
Splicing Bicycle Tire, 98, 292
Splicing Wire Rope, 441
Spoke Repairs Tools, 568
Stationery Holder, 228
Stencil Design, 458
Still, Parts of, 651; A Small, 490
Stool, Folding, 341, 434
Stuffed Birds, Case for, 60
Sugar from Beetroot, Machinery, 112
Summer-House, Lean-to, 197, 198; An Octagonal, 65, 67
Sundials (*see* "Dials and Dialling")
Sunflower in Metal, 28
Supports in Sculpture, 256
Surface Plates, 676
Syphon in Gas-Fitting, 244

T-JOINT, 76
Telephone Circuit, 357; Connections, 98, 781; Transmitter, 45
Telephone, The Gower-Bell, 617
Telescope, Parts, 760; Stop, 293
Tenon, A Broken, 291
Tiles, 517
Time Indicator, 310
Tinmen's Mountings, 469
Tins for Pie-Making, 390
Tobacco Jar, 243
Toboggan, 715, 814
Tool Cabinet, "Compactum," 42
Tool Chest, Combination, 653
Tool Rack, 828
Tools:—Hand Beading and Sash Moulding, 598; Bench Screw, 615; Bit and Square Level, 322; Bit, Joiners', 846; Bookbinding, 448, 823; Boot Soling, 796; Brace, 306; Centre-Bit, Expanding, 434; Centring Disc and Gauge, 645; Chuck, Oval, 28; Clock Drill Stock, 322; Ratchet Drill, 210; for Graining, 40; Haft, 322; Latch Pincers, 590; for Lining, 654; Marking Gauge, 535; Mitre Shoot, Hodge's, 26; Plier Nut-Wrench, 582; Punches, 322; for Repoussé Work, 639; Router for Wood Carvers, 126; Scroll Saw, 13; for Sculpture, 740, 741; Side Rest, 243; Slide Rest, 28, 174, 206; Square Mitre and Bevel, 58; A Set Square, 185; T-Square, 625, 827; Top-Jointing, 456; Wood-Turner's Cutting Dividers, 630; Vice-Cutting Tool, 322
Trestle for Brazing Band Saw, 20
Trumpet, Chrom. Double-Slide, 550
Tubes for Engine, 668

UMBRELLA SEGMENTS, 619
Upholstering, Blind Stitch, 807

VEHICLE, A USEFUL, 419
Vellum, Stretching, for Illuminating, 719
Ventilating Fan, 566
Ventilator, 130
"Victor" Carriage, 142
Violin Bow-Guide and Music-Holder, 242; Bridges, 810; Mute, 814
WAGGON STANDARDS AND STAY, 748
Wall Decorator, Church's, 1
Washer, Greenall's Steam, 614
Watch, Parts of, 193, 456, 505
Watches, Instrument Applying Oil, 287
Water Cycle, 670
Water Gauge Model, 261
Water Jacket Cylinder Pattern, 260
Water Jet, A Converging, 190
Wax-Ends, 351
Wheels, Cog, 245; Pitch Line of Tooth, 374
Wheelbarrow (*see* "Barrow")
Window Boxes, 233
Wire for Bird-Cages, Bending and Straightening, 21, 59
Wood Bungs, Machine, 261
Wood Carving, Cover for WORK, 25; Design Sheet, Art Supplement, 2
Wood Letter Cutter, 474
Woodwork, Framing, 384, 477; Doors, 385
Writing Cabinet, A Simple, 88
Writing Desk, 144, 224
XYLOPHONE, 162
YACHT, PARTS OF MODEL, 652
ZINC PIPE, GAUGE FOR CUTTING, 98
Zither, 275

INDEX TO SHOP.

ACCUMULATORS, 226, 245 (*see* "Battery")
Acid Guard, 262, 326, 374
Acorn and Cone Work, 700
Address Wanted, 29, 230, 340, 438, 442, 458, 487, 536, 602, 632
Adhesive Matter, Post-Office, 388
Agglomerate Blocks, 30, 98
Air Gas Mixtures, 246
Air, Machine for Current of, 159
Air-Pump, 28, 178, 520, 733
Alarm Bell, Electric, for Trains, 442
Alarum Bell, 308
Alarum, Electric, Switch for, 226
Alarum, Electric Time, 28, 45, 61, 95, 144, 175, 421, 435, 649, 699, 747
Alloy, 764
Alum, Powdering Crystals, 341
Aluminium, 177
Analysing Metals, 390
Angles, Ogee, 307
Angling, 812
Antimonial Lead, 422
Antimony, Butter of, 552
Appointment, 634
Apprenticeship, 747; Electrical Engineer, 702; Marine Engineer, 78
Aquarium, 61, 373, 390, 457, 554, 765, 813
Arch, 844; Elliptic, 763
Armature, 307, 342
Artificial, Eyes, 522, 618; Leg, 94, 129; Water, 522, 602, 731
Artists' Canvas, 12, 765
Asbestos Cloth, 521

BAGATELLE TABLE, 29, 437, 553
Balloons, 245, 422, 472, 618, 762, 813
Bamboo Canes, 60, 97, 177; Bending, 765; Cabinet, 277; Fastening, 76
Banjo Making, 208, 374, 422, 471, 521, 586, 602, 814, 828; Bridge, 669; Fretting, 292, 355, 435, 503, 583, 631, 731, 747
Barbotine Modelling, 127
Barometer, 309, 420
Barrow, A Child's, 471
Basket Making, 161
Bassinette, 471, 551
Bath, Heating a, 246; Portable, 389
Battery, 442; Austin-Leclanché, 647; Bennett, 225; Bichromate, 668; Daniell, 324; Edco, 277; Fuller, 29; Galvanic, 209, 226, 601; Gassner, 45, 97, 143, 146; Leclanché, 230, 260, 310, 506, 764; Primary, 765; Smee, 732; Storage, 44, 266, 245, 307, 632
Battery for Alarum, 62, 145; Blocks for Cell, 30, 98; Capability of, 226; Casting Lead Caps to Carbons, 230; for Coil, 230, 387; for Electric Bell, 422; for Electric Light, 145, 176, 193, 230, 307, 310, 552, 764, 829; Electric Scarf Pin, 355; Granule Carbon, 342, 732; Plates for Storage, 307; Salt in Bunsen, 584; Sealing Cells, 308, 796; Shock from Leclanché, 260; for Telephone, 129, 339; Where to Buy, 27
Bearings, Worn, 326, 435
Bed Tray, Invalid's, 13, 175
Bedstead, Draping for, 699
Bellows, Hydrostatic, 634
Bell-shaped Vessels, 538
Belts Slipping, 766
Bench, 749; Carpenter's, 471, 647; Screw, 441, 615; Stop, 339
Bending Brass Beading, 653
Beryl, 30
Bicarbonate of Potash, 668
Bicycles (*see* "Cycles")
Billiard Table, 374
Binding Screws, Zinc, 98
Bird Cages, 602, 763; Sticks for Wooden, 208
Bird Skins, Preparing, 276
Bird Stuffing, 194
Birds, Stuffed, Case for, 60
Bismarck Brown, 701
Bismuth Sample, 437
Blackboards, Preparation of, 650, 686, 718, 750, 798, 814, 830
Blacking, Receipe for, 586
Blacklead, 293
Black, Dead, for Brass, 490
Black Stone, 456
Blacksmithing, 634
Blast Pressure, 374
Blinds, Rollers, 442; Wire Gauze, Converting, 60; Venetian, 373, 585, 586, 602, 634, 715, 733, 734
Blocking, 505
Blocking Powder, 602
Blouses, Painters', 210
Blowpipe, 243, 458, 653
Boat Building, 30, 113, 175, 230; Small Screw, 651
Blueing Pointers, 796
Boiler, Cleaning, 340; Deposit, 259; for Engine, 75, 308, 765; Locomotive, 438; Making, 75; Rusty, 307
Bolt Heads, 733
Book Boards, 781; Plough, 392
Books:—Accumulators, 192; Alloys, 127; Architects', 843; Banjo, 228; Bee-Keepers', 114; Blacksmithing, 685; on Boiler and Bridge Making, 633; Boot and Shoe Trade, 653; Bricks and Tiles, 421; Builder's, 95, 112, 278, 435, 843; Carpentering, 113, 731; Coach-Building, 829; Colour, 717; Copperplate Engraving, 340; Crests and Monograms, 797; Cutting Tools, 46; Decorators', 44; Draughtsmanship, 421, 686; Dyeing, 458; Dynamo, 144, 504, 829; Electric Bells, 732; Electric Lighting, 506; Electrical Engineering, 520; Electricity, 535, 717, 827; Electro-Plating, 683; Electrotyping, 844; Engine Indicator, 77; Engine, Horizontal, 75; Engineering, 455; Engraving and Etching, 97; "Our Eyes," 647; French Polishing, 277; Glass Firing, 78; Graining, 585; Illuminating and Missal Painting, 798; Inlaying, 28; Intensity Coils, 600; Iron Founding, 227; Ironwork, 648; Joinery, 76, 731; Lathes and Turning, 45; Lenses, 98; Levelling, 797; Lithography, 389; Locks, 114; Locomotives, 390; Machinists, 422; Machine Design, 227; Magic Lantern, 178; Marbling, 535, Book Edges, 683; Mattress and Bedding, 371; Mensuration, 797; Metal Working, 207, 225, 294, 308, 355; Metal Work, Sheet, 94, 130, 191, 387, 435, 487; Mill Gearing, 227; Mineral Water Trade, 223; Motors, Electro, 747; Organ Building, 76, 92, 97, 160, 339, 538, 649; Painting, Coach, 278; Painting, House, 162, 827; Patentees, 734; Pattern Making, 14, 227; Perspective, 647; Photographic, 113; Physiology, Human, 374; Picture-Frame Making, 356, 685; Pigeon Keeper, 717; Plumbing, 648, 780; Preserves, 748; Printing, 143; Rabbit Keeper, 717; Saws, Circular, 683; Scales and Weights, 358; Ship Joinery, 293; for Sign Writers, 144, 340, 358, 648, 716; Slöjd, 97; Smiths' Work, 278; Social Questions, 244; Surveying, 504, 797; Templeton, 227; Timber, 731; Tinman's Patterns, 223; Tinsmiths', 340; Tin-Plate Work, 535, 731; Turning, 28; Upholstery, 685; Watch and Clockmakers', 77, 223, 339, 404; Weights of Metals, 632; Wire Working, 765; Wood Carving, 277; Wood Engraving, 62; Workshop Receipts, Spon's, 599
Bookbinders' Materials, 224, 355
Bookbinding, 43, 44, 113, 162, 261, 292, 310, 389, 457, 505, 586, 781; Backs of Books, 94, 245; Colour for Edges, 797; Cutting Edges, 92, 93, 113; End Papers, 61; Gold Blocking, 60, 294; Heating Tools, 686, 734; Lettering Backs, 94; Marbling, 113; Metal Rims, 797; Monogram in Gold, 325; Press, 599; Price List, 748; to Remove Impression from Cover, 781; Tools, 129
Boomerang, 669
Boot and Shoe Making, 13, 143, 569, 650, 717, 750; Last Iron, 490, 830; Patterns, 845; Tops, Restoring, 389; Varnish, 339; Water-tight, 30, 685; Wax-Ends, 260
Boot Mending, 535; Sewn Heels, 568; Soling, 796; Welting, 733
Boring out Rifle, 438
Bottles, 29; Glass, 536
Boxes, Pill, 439; for Ointment, 538
Bracket Pieces, Cutting, 129
Brake, Westinghouse, 76
Brass, 731
Brass, Bushes, Converting, 243; Castings, 76; Cleaning, 455, 780, 843; Engravings, Monumental, 176; Melting, Temperature of, 145; Brass Plates, 812; Fitting Compo for, 551; for Engraving, Preparation of, 178; Fixing to Wood, 224; Polishing, 243, 324, 538; Sheet, 225, 489
Brazed Work, Finishing, 307
Brazing Band Saw, 59, 191, 262, 326, 374, 456; Brazing, Cold, 633; Brazing Cycle Joints, 60; Frames, 91; Brazing Lathe Head, 387
Bricks, 667; Bricklaying, 113, 552; Brickwork, 715
Bristles in Brushes, 650
Bronzes, 145, 324; Black, for Brass, 387; Copper, 226, 390; Steel, 390
Bronzing Piano Frame, 129; Plaster of Paris, 310
Brooch Pins, 261
Bruises in Plate, 618, 766
Bruises in Brass Instruments, 780
Brush, A Rotary, 618
Brushes, Preserving, 243
Buckle, 357
Bungs, Wood, 261
Bunsen Burner, 615
Burnishing, Brass, 442; Gold, 227

CABINET FITTINGS, 602, 670, 750
Cabinet Plans, 95
Cabins, 176
Cages, Metal, 455
Calcarium, 553
Camera Obscura, 403, 647
Canada Balsam Cement, 45, 419
Canoe Building, 584
Cantor Lectures, 436
Canvas, 226, 458, 553, 568, 647
Canvas, Artists', Preparation, 12, 765
Cap, Carpenter's Paper, 437
Cardboard, 830; Cutting Circles, 13; Letters, 648; Models, 94, 634, 718, 828, 830
Cards, 91, 669
Card Surface, 718
Carpentering, 46
Carpentry, Portable, 826
Carriage Cushions, 436, 535
Cartridge Ejector, 389
Carts:—Battlesden, 29, 225, 471, 717; Dog, 701; Hand, 225, 717; Mail, 60, 405, 419; Milk Float, 830; Small Cart, 765; Spokes, 321; Waggon, 748; Waterproofing Wheel, 686
Cartwrighting, 812
Carved Bowls, 716; Wood Impressions, 224; Wood Tobacco Jar, 243
Carved Oak Mirror Frame, 668
Carving in Stone, 309
Case Hardening, 14, 95, 144, 191, 207, 812
Case for Heating Plant, 731
Casting Brass, 13, 76, 422, 812; in Plaster, 161, 520; Small Steel, 129
Castings, 504, 782; Metal, 91
Casts, Cleaning Plaster, 455, 601
Catamaran, 670
Catgut, 830
Caulking, Rushes for, 326
Ceiling, Colouring and Whitewashing, 30, 130, 277, 294
Celluloid, 405
Cement, 436; to resist Carbon Bi-sulphide, 471; Fastener, 98; Fresco, 700; for Glass, 650, 750; fixing Iron in Wood (Waterproof), 406; Attaching Metal to Marble, 551; Lamp, 487; Softening Plaster, 471
Chains, Cast, 145
Chair, Cane, 176, 765; Church, 584
Chair, Folding, 76, 260, 455, 535, 537; Riveting, 12, 61, 111
Chair, Garden, 96, 323; Oak, 811; Renovating, 277; Repairs, 98; Seats, 747; Staining, 96; Stuffing, 584
Chapel and Class-Room, 504
Charcoal Iron, 633
Chasing, Silver, 551
Cheval Screen, 61
Chilblains, 811
Chimney, Pot, 683; Smoky, 46, 811
China, 536; Cement, 145; Drilling, 177, 309, 323; Repairs, 145; Riveting, 46, 127
Chip Carving, 747
Chocolate-Making Appliances, 602
Chucks, 473; for Brace, 357, 442; Combination, 716, 797; Design for, 28; Lead, 162; Oval, 176, 193, 631; Spiral, 633
Churn, Tinplate, 356
Cigarettes, 420
Cigarette Maker, 94, 191, 243, 307
Cinder Sifter, 670, 797
Circles, Cutting, 13; Circumference of, 631; on Circle Templates, 844
Classes in Winter, 387, 519
Classes, Winter, Cabinet Making, 441; Carpentering, 747; Drawing, 647; Electricity, 765, 830; Etching, 731; Plumbing, 97; Technical, 648
Cleaning Gold Bands, 223
Cleaning Terra-Cotta, 765, 829
Clog Irons, 14
Cloth, American, 439
Cloth, Oil from, 339
Coal Bunker, 653
Coal Saver, 471, 535, 602
Coffee Stall, 160
Coffins, 439

Clocks, 226, 373, 404, 455, 487, 716; Bushes, 160; Case-Carving, 61; Cleaning, 553, 748, 827; Case Designs, 94; Dial, 355, 650; Electric Clock, 520, 763; Grandfather, 747; Making, 654, 844; Materials, 159, 244, 371; Movement, 98; Pendulum, 421; Regulating, 228; Repairs, 435, 456, 601, 648; Striking American, 632; Striking Wires, 310; Ticking of Alarm Clock, 225; Weights, 95; Parts, A Chime, 276
Coil, 228, 358, 506, 562, 634, 651, 715; Condenser, 373; Wire, 309, 339
Cold Room, A, 782
Collieries, 538, 618
Colour Box, 114; Colours, 44, 357, 387
Compo. for Top Pomatum Pot, 701
Compo. filling Pearl, etc., 495, 813
Composition of Raised Ornaments, 98
Concertina, Tuning, 585, 686, 750
Concreting Yard, 372
Condensers, 683
Condensing Steam, 631
Copper Analysis, 358
Copper Bronzing, 226; Deposit, 699
Coppering Blotting-Paper, 192; Solution, 616
Copying Apparatus (*see* "Graph")
Copyright, 176, 403
Coral, Cleaning, 601
Cork, 650; for Life Belts, 798
Cornice, Window, 843
Cot, A Child's, 59, 192, 537
Cottages, Design for, 653
Coupling Truck, 406 [Plush, 29
Cover for Book, 194; for Box, in
Cowl, A Lobster Back, 307
Cramp and Block, 781
Cress, 781
Crucibles, 192, 309, 731
Crutches, Rubber Shoes, 504, 522, 536
Crystoleum Painting, 356, 747, 764
Cupboards, Unsightly, 583
Cushions for Carriage, 436, 535
Cuts, Treatment of, 12, 143 [473
Cutting Agates, Jaspers, and Opals,
Cutting and Polishing Opals, 111
Cycles, 29, 374, 439, 455; Brazing, 60, 91; Bright Parts, 504; Cement, 455; Chain for, 535; Crank, Safety, 292; Crank, Keying, 521; "Diamond" Safety, 536; Enamel, 210, 537; Gearing, 422; Lamps, 585, 600; Makers, 405; Oil, 372; Painting, 373; Plating, 324, 796; Repairs, 60, 292, 373; Seats, 419; Tire, Splicing, 98; Tire, Cementing, 828; Springs, 490; Victor Cycle Company, 209; Wheel, Respoking, 702; — Bicycles, 584; Safety, 371, 404, 650; — Tricycles, 208, 584; Hut, 631; Wooden, 765
Cylinder, 14, 747; Castings of, 276

DADO FOR WALL, 749
Deafness, 161
Decorative Process, 44
Delta Metal, 177
Designs, 585, 648, 669, 763; Calico, 814;
Diagonals, 615 [Perforating, 472
Diagram, Enlarging, 472
Dialling, 311, 438, 731, 733; Dials, 60
Dial, fixing by the Compass, 436
Diamond for Boring Rocks, 780; Setting Glazier's, 244
Diaphragm Parchment, 781
Die Stamping, 781
Die Tool Box, 160
Distemper, Washable, 112
Distempering, 145, 277, 294, 716
Diving, Sea, 536
Doll's House, 669
Door Fastener, 177
Dovetailing, 176, 437, 669
Dowel Making, 191
Dragon's Blood, 733, 780
Drain Pipes for Decorating, 650
Draught Board, 782, 826
Draughtsman's Work, 647
Draughtsmanship, 371, 372
Drawing, 114, 339; Backlined, 683; Ellipse, 765; Map and Plan, 388; Materials, 633; Mechanical, 374; Ovals, 230, 419, 519, 599, 631, 765; to Scale, 62; Table, 521
Drawings and Specifications, 632
Drawings, 309; to take Stain out of,
Dresser, 437 [421; Restoring, 843
Dulcimer, 13, 44, 60, 113, 159, 207, 208, 225, 435, 521, 601, 615, 649, 716, 731, 764; Drawings, 487; Playing, 436; Stand, 223; Strings, 355; Tuning,
Dye for Brown Leather, 225 [388
Dyeing, 390
Dynamo, Gramme, 246, 323, 520, 683; Manchester, 61
Dynamos, 127, 358, 440, 489, 632, 731, 765, 827, 830, 844; Armature, 307; Attendance on, 371; Castings, 489, 552, 844; Papers on, 310; Resistance Coil, 442; Shock from, 844; Speed, 649; Technical Work, 176; Winding, 161, 177, 246, 683, 843

EAR DRUMS, 129, 143
Earthenware, Drilling, 144; Glue for,
Easel, 128, 229, 374 [27, 143
Ebonite, 160, 225
Eccentric Fixing, 77
Edge, Round, on Wood, 716
Egg-Cup, "Holdfast," 781
Eggs, Mounting, 569
Elastic, 92
Elastic Wheel, 45
Elbow Making, 570
Electrical, Engineering, 520, 536, 631, 701, 702; Experiments, 552, 844; Queries, 98, 176; Resistance, 700; Science, 827; Tables, 159; Vendor of Goods, 226
Electric Bells, 98, 127, 144, 146, 275, 276, 387, 552, 601, 702, 812; Converting Bicycle Bell, 92; Jensen's, 227, 504, 617; Line Wires, 715
Electric Belt, 325, 373, 827; Depilatory, 308, 487; Machine, 442, 521, 552, 647; Repeater, 145
Electric Lamps and Lighting, 13, 27, 44, 45, 62, 76, 113, 191, 209, 259, 275, 308, 339, 355, 442, 506, 568, 600, 668, 701, 731, 765, 782, 829, 844; for Cycles, 585; Gas Lighter, 763; Guards for Lamps, 406; Night Light, 764; Scarf Pin, 520, 599, 793; Windmill for, 230, 600; Wiring House, 632
Electricity for Cure of Disease, 325, 373, 536; Direction of Current, 584
Electro-Magnet, 358; for Cleaning
Electricians, 538 [Brass Filings, 178
Electro-Gilding, 649
Electrotype, 228; Copies of Leaves, 844; Copying Busts in, 499; Stripping, 75
Electrotyping, 387, 520, 732; Bath, 422; Composition, 145; Stereos, 143
Elephant's Teeth, Working, 326
Emigration to South Africa, 731
Enamel, 586; Black, for Metal, 765; Inlay, 813
Enamel Paint, 145; Foochow, 455
Enamelled Pails, 716
Enamel Painted Furniture, 276
Enamelling, 437; Bath, 160
Engine, Castings, 325; Expansion, 373; Governor, 294, 308, 405, 653, 683; Horse Power of, 275, 812; Indicator, 77; Slack, 828; Tubes for, 668; Small Wheels for, 92
Engineering, 372, 437
Engines, 342, 471, 553, 617, 812; Gas, 310, 372, 537, 568, 683, 748; the "Seal" Gas, 647, 717, 732, 748, 811; Horizontal, 537, 716; Hot-Air, 94; Petroleum, 733; Steam, 538, 747
Engraver's Wax, 178
Engraving, 162; Brass Plates, 178; on Metal, 308, 765; Name Plates, 339; Whetting Graver, 504; Stones, 647
Erratum, 551, 715, 810, 843
Etching:—Acids, 651, 669; on Copper, 488; on Steel, 5; Photo Zinc, 30
Etchings, 309
Examination (Elementary) Papers Building Construction, 1890, 684
Examinations, Building Trades, 404
Exhaust Fan, 30, 130
Exhausting Tins, 553
Exhibitions of Craft Work, 175; at
Eyes, Artificial, 522, 618 [Glasgow, 812

FAIRY BELLS, 95, 209, 323, 716
Fan Blowers, 474
Fan, Exhaust, 30, 130; for Forge, 177; A Small Fire, 650; Mounting, 554, 843; Suction of, 487
Feather Sorter, 734
Fern Case, 373, 390
Filings, Electro-Magnet for Cleaning, 178
Filter, 95, 144, 420
Fire-Irons, 29
Fire-Lighters, 143, 648, 763, 842
Fire-Proof Box, 227
Fire-Pump, 828
Fireplace, Ornamenting, 129; Tiles,
Firewood, Manufacturing, 357 [113
Firing Glass Facias, 78; Terra-Cotta Busts, 732
Fishing Rod, 520, 812; Japanese, 96
Fixing Memorial Stones, 389
Float, Cylinder, 843
Flute, Repairing, 733
Fog Signal, Patent, 341
Foliate, 442
Folio for WORK, 474
Foot-Warmer, 97, 309
Force Pump, 797
Forge, 243, 275; Fan, 177
Forgings, Light, 192
Formulæ, 699, 780; for H. P., 718, 798
Foundry Plant, 616
Fountain, 456, 631; Self-Acting, 373, 421, 455, 473, 537, 584, 765
Freezing Liquids, 294, 455
Fret Dealer, 371; Designs, 97, 143, 159, 275, 765; Machine, 13, 30, 43, 91, 146, 259, 323, 355, 455, 649, 701, 764, 765, 811, 846
Fret-Lead Glazing, 92
Fret Machine, Converting a Sewing-Machine Stand into a, 128
Fret Polishing, 14
Fret Saw, 159, 191, 632, 764, 765; Griffin's, 259; Hint, 207; Wire Thread, 12, 278, 700, 813
Fret-Wood Dealers, 439
Frotwork, 227, 275, 536, 829; Cabinet, 602; Copying Patterns, 12; Frame, 191, 390; Monogram, 843; Stencils, 520, 718; Panel for Spoon Box, 749
Frosting, 145, 648, 814; Lathe Beds, 618; Window, 734
Fumigating Mahogany, 92; Oak, 29
Furniture:—Bookcase, 146, 259, 371, 439, 551, 600; Chair, Oak, 811; Coal Box, 731; Combination Bedroom Suite, 29, 59; Chiffonier, 308, 570, 701, 798; Commode, 733; Dining-Table, 98, 194, 568; Dining-Room Couch, 62; Drawers, Chest of, 488; Dressing Table, 325; Duchesse Table, 161; Escritoire, 339; Fender, 651; Gipsy Table, 616; Hat Stand, 96; Overmantel, 46, 96, 262, 419, 457, 474, 520, 651, 667, 733, 829, 843; Portable Music Stand, 261; Press Bed, 749; Secretaire, 278; Sideboard, 75, 114, 227; Umbrella Stand 96, 455; Wardrobe, 146, 440; Washstand, 309, 325, 438; Writing Cabinet, 797; Writing Table, 669, 813
Furniture, Frames, 260; Repairing, 733; Wood, 506

GALVANISING, 129
Galvanometer, 308, 732 [Seat, 489
Garden, Chair, 96; Frame, 277, 797;
Gas, Burners, 13, 44, 292, 535; Governor, 842; Lighter, Electric, 763; Matters, 128; Meter, 422
Gates, 686, 750
Gelatine and Glue, 129
Geometry, etc., 583
Gesso Work, 27, 223, 246, 308, 355, 505
Gilding, 215, 261, 602, 634, 649, 686, 701, 718, 750; Coin, 700; Copper, 601; Solution, 144; Tarnished, 96
Girder, Camber of, 536
Glacier Window Decorations, 143
Glass:—Bevelled, 114; Blowing, 371, 389; Boring, 14, 29; Bottles, 536; Burning Kiln, 46; Calculator, 457, 554; Cement, 750, 766; Cutting Bottle in two, 647; Drill, 309, 323; Embossing, 261, 357, 436, 601; Firing, 78; Flexible, 503; Frosted Imitation, 535, 782; Gilding, 357; Grinding, 29, 60; Lettering, 701; Painting, 144, 224, 226, 458, 828; Pen, 14; for Picture, 828; P. R. P., 191; Polishing, 161; Powdered, 536; Signs, 522, 602; Silvering, 44, 62, 373, 419, 422, 503, 536; Silvered, Fluted, 731; Stained Imitation, 143; Tube, 538; Water Glass, 127; Writing on, 487, 732
Glass-Papering Hints, 27
Glaze for Porcelain, 406
Glaze for White Shirts, 506
Glazier's Diamonds, 244
Glue and Gelatine, 129
Glue, Brush, Hard, 96; for Earthenware, 27, 143; Marine, 631; Test, Quality of, 193; Transparent, 75
Gold, Acid on, 371
Gold, Bands, Cleaning, 223; Blocking, 487; Burnishing, 227; Dissolving, 585; Leaf, 207, 310, 554; Lettering (Japanners'), 112; Lines, 586; Melting in Small Quantities, 648
Gongs, 78, 175 [716, 717
Graining, 145, 194, 210, 553, 601, 683,
Graph and Copying Apparatus, 44, 113, 405, 442, 456, 522, 602, 747; Ink,
Grate, 651 [405
Gravers, Whetting, 733
Gravestone Letters, 538
Greenhouse, 650; Door, 310, 421; Heating, 310, 686; Ventilating, 310
Grinding, Scissor, 387
Grindstone, 340
Guitar Making, 422
Gum, Adhesive, 472
Gun, A Walking-Stick, 504, 749
Gun Barrel, Browning, 734, 765, 811, 814; Blueing, 632, 634
Gun Carriage, 569
Gutta-Percha, 827; for Barbotine
Gypsum, 586, 670 [Work, 389

HAIR-LINES, SPINNING, 259
Hammering Plates, 631
Hammock Stand, 405; String, 192
Handles, Compositions for, 339
Handrailing, 176, 210
Hardening Steel, 601, 617; Tools, 372
Harmonium Reeds, 143
Harness Making, 812
Harp, 161, 458, 522; Æolian, 95, 175, 440; Prince of Wales', 439
Heat from Stove Pipe, 457
Heating, Greenhouse, 310, 686; Plant
Heliographs, 421 [Case, 521
Help, Mechanical, in Making Inven-
Hinge, 521; Spring, 339 [tion, 764
Hinges for Screen, 76, 227, 487
Hints from New Zealand, Various, 27
Hives, Bee, 114, 372
Hoist, Hand-Power, 324
Home-Made Articles, 27
Horsehair, 830
Hot-Air Fitting, 43
Hot Water, Apparatus, 419; Engineering, 506; Heating, 97, 653; Supply, 292; Towel Airer, 308
House, Agency, 325; Wooden, 406
Hutch, 632
Hydraulic Jack, 616

ICE-CREAM FREEZER, 618
Icicles, Imitation, 765
Idea, Merits on an, 77
Illuminating, 601, 798, 830
Improver, 797
Incubation, 419
Incubators, 13, 59, 113, 193, 223, 224, 535, 617, 762, 764; Champion, 667
Indiarubber, 292; Gas Bags, Repairing, 440; Letters, 96; Melting for Moulding, 669; Oddments, 700; Ornaments, 734; Process, 700; Sheeting, 438; Stamps, 92, 129, 210, 763, 813; Stamp Thermometer, 245; Stamp Ink, 30; Tubing for Hookahs, 520; Type, 143, 830; Tyres, 633
Induction Coils, 358
Initials, 357, 437
Inks, for Block Printing on Calico, 371; for Copying Pad, 389; Green, Writing, 341; for Indiarubber Stamp, 30; Jet Black, 371, 420; Solid, for Stencils, 780; for Typewriter, 91, 98; Waterproof Red,
Inlay Shading with Hot Sand, 390 [552
Inlaying, 75, 193, 340, 405, 764, 827; Chair, 76; Imitation of, 373, 843;
Insulated Wire, 323 [Top, 277
Iron, Founding, 227; Goods, Electro-Tinning, 145; Houses, 764; Sheet, 60, 648; Signboards, Enamelled, 98; Sticking to Wood, 388; Strip, 94; Weight of, 92, 175
Iron, Cast, Polished, 404; Softening,
Ironwork, Ornamental, 421 [472
Iron, Wrought, 97
Ivorine, 75
Ivory, 246, 568; Imitation, 75, 781; Initials on, 340; Vegetable, 61; Printing on (Cutlery), 650

JAPANESE MATERIALS, 261
Jewellers' Waste, 615
Joining Gut-Bands, 797
Joint Making, 208
Jointing Boards, 191
Jug Mending, 490

KALEIDOSCOPE, COMPOUND, 732, 812
Kennel, 355, 617
Kettle Spouts, 715, 826
Key, 143, 648

LABELS, FIXING ON TIN, 441; Parcels,
Laces, Leather, 130; Machine, 44 [421
Lacquer, Brass, 23, 75, 551, 731; Cleaning Brass, 843; Cold, 455; Plating
Lacquering Zinc, 585 [Figures, 61
Lamp, 436, 829; Burner for, 358; Chimneys, 339; Fixing, 356; Glass, 389; Hall, 208; Moderator, 845; Paquelin, 78, 406, 552; Paraffin, 667, 685; for Pocket, 191, 262, 326, 342, 371; Reading for Lantern, 489
Lantern, 228, 520, 634, 716, 747, 828
Lantern Lamp, 488
Lantern Lens, 473
Lantern Slides, 259, 325; Painting, 13, 77, 228, 632; Transfers, 309, 457, 458
Lantern Stands, 504
Lantern, Triunial Optical, 632; Triple Optical, 633, 733
Lapidary Work, 262
Lathes, 29, 144, 226, 473, 586, 602, 618, 670, 683, 685, 718, 747, 764, 780; Attachment for, 583; Brazing Head, 387; Carrier for, 246; Chuck, 442; Conversion to, 276; Dimensions, 262; Earning Money with, 652; Fittings, 617; Fly Wheel, 441; Home-Made, 504; Improved Attachment for, 733; Mandrel for, 159, 243, 245, 246, 259, 326, 371, 372, 455, 632, 650, 700; Overhead, 519; Planing, 93; Price of, 372; Second-hand, 489; Speed for, 193; Tools,
Laths, Splitting, 224 [77
Lawn Mower, 162
Laws of Chance, 97
Lead Lights, Cementing, 438
Lead, Melting, 649; Mining, 388
Leather, 829; Belts, Cleaning, 309; Currying, 93; Renovating, 144; Work, 716
Lectures, Cantor, 436
Lectures in Drawing, 647
Lenses, 618, 632, 812; Micro, 97, 193
Lenses, Polishing, 371
Letters, Body and Glaze, 600; Cardboard, 648; Opal, 581; Wood, for Outdoor Signs, 521
Library, Lending, 223
Life-Saving Apparatus, 456
Limelight Boxes, Theatrical, 144
Lincrusta Decoration, 490; Hanging, 227; Methods, 144
Lining (*see* "Painting")
Linoleum, 114

Lithographs, 309
Lithography, 129, 162, 374; Solid Black from Stone, 390; Stone Press, 602; Transfers, 127, 341; Transferring Litter, 685 [to Wood, 75
Lock, Picking, 209, 716; Repairs, 145; Unpickable, 648; Maker, 207
Looking Glass, 223
Lubricant, 145
Lucide, 341

MACHINE:—Belts, Leather and Cotton, 519; for Cabinet Makers, 93; Cigarette (*see* "C"); Cork-Cutting, 504, 554; Cutting, 780; Cutting Cardboard, 830; Grinding, 669; Magnetic Electric, 489; Marquetry, 371; Mineing, 552; Mitre-Cutting, 96, 828; Moulding, 309; Netting, 599, 718; Pie-Making, 309, 390; Sawing, 585, 731; Saw and Drill, 716; Band-Saw, 765; Circular Saw Bench, 782; Tinsmith's, 357; Weighing, 538, 618, 683; Wood-Slicing, 782
Magic Lantern (*see* "Lantern")
Magic Picture, 702
Magnesium Wire, 387, 520
Magnets, Permanent, 654
Magnetic Belts, 226, 246
Magnetising Steel, 600
Mail-Cart Wheels, 227
Maize, Treatment, 95
Mallcable Castings, 161, 276
Mandoline Making, 229, 522
Mantelpiece, 372
Manufactories of Pins, Mohair Laces, and Elastic, 472 [93
Map, Cleaning, 162; Globe, 701; Linen,
Marble, Artificial, 227; Cleaning, 458; Imitation, 112; Removing Discolorations, 406, 437
Marbling, 175, 210, 585
Masonry, 436
Mattress, 554; Spring, 76, 275, 811
Measures, French and English, 309
Measurement, Superficial, 293
Measuring Timber, 43
Meat Safes, 389
Mechanics' Tips, 436
Medical Coil, 308, 326
Medicine Chest, Wooden, 668
Melting Gold Dust, 293
Metal, Coloured, 521; fixing to Marble, 551; Plate Pickling, 355; Purchasing, 437; for Toys, 828; Sample, 437; Stresses of, 191; Soldiers, 488
Metal Work, Sheet, 93; Black, 406
Mica, 226, 339
Microphone, 112
Microscope, 60, 731; Lenses, 97, 193; Mounting, 293
Millboard Rings, 473
Milling Cutters, 111
Mirror Frame, 668
Mitre Block, 143
Mitre Cramps, 43, 111, 114, 143, 175, 275, 326, 371, 387, 781
Mitre, Cutting, 207, 323, 419; Planing, 813; Shoot, 814
Model Making and Tools, 91
Modelling, 208, 373; Barbotine, 127; in Clay, 96
Modelling and Casting Bust, 307
Models, Cardboard, 94, 634, 718, 828, 830; Chinese or Japanese, 207; Cutter, 585; Electric Railway, 702; Hansom Cab, 567; Locomotives, 75, 114, 176, 632; Marine Engine, 797; Paddles for Steamer, 633; Sailor, 718; Schooner, 782; Mechanical Ship, 716; Spring for, 421; Steam Engine, 94; Steam Launch, 129, 357, 569; Telegraph, 45; Water Gauge, 261, 670; Yacht, 341, 441,
Monogram, 618 [652
Morocco, Ironing, 617
Mortising, 194, 829
Motors, for Dynamo, 405, 844; Electric, 114, 358, 404, 731, 827; Griscom Electro, 92, 812; for Lathes, 30; Water, 127, 310, 356
Moulding, 127, 668; Composition, 178; Shellac and Emery, 403
Moulds, Wax, for Plaster, 685, 829
Mount Cutting, 683; Ovals, 669
Mounting Drawings, 358; Prints, 748; Velvet, 356
Mounts, Bevelled, 668; Gilding, 207; Gold Paper for, 685; for Pictures, 340 [Edged, 91
Mounts and Cards, Gold Bevel-
Musical Box Comb, 371, 844
Musical Glasses, 357
Music Stand, 161, 228, 261

NAME AND ADDRESS PLATES, 357
Name Plate on Desk, 537
Nesting Basket for Birds, 699
Net, Landing, 585; for Onions, etc.,
Netting Needle, 551, 670 [764
Nitric Acid Guard, 262, 326, 374

OBOE REEDS, 748
Octagon, 340
Oil Fuel, 114; Oil Paper, 830 [569
Oil in Machine Table, Removing,
Oilstone, 127; Rubbing Down, 130,
Oil Working from Axle, 670 [191
Opalistic Topaz, 207
Opals, To Cut and Polish, 111
Ores, Specimens, 617
Organ, Chamber, 634; Matters, 225; Noisy Tremulant, 325; Decoration of Pipes, 160; Pipes and Connecting Action, 97; Tuning Pipes, 490; Wind to Pipes, 160; Soundboard, 178, 649; Stopknobs, 341; Warming Room, 162;—American, 633; Fittings, 654; Papers, 617; Reed Boards, 75; Softening Bass, 76; Tuning Cones and Cups, 76
Organette, "Ariston," 780; Chords for, 94, 191; Cutting Music for, 175, 230

PACKING CASE, 538, 782
Packing, Non-Conducting, 129
Paint, 553, 827; Blistering, 585; for Boats, 207; Colour Mixing, 44; Luminous, 602, 670, 718; Manufacturers, 554; for Tickets, 357, 601, 686; Vandyke Brown, 585; for Water-Can, 764; Windmill Sail,
Painters' Blouses, 210 [225
Painting, 326, 553, 750; Boards for Lettering, 648; Brasswork, 535; Brougham, 160; Cart, 209, 473, 581; Ceiling, 310; China Painting, 457, 488, 504; Coach, 647; Coal Box, 307; Cycle, 373; Flowers, 650; Furniture, 62; House, 76, 458; Lines, 649, 654; Mirror, 553, 685; Oil Paintings, Re-lining, 600; Patches in, 585; Portland Cement, 538; Terra-Cotta, 435, 750, 766; on Velvet, 701; Wainscot, 60
Palliasse, 439
Panels, in Canework, 647; Composition for, 357; Wood, 765
Pantograph, 227, 262
Paper, 357; Pulp, 830
Paper, Manuscript, 159
Paper, Pulping, 406; Hanging, 112, 326, 458, 602, 686, 718; Unsized, 651
Papier-Mâché, 127, 389, 521
Paquelin Lamp, 78, 406, 552
Paraffin Lamps, 667, 685
Paraffin Lamp, Indicator for Reser-
Paraffin Wax, 649 [voir, 686
Parquet Flooring, 504
Paste, 617; for Lincrusta, 129; for Parchment, 584; to Keep from Souring, 12
Patents, Taking Out, Cost, etc., 59, 61, 78, 93, 96, 97, 113, 127, 128, 176, 178, 228, 277, 278, 292, 293, 324, 373, 387, 420, 441, 458, 504, 521, 525, 536, 568, 601, 602, 632, 649, 668, 669, 683, 685, 686, 731, 734, 748, 749, 764, 765; Colonial and Foreign, 521, 732; Licensee Under, 176; Making Patented Article, 355; Medicine, 127, 146; Patenting an Improvement on an Existing Patent, 225; Royalties, 176
Pattern, Drawings, 747; Making, 114, 161, 403; Tracing, 129
Patterns, on Canvas, 554, 734; for Carving, 259, 504, 551; Cutting, 422; on Plush, 829; Tinplate, 356
Pearl, 650
Pebbles, 421
Pen, Audaseript, 111; Glass, 14
Pencil Cases, Tubing for, 388
Pencils, Cedar, 686
Pepper's Ghost, 538 [ing, 145
Permanganate of Potash for Stain-
Perpetual Motion, 551 [308
Perspective, 505; Cabinet Sketches,
Phonograph, 27, 92, 93, 96, 228, 404, 455, 617, 667, 716, 747; Parts, 388, 437, 537, 812
Photograph, Colouring, 278, 503; Enlarging, 341; Frame, 700; Mounts and Sizes, 227; on Tin, 308
Photographic: — Appliances, 46; Blue Prints, 843; Brass Rim Mounts, 442; Camera, 61, 177, 223, 261, 276, 308, 326, 388, 505, 585, 600, 602, 700, 829; Detective Camera, 406, 440; Camera Bellows, 113, 145, 764; Camera Fittings, 670, 686, 718, 798; Developer, 77, 456; Developing, 358, 505; Dry Plate, 844; Emulsion, 585; Enlarging Exposures, 616; Expedient, 551; Lenses, 224, 505; Materials, 341; Sensitised Paper, 162; Slides, Colouring, 77; Tents, 683, 797; View Finder, 388; Wet Process,
Photography, 162, 734 [488
Photo Telescope, 78
Photographing on Wood, 344, 537
Photo Zinc, 30, 421
Piano, 45, 96, 129, 440, 844; Bronzing Frame, 129; Front, 440; Keys, 98; Keys Squeaking, 129; Materials, 129; Reeds, 781; Rusty Strings, 440; Soundboard, 437; Stringing, 440; A Table, 437; Tuning, 243; Wire for, 797
Picks, Mill, 668
Picture Frames, 457, 632, 747, 748, 763; Cleaning Gold, 96; Compo for, 225, 683, 716; Gilding, 61, 77, 112, 207, 458; Making, 76, 488, 668, 669; Mouldings, 340, 341, 506, 650, 669, 731; Quotations, 520; Varnishing, 61, 844
Pie-Making Machine, 309, 390
Pigments, 357
Pinion and Rack, 372
Pipeclay, 441
Pipe Making, 670
Pipes, Meerschaum, Varnish for, 46; Meerschaum, Re-waxing, 94, 175
Pipes, Water, Bursting, 554; Deposit
Piping, 244 [in, 130
Plane Irons, 522
Plane for Pipe Lighters, 113
Plane Sharpening, 602
Plant Case, Heating, 521
Plaster, Giving the Appearance of
Plaster of Paris, 177 [Ivory, 276
Plaster Moulds, 537
Plastering, House, 95
Plate, Bruises in, 618, 766; Cleaning, 44; Polishing, 323
Plate Rack, 29, 812
Plates, Coloured, 114
Plating, 93; Acids for, 535; Gold, 93, 536; Nickel, 97, 387, 474, 551, 552, 668, 796; Cycles, 699, 796; Silver and Electro, 61, 93, 143, 177, 323, 355, 387, 487, 535, 669, 764
Platinum, Pin, 405; Points, 552; Spongy, 647; Test, 440
Play Box, 843
Plumbers' Cloths, 95
Plumbing, 76, 439
Points and Crossings, 686
Pole Indicator, 844
Polish, French, 437, 554, 650, 829; Glaze, 29; Reviver, 829; Stains, 20
Polishing, 29, 46, 92, 95, 96, 111, 162, 177, 209, 262, 275, 277, 355, 389, 506, 683, 733, 747, 748, 763, 780; Bamboo Canes, 717; Bookcase and Piano, 600; Brass, 243, 324, 538; Bureau, 261; Celluloid, 551; Doors, 75; Drawers, 259; Fret, 14; Furniture, 96; Hatstand, 75; Horns, 410; Iron Cast, 401; Lenses, 371; Marble, 489; Oak Seats, 277; Organ, 747; Overmantel, 617; Pebbles, 442; Recipes for, 780; Shells, 505; Smudges in, 522; Spiriting Off, 77;
Polishing, Oil, 96, 387 [Steel, 648
Porcelain, Glaze for, 143
Preserves, 553
Prices, 700
Prices and Patterns, 419
Printers', Rollers, 59, 60, 143; Wood Type, 474; Varnish, 61
Printing, 129; Cut-Work in, 225; Gold Composition, 371; Hatters' Labels, 192; Ink, 12, 127, 159, 213; Press, 14, 311, 670, 700, 747; on Tin, 734
Prints, Blue, 843
Process Block Making, 92
Profession, Choice of a, 178
Pulleys, Size and Speed, 503, 599
Pump, Castings, 471; Centrifugal, 436 [325
Pumping Engine, Horse-Power of,
Punch, Hydraulic, 160
Punt, 129, 631
Putty, to prevent Hardening, 782
Pyrogravure, 670

RABBETING, 162
Rabbit Box, 29
Rack and Pinion, 292
Rain Gauge, 278
Raising Water, 292 [685, 782
Razor, Grinding and Setting, 506, 554,
Reading Desk for Bed, 259
Reading Stand, Folding, 439
Rebating, 162
Reflectors, Silvering, 144
Registration, 176, 177, 668
Reins, A Child's, 568
Relief Stamping, 715
Repoussé Work, 228
Reversing Valves, 75
Riddles, 631, 731
Rifle, Boring out, 438
Rocking Boat for Children, 62
Rocking Chair, 617
Roller Slide, 276 [97, 208
Roof, 733; Strains, 503; Sweating,
Roofing, Iron, 505; Wire-Wove, 308
Room, Sitting or Smoking (Outside),
Rubber (*see* "Indiarubber") [765
Ruling Covers, 569

SADDLE, PACK-SADDLES, 585
Safes, Fireproof, 226, 634
Sal-Ammoniac, Dissolving, 146
Salt Melter, 97
Sandblast, 282
Sanitary Inspectors' Duties, 420
Sash-Bar, Dowelling, 602
Sash Door, 456
Sashes, 192
Sash Fastener, Burglar-Proof, 127
Sash Hanging, 405
Saw, Circular, Bench, 177, 262, 782
Saw Hammering, 12, 191, 568, 747, 827
Sawdust and Tar, 224
Sawing, 813; Charges for, 650, 830
Saw Mill Machinery, How to Lay Out, 43
Saw Teeth, Circular, 403, 471
Saws, 731; Band, 12, 143, 403, 830; Belt, 227; Brazing, 59, 191, 262, 326, 374, 456; Circular, 536, 552, 631, 650; Hand, 701, 747, 780; Foot-Power, 223; Scroll, 13; Stanley's Portable, 631 (*see also* "Machines")
Scale Drawing, 208
Scales, Polytechnic Paper, 650
Scarf Pin, 294; Electric Pin, 520, 599, 796; Electric Battery, 355
Scene Painting, 145, 357
Scientific Degrees, 159
Scissors, Sharpening, 830
Screens, 308, 600, 618, 765, 780; Cheval, 61; Covering, 207; Draught, 224; Hingeing, 76, 227; Japanese, to Imitate, 128, 844; Scrap, 260
Screw, 340
Screw Cutting, 388 [pering, 601
Screw Taps, Hardening and Tem-
Screws, 747, 813
Scribing Block, Adjusting, 647
Sewing-Machine Stand, Converting into a Fret Machine, 128; Conversion to Lathe, 276
Sequoia Varnishing, 96
Sharpening Scissors, etc., 830
Shelf, 732
Shellac, 487
Shoe Cement and Burnish, 458
Shoe Laces, Hooks for, 653
Shooting Board, 97
"Shop," Answers in, 473, 521, 631, 762; Correspondence, 176
Sideboard Decoration, 161
Side Tools, Combined, 213
Signboard, 340; Enamelled Iron, 98; Wood Letters, 145
Sign Writing, 356, 487, 617, 732, 844
Silk and Silkworms, 246, 731
Silk Winder, 536
Silver, German, 371, 813
Silvering, 669; Dials, 766; Glass, 536, 763, 828; Reflectors, 144
Silver Leaf, Iridescent, 61
Silver Test, 161; Unsound, 600
Sink, Repairing, 521 [etc., 12
Size for Water Colours, Maps, Prints,
Sizing and Varnishing Oak Frames,
Skeletons, Preserving, 61 [225
Skins, Rabbit, 294, 634, 718, 814, 830
Skipping Rope, Musical, 765
Slating, 193, 419
Slide-Rest Tools, 28
Slide Rule, 28, 143
Slide Valve, 43, 127, 307, 309, 717, 812
Slot Guard, 324
Smithing, 683
Smoke Consumer, 551
Sockets, Turning, 651
Solder and Soldering, 159, 309, 421, 552, 631, 633, 731; Brass Solder, 160; Flux, 46, 111, 307; Fret Lead, 92; for Gold and Silver, 388, 828; for Lamps, etc., 309, 323, 763; Pinholes in, 325; Spelter, 225, 634, 748, Tinware, 373; Wires, 584
Soldiers, Metal, 669
Solenoid, 844
Sound Conductors or Reflectors, 538
Spar Stone, White, 600
Specifications, 632
Spectacles, 567
Spirals, Cutting, in Wood, 535
Spirit-Level Tubes, 41
Splicing Wire Rope, 441
Spokes, 324
Springs, 293, 309, 747; Reversible, 276, Spiral, 310; Steel, 111, 127
Stains and Staining, 44, 95, 96, 325, 439, 520, 600, 632, 633, 701; Black, 747; Canvas, 339; Deal, 128; Ebony, 146, 355; Mahogany, 29, 92, 146, 277; Oak, 128, 292, 506; Walnut, 91, 312, 373
Stains, Oil, from Cloth, 339
Staircasing, 176
Stair-Eyes, Cheap, 811
Stamp Mounting, 700
Stamps, Foreign, 223
Starch, Gum, 276; from Maize, 128
Stationery Holder, 228, 457, 503, 504
Steel, Bronzing, 230; Castings, 356; Enamelling, 111; Furnace, 813; Lamina, 406; Plates, Holes in, 716; Sheet, 458; Tempering, 91; Weight of, 92; Wire, Annealing,
Stencil Cutting, 27, 93, 95 [616
Stereo Casts, 191
Stereoscopic Slides, 521
Stereotypes, 732
Still, A Small, 490, 651
Stilts, 520
Stone Cutting and Masonry, 436
Stones, Cutting and Polishing, 111; Imitation, 601; Memorial, Fixing, on Bases, 389
Stool, A Shut-Up, 341, 387
Stopping Joints, Staining, etc., 632
Stove Work, Bright, 473
Stoves for Cooking, 373
Straightening Rods, 436

Straightedge, Steel, 421
Strain on Rings, 373
Stresses of Metals, 191
Stuffed Birds, Cases for, 60
Stylographic Pen, 223
Suction Pipe, 442
Sugar from Beetroot, 112
Sunflower, Metal, 28
Sweaty Hands, 324
Swords, 96, 294
Syphons, Flow of Water through, 503

T-JOINT, 76
Table, 161
Tableaux, 244
Tanks, 324, 388; Cement for, 390
Tar Paving, 98
Taxidermy, 194
Telephone, 98, 160, 162, 260, 275, 357, 403, 421, 505, 506, 521, 536, 537, 568, 617, 649, 715, 781; Bars, 326; the Bell, 111, 292, 829; District and Section, 586; Erratum, 127; Transmitter, 45, 246, 633
Telescopes, 309; Dialyte, 700; Lenses, 92, 243, 244, 245, 843; Refracting Achromatic Eye-Piece, Magnifying Powers, 293; Tempering, 601, 617; Tubing, 843
Tempering, Brass Wire, 77; Chisels, 813; Pivot Drills, 308; Steel, 91
Tennis, Stringing Racquet, 27; Clean-[ing Balls, 843
Tent Making, 421
Terms, Misuse of, 27
Tesseræ, Brick and Marble, 669, 830
Thermometer, 827; Rubber Stamp, [245
Thread of Nuts, 144
Threads, Left-Hand, 813
Ticket Writing, Tin, 357 (*see* "Paint")
Tiles, 843
Timber, Frame, 223; Measuring, 43; Purchasing, 113, 191, 521, 732, 843
Time Indication Patents, 309
Tin, Decorated and Coloured, 521
Tinfoil for Mirrors, 60
Tin Goods, Cleaning, 113
Tin Labels, 830
Tinning Silver Spouts, 813
Tinplate Work, 618
Tins for Blacking, 208
Tin Sheets, Decorated, 648
Tinware, Wiring, 632
Tobacco Jar, Carved Wood, 243
Tobacco Plant, 441
Toboggan, 522, 715, 814
Tool, Chest, 437, 653; Rack, 828
Tool Contrivance, 325
Tools, 91, 97, 828; Beader, 829; Bookbinding, 129; Boot Soling, 796; Brace and Bits, 632, 830, 845, 734; Carvers', 227, 634, 811; for Dowelling, 387; Draw Knife, 830; Drills, 210, 309, 323, 390, 521; Divers', 669; Engineers', 504; Engravers', Metal, 225, 339, 585; Etching, 128; Hardening, 372; Level, 700; Mallet, 811; Marking Gauge, 535; Mitre Cutting, 96; Mount Cutters', 668, 669; Pattern Makers', 75, 472; Picture-Frame Making, 356, 669; Rimering, 648; Rusty, 554; Scratch, 29; Slide-Rest, 28; Top-Jointing, 456; Where to Purchase, [113
Topas, Opalestic, 129
Toy Making, 277
Tracings, To make Reversed, 599
Trade, 372, 441; Change of, 554, 601; Usages, 127, 207, 357
Trade Mark, 341
Tramway, Lineff, 632
Transfers for China, 389; to Glass, 442; Gold, 293; Process Pictures, [193, 830
Transferring Papers, 207
Transparencies, 747
Trapping Blackbirds, etc., 487
Tricycles (*see* "Cycles")
Tub, Pig-Scalding, 782
Tubes, Forming Small, 654
Turbine, 309, 765
Turkey Stone, 553
Turned Articles, 46
Turners, Wood, 129
Turning, 403, 700; Draughtsman, 159; Eccentrics, 276; Lesson in, 403; Oval, 404
Type Writer, 114; Ink, 91, 98
Tyre, Indiarubber, 536
Tyres, Cementing Rubber, 310, 355, 828
UMBRELLA, MAKING, 649; Patent, [829
178; Sign, 358
Upholstering, 75, 260, 277, 389, 554, 731,
VALVES, METAL FOR, 406
Vaporiser, 750
Varnish, 12, 230, 277, 567, 632, 716, 717, 780; Bedstead Varnish, 224; Copal, 76; for Cycles, 276; Printers', 61; for Tin Ticket Writers, 357; Varnish, Spirit, 112; Violin, 93, 669, 813
Varnishing, 96, 325, 765; Leather, 538; Oak Frames, 225; Sequoia, 96;
Vehicle, A Useful, 419
Vellum Making, 441
Vending Ointment, 227
Veneers, 75; Purchasing, 46, 60
Veneering, 176, 293
Venetian Blinds, 373, 585, 586, 602, 634, [715, 733, 734
Ventilators, 130, 292
Violin, 406, 436, 617, 648, 716, 765, 780, 814; Bass Bar, 209, 405; Belly, 145; Bow, 339; Bridges, 810; Mute, 650, 750, 766, 798, 814; Necks, 60; Rib Bending, 358; Scratches in, 93; Varnish, 93, 669, 813; Wood, 262, [487
Voixophone, 371, 601
Voltmeter, 633, 763
WAGGON BUILDING, 748
Walking-Stick, etc., Mountings, 718
Wall-Paper Maker, 436
Walls, Damp, 456
Warming Organ Room, 162, [456, 519
Watch and Clock Repairing, 193, 435,
Watches, 259, 700, 830; Cases, Metal, 61; Cleaning, 553; Demagnetising, 796; Lever Escapement, 505; Mainspring, 61, 552; Spring Balance, 844; Turning Hands back, 570; Verge, 648
Water Barrows, Leakage, 601
Water, Cycle, 670; Decomposition of, 683; Hardness of, 813; Jacket Cylinder Pattern, 260
Water Pipes, 634; Bursting, 686, 734; Silting Up, 30
Waterproofing, 457, 505, 602; Boots, 30, 685; Canvas, 340; Cloth, 487; Sailcloth, 77
Wax, 733; Engravers', 178; Flowers, 440; Modelling, 230; Moulds, 685,
Wax-Ends, 260, [829
Waxing Floors, 650
Wedding-Rings, 357, 650
Wheels, Boring Pinion, 584; Cog, 245; Cutting, 111; Elastic, 45; Emery, 30, 92, 764; Felloes, Length of, 441; Fly, 276; Gearing, 324, 586, 670; Galting, 440, 519, 583; Hand-Cart, 225; Mail-Cart, 227, 732; Omnibus, 519; Repairing Spoke, 568; Small, for Engine, 92; Teeth
Whalebone, 554
Whitewashing Ceilings, 277, 294
Willesden Paper, 669
Winding Coil, 765
Windmill, for Electric Lighting, 230; Speed, 438
Window Cleaning, 634, 766, 830
Window Steaming and Vaporiser, 670, 750, 764, 766, 811
Wire, Covering for, 275; for Fire-[of, 223
wood, 830; Gauge Riddles, 553, 631, 634, 731; German Silver, 128; Magnesium, 387, 520; Steel, 797; Straightening, 59, 97; (Brass) Tempering, 191; Twist, 797
Wirework, 647
Wood Buying, 113, 191, 521, 732, 843; Oak, 162
Wood Carving, 95, 210, 441, 538, 599,
Wood, Drying, 536; Letters, 521; Merchants, 246; Sample, 95; Type, Printers', 474; Warped, 339; Waste, 244; Weight of, 175; Worm in, 437, 813
Wood Engraving, 143
Woods, Acacia, 437; Ebony, 732; Mahogany, 829, Holes in, 372, Darkening, 92; Quebec Pine, 294; Rosewood, 829; Sandal, 260; Swiss Pine, 98; Sycamore, 551; Chip Carving, Wood for, 521; for
Wooden Cakes, 94
Woodwork, Strength in, 291
WORK:—About Work, 12, 98; Advertisements, 422, 520, 633; Answers, 650; Arrangement of, 436; Articles in, 60, 682; Back Numbers, 160, 161, 178, 223, 245, 733; Beginning of, 669; Complaint, 293; Cover for Binding, 422, 812, 828; Drawing for, 389; Future Subjects, 46, 95, 209, 243, 307, 441, 844; Improvement, 733; Index to, 128, 159, 161, 176, 223, 224, 259, 275, 422, 731; Lathe Articles, 700; Motto for, 583; Paging, 647; Pages Missing, 649; Replies in, 277, 553; Subjects Treated, 308, 829; Volumes, 245, 309, 373, 436, 701, 731
WORK Exhibition, 390, 474, 615, 811; Catalogue, 747; Exhibition Number, 631
Wringing Machine, 309, 685
Writing Desk, 144, 224
XYLOPHONE, 162, 193, 601
YACHT, 521
ZINC, AMALGAMATING, 732; Annealing, 554; Etching, 208; Manufacturers', 812; Perforated, 143, 145; Pipe-Cutting, 98; Plates, 602
Zinco Blocks, 145, 489; Rods, Casting, 355
Zither, 275, 325, 440, 487

GENERAL INDEX ("SHOP" not included).

ACCUMULATORS, 790
Agricultural Machine, Root Cleaner, Slicer, Fingerer, and Pulper, 534
Alarum, Electric Time, 157, 416, 582,
Aluminium, 470
Aquarium, Cement for, 354
Armature, Winding, 644, 724
Armchair, An, How to make the Frame and Upholstor it, 409; Seat Frame, Tenons in Side Rails, East-End Furniture, 481; Turned Work and Stretchers, 595; Seats, Upholstering, and Materials, 770; Upholstering, 806
Art Supplement, 2
BAG-PORTMANTEAU LOCKS, 645
Banjos, etc., Division of Strings, 546
Baskets, Sussex Trug, 525
Battery, 591; Austin-Leclanché, 514; Gassner Dry, 497
Bedstead, How to Drape a (Canopies [in Wood), 541
Beehives (*see* "Hives")
Bench Clip, 566
Bicycles (*see* "Cycles")
Billiard Chalk Holder, 630
Binder and Trimmer, 582
Bird-Cages, 20, 445
Blowpipes, 323, 567
Boat Designing, Simple, 297
Bookbinding, Handy Apparatus, 822
Bookbinding, Practical Details of:—Introduction, Early Bookbinding, 69; Folding, Stitching, Sizes of Paper, etc., Machines for Folding and Stitching, 135; Covering Pamphlets, Gathering, Collating, Rolling, and Pressing, 200; Book-Sewing by Machinery, End or Waste Papers, Case Making, 267; Rounding and Jointing, Turning up or Cutting with Plough, Pressing, 321; Treatment of Edges, Sprinkling, Marbling, Gilding, etc., 366; Lining the Backs, Covering, Finishing, Lettering, 448; Paper-Ruling and Account-Book Binding, 527
Books:—Accumulators, 192; Almanack, Mechanics', 762; Aluminium, 470; Architects, Photography for, 762; Blacksmithing, 598; Builders' Price Book, 90, 810; Builder's Vade Mecum, 470; Cabinet Workers', 762; Carpentry, 74; Chemistry, Elementary, 699; Decorators' and Artisans' Handbook, 386; Designs for Repoussé, 842; Electric Light Installation, 762; Electricity in Every-day Life, 714; Electro-Motors, 714; Engineering, 74; Foliage, Outlines of, 794; Fretworker, 762, 842; "Furniture and Decoration," 810; Geometry, 74; Graining, etc., 174; Handrailing and Staircasing, 518; Lights, 354; Magic Lantern, 178; Mechanics' Almanack, 762; Metal Work, 191; Painting, Graining, etc., 174; Patentee, 354; Photographic:—826, 842, for Amateurs, 826, for Architects, 762, Bulletin, 354, Encyclopædia, 354, Exposure Notes, 714, Retouching, 826; Photogravure, 486; "Physique," 826; Ready Reckoner, Indexed, 90; Repoussé, 534; Screw Threads, 518; Slöjd, 74; Taxidermy, 194; Technical Books, Buyers' Guide to, 666; Timber Merchants', etc., 470; Turning Lathes, 90; Wood Carving, 598, 842; Wood Working, 518; CATALOGUES, PRICE LISTS, etc.:—Binks & Co., 90; Electric Light and Telegraph Price List, 90; Grimshaw & Baxter's Price List, 354; Harger Bros.' Price List, 534; Machinery Market, 762; Nurse and Co.'s Price List, 762; Photographic Price List, 90
Boots, Re-soling, 808
Box, 843
Bracket, Wall, with Carved Square Pillars, 319
Brass Cleaning and Lacquering, 35, 82, 708
Brass: Its Analysis, 367
Brass, Pickle for Cleaning, 157
Brass Plates, "Rubbing Off," 517
Bricklayers' Work:—Bricks and Brickmaking, 22; Fire Bricks, Tiles, and Sanitary Pipes, 68; Appliances and Tools, 119; Foundations, 120; Concrete, Mortar and Cement, Drains, Footings, Bond of Brickwork, Old English Bond, Flemish Bond, Garden Wall Bond, Heading Bond, Herring-Bone Bond, Hollow Walls, 183; Setting Out, Joints, Damp Course, Air Bricks, Inverts, Wood Bricks, Bond Timber and Iron Bonding, Relieving Arches, Flues, 251; Underpinning, Beamfilling, Shoring up, Pointing, 316; Arches, 363; Arches, Setting, Moulded Bricks, Paving, Tile Laying, 427; Furnace Chimneys, Tiling, Pantiles, Plain Tiles, Measuring, 517
Bridges, Rustic, for the Garden, 150
Burnishing and Burnishers, 411
Busts, Electrotype Copies of, 335
Button, A Metal Screw, 242
CANOE BUILDING IN WOOD, 5, 84, 155
Canoe, A Canvas, 450
Canvas Stretching, 547
Carriage Axles, Cap for, 454
Carriages, Cricket Seats for, 171
Cart, A Donkey, 657
Cartridge Case, 274
Carved Wood Cover for WORK, 24
Casts, Plaster, Bronzing, etc., 660
Catch (Ball) for Drawers, etc., 306
Ceiling, Stencilled Decoration, 134
"Celuzon," Ashley's, 682
Cement for Aquarium, 354
Cement, Stick-All, 274
Chair, Adjusting Hammock, 241; Child's, 103; Invalid's, 646
Chairs, Murray's Metal Frame, 110
Child's Carriage, The "Victor," 142
China and Glass Riveting, 4
Chip Carving, 185, 351
Chuck, Fitting an Elliptic:—Simpler Form, Back Plate, Front Plate, Nose Plate, Ring, 429; Inside Screw for Mandrel, Sliding Plate, Pallets, Slots, 467; Fine Filing, Finishing, Tapping, 547; Revolving Nose Piece, Division Wheel, 611
Church's Wall Decorator, 10
Clock Cleaning and Repairing, 580,
Clocks, 157
Clocks and Clock Cases, Grandfather's Clock, 328
Clog Iron Repairing, 614
Constructive Strength in Woodwork (*see* "Woodwork")
Cot, A Child's Wooden, 137
Cottages, Pair of Semi-detached, 288
Cowl, Patent Extracting, 502
Cramping Joints Thin Stuff, 730
Cricket Ball, How I Made it, 152
Cricket Seats for Carriages, 171
Crutches, Indiarubber Shoe for, 386
Cupboard, A Corner, 483
Curtain Rod, Door, 26
Cycle Chair, Stanley's Coventry, 646
Cycles:—Building a Tricycle House, 181; Hints to Purchasers, 213; Hints on Riding, 531; Interchangeable Fore and Rear Handle-Bars for Bicycles, 622
DECORATIONS, TEMPORARY, FOR THE INTERIOR OF BUILDINGS, 510, 558
Decorative Material, New, 811
Design Fretwork Blotting Book, 71
Design Fretwork Case, WORK, 8
Designing for Work, 34, 218, 626
Design Sheet for Wood Carving, 2
Dials and the Art of Dialling:—Horizontal Sundials, 18; Vertical North and South, 104; Vertical East and West, 139; Adjustable Sundials, 566
Disaster, A, Its Moral and Cause, 158
Dovetailing Machine, 10
Dowelling, 822
Drape a Bedstead, How to, 541
Drawer Supporter, 660
Drawing-Board and Instruments for Draughtsmen, 256
Drawing Ellipses, Cross-Staff, 331
Drawing-Table, An Improved, 266
Drawings, Diagrams, etc., A New Method of Enlarging, 106
Dresser, A Kitchen, 117
Dynamos, 612, 676, 756
EASEL, A PAINTER'S, 453
Electric Lights, Model:—Introduction, Electric Lamp, How the Light is obtained, Cost, 378; Heating Effects of Current in Lamps, Candle Power, 482; Radiant Power of Incandescent Lamps, Lighting by Means of Primary

Batteries, 482; Batteries, Electric Light for Photo, Dark Room, 591; Dynamos, Field Magnets, the Armature, Commutator and Brushes, Winding the Armature, 642; Small Dynamos, 676; Spindle for and Winding of Gramme Armature, Commutator, Brush Holders and Brushes, Winding the Field Magnets, 724; Manchester and Simplex Dynamos, 756; Acummulators, 790; Fittings, Switches, Cut-Outs, Measuring Instruments, Lamps, Electroliers, Care of Lamps and Batteries, Conclusion, 834
Electric Testing Apparatus, 402
Electrical Induction Machine, 573
Electrotype Copies of Busts, 335
Ellipse, Marking out, 822
Enamel, Macpherson's Foochow,
Engine, Mine, 833 [370
Engineers, Dividing Appliance for, 206
Etching, Hints on, 514
Etching on Steel or Iron, 415
Examination, Carpenters', 390

FAN, JAPANESE, A NOVEL USE FOR,
Fan Mounting, 610 [88
File Handle, A Cheap, 158
Firebricks, 386
Fire-Extinguishing Apparatus, 550
Firelighter, The "Ridsdale," 698
Fishing-Rod, Home-Made, 802 [581
Flower Vase, A Novel and Pretty,
Forge Bellows, How to Hang, 57
Forging, Modern:—Forges, Anvils, Hammers, 167; Bars, Rounds, Squares, and Flats, Making up Fire, Firing Tools, Chisels, 219; Drawing Down, 282; Upsetting, 336; Welding, 397; Principles of Formation, 463; Miscellaneous Examples, 544; Bossed Levers, Eccentric and Valve Rods, Slide-Valve Spindles, Bridles, 607; Miscellaneous Examples, 708; Formation of Bolts and Swivels, 804
Fountain, A Design for Self-Acting,
Frame, A Cabinet Photo, 680 [265
Frame, with Folding Doors for Photograph, 532 [338
Fret Cutting, Two Finger-Plates for,
Fret-Saw Machine, Adaptation of Sewing Machine for, 57
Fretwork Album Case, 738
Fretwork Bracket, Design for, 432
Fretwork, Circular Panels in, 108
Fretwork Designs (*see* "Designs")
Fretworkers, A Wrinkle for, 730
Fretwork Hanging Cupboard, 770
Furniture:—Armchair, 409, 481, 595, 770; Bookcase, Plain, 361, 446, 529; Bookcase, Portable Folding, 217; Coal and Coke Box, 81; Corner Cupboard, 483; Cupboard Folding Flap, 785; Cupboard Bedstead, 55; Dressing Chest, with Jewel Drawers and Glass, 753; Hall Settle, 346; Mirror, with Brush Box, 597; Music Cabinet, 462; Ottoman Couch, 728; Overmantel in Arabian Style, 378; Repairing, 658; Sideboard, 801; Table for Chess, Backgammon, and Cards, 606; Toilette and Writing-Table combined, 400; Towel Horse, 73; Work-Table and Escritoire, 49; Work-Table, Automatic Enlarging, 235; Writing Cabinet, 87

GARDEN, BARROW, 249; Furniture, Movable, 101; Hammock, 425; Roller, 221; Rustic (*see* "Rustic")
Gas-Burner Regulators, 274 [454
Gas Regulator, Inlet Double Check,
Gas Regulator, Mangnall's, 746
Gate for Staircase, 730
Gate-Fastener, An Automatic, 629
Glass, Boring Holes in, 171
Glass Painting:—Ecclesiastical, 122; Tracing, Staining, 204; Leading,
Glue Fluid, Waterproof, 666 [254
Graining, The Art of:—Preparing Work, Grounds and Graining Colours, Tools, 38; Oak in Oils, 86; Graining, Overgraining, and Shading Oak, 152; Grounds and Graining Colours for all Varieties of Oak, 199; Mechanical Aids, Patents and Special Materials, 270; Oak in Spirit and Water Colour, 314; Pollard Oak and Knotted Oak, 380; Useful Methods of Graining and Finishing Cheap Furniture, 430; Maple and Pitch Pine, 514; Mahogany and Satinwood, 594; Italian Walnut, 663; Plain Staining and Graining upon Unpainted Wood, 694; Rosewood, American Walnut, Birch, Teak, and other Fancy Woods, 738; Imitations of Inlaid Woods, 772; Imitations of Marquetry and Inlaid Woods, 824
Graph, Hints for Working, 613
Grindstone, Fitting, to Lathe, 513
Gun-Sling Hook, Safety, 449

HAMMOCK, A GARDEN, 425
Harp, Æolian, 37
Hat Shaper, Bruce's Patent, 242
Hives and other Apiarian Appliances:—Abbott's Makeshift Hive, 7; Apis Hive, 51; Cowan Hive, 120; Internal Fittings, Frames, Frame Block, Distance Rack, Distance Pins, Metal Ends, Reversible Frames, Section Frames, Queen Excluder, 187; Queen Excluder, Sections, Section Racks, Planing Trough, Comb Box, Comb Stand, 237; Foundation, Curlin Cutter, Woiblet Spur Embedder, Foundation Fixers, Clarke Smoker, 285; The Bingham Smoker, 333; The "Little Wonder" Extractor, 395; The Cylinder Extractor, 465; Wax Extractors, 576; Wax Smelter, Honey Ripener and Strainer, Feeders, 692; Super Clearer, Bee Trap, Drone Traps, 755; Bennett's and Alley's Self-Hiver, Queen Cages, Driving Irons, Bingham Uncapping Knife, Winter Passage Cutter, Transferring Rack, Conclusion, 819
Horse Collars, Air-Stuffed, 534
INCUBATOR, 589; Champion, 158
Indiarubber Felloe-Rims, 543
JACK, NEW CARRIAGE, 386
Japanese Fans, A Novel Use for, 88
Joisting, 166
KETTLE SUSTAINER, 486
Knives, Pocket, Care of, 630
LAMP BRACKET IN BENT IRON, 315
Lamp Stand in Wood, 565
Lamps, Paraffin (*see* "Paraffin")
Lantern, Triunial Optical, 493, 562,
Latch Pincers, 590 [623, 706, 774
Lathes, Fitting Grindstone and Circular Saw to, 513; Improvements, 517; A Cheap Overhead, 365; Slide Rest, 174, 206; Tool Holdor, The "Climax," 174; Wooden Rest, 562
Lawn Mowers, Care and Repair, 54
Letter Receptacle, Folding, 582
Locks, How to Fix, 106
MACHINES AND APPLIANCES:—Bookbinders', 136; Brazing, 354; Dividing Appliance for Engineers, 206; Dovetailing, 10; Drilling, 222, 558; for Metal Workers, 238, 300, 413; Milling, 206, 222, 252; Mortising and Boring, 90; Polishing Lathe, 333; Saw and Drill, 558; Screwing, 206; Slide-Rest, 174, 206; Wheel Cutter, 730
Magazine Cases, 454
Mantelpiece, with Renaissance Carvings:—General Design, Carving on Pilaster, 313; Construction of Mantel proper, Dimensions, Jambs, Mouldings, Frieze, Mantelshelf, 368; Carvings of Mouldings, etc., Alternative Treatment of Mantelpiece, 416
Map Holdor, How to Make it, 169
Marble, Removing Discoloration, 742 [711
Matchboarding, Its Application, 627,
Means, Modes, and Methods, 106, 157, 287, 354, 386, 546, 582, 613, 629, 645,
Measuring Rod, 566 [714, 730, 822
Mechanical Movements, 214, 269
Mechanical Problems, 150
Mechanical Process (*see* "Sculpture")
Metal Work, Sheet:—The Workshop, Work Bench, Material, Position and Height of same, Tools and Machines, 238; Description of Machines and Tools, Paning-Down Machine, Circular Cutter, Bench Tools, Stakes, Hand Tools, etc., Material, Tin, Zinc, Iron, Repairs, To Re-bottom Articles, and Prices, 300; Description of Tools, Prices, and Repairing, 413; Timmen's Mountings or Furniture Illustrated and Described, Repairing Handles to Tea and Coffee Pots, Stralners to Tin and Metal Teapots, Saucepans, Marking and Cutting out, 468; The Saucepan and Kindred Articles, Groving, Wiring, Edging, Making Small Work and Cover, 661
Metal, Hammered, The Artistic Treatment of, 637 [562
Microscopic Slides, Turn-Table for,
Microscopical Work, 681
Mirror, Hanging, with Brush Box, 597
Mitre Shoot, Hodge's, 26
Modern Forging (*see* "Forging")
Mortices and Tenons, 166
Motor, Model Electro, 842
Musical Box, How to Repair, 23
Musical Strings for Banjos, etc., Division of, 546
Music Cabinet, Octagonal, 462
Music Easel, 613
NEWSPAPER EASEL, 613
OILSTONES, AND MOUNT, 549
Operating Table for Animals, 629
Our Guide to Good Things, 10, 26, 42, 58, 74, 90, 110, 126, 142, 158, 174, 190, 206, 222, 242, 258, 274, 306, 322, 338, 354, 370, 386, 402, 434, 454, 470, 486, 502, 518, 531, 550, 566, 582, 598, 614, 630, 646, 666, 682, 698, 714, 730, 746, 762, 810, 826, 842
Ovals, An Easy Method of Obtaining,
Overhead, A Cheap, 365 [106
PACKING FRAIL ARTICLES, 495
Paint for Out-door Work, 287; Fireproof, 667
Painting Decorative Panels, 172
Painting Fans, 498
Paint Strainer, 434
Panels, Carved, 126, 273, 305
Panels, Painting Decorative, 172
Paraffin Lamp:—Defects, Burners, Reservoirs, My First Lamp, Reading Lamp, Where to Buy Burners, Materials, 479; Pattern for Stand, Handle, Sliding-Piece, Set-Screws, Making Stand, Reservoir, Tube for Bottom Sliding-Piece, Finishing, Lacquering Base, 575; Small Hand Lamp, Spirit Lamp, Hanging Lamp, 695; Arm of Reservoir, Suspending Wires, Chain, 759; Suspending Hanging Lamp, Snake or Hanging Lamp on Stand, Snake Supports, 802; Various Lamps, Shades, Filling Can, 839
Pedestal for Bust or Lamp, 727
Pencil, How to Sharpen properly, 697
Perspective Diagrams, 434
Photographic Appliances:—Automatic Plate Rocker, Stand Holder, Kallitype Paper, 550; Brasswork, 110; Camera, Home-Made, 281; "Alpenstock" Camera Stand, 258; Portable Dark Room and Backgrounds, 481; Exposure Meter, 274; Cantilever Enlarging Apparatus, 582; A Roller-Blind Instantaneous Shutter, 744; Lamp, "Simplex" Repeating Flash, 810; Lenses, 346; Negatives, A New Use for Spoilt, 397; Utilising Dry Plate Boxes, 761
Photograph Frames with Doors, 532
Photo Mount, A Novel and Artistic,
Picture-Frame Making, 287 [111
Plate Shelves for Kitchen, Set of, 170
Polishing, 318, 707
Polishing Marble, 742
Portière, Patent, 26
RAT TRAP, 299
Reading Desk, An Adjustable, 713
Riveting, China and Glass, 4
Roadways, Town, 818
Rocking-Boat, Child's, 809
Rustic Bridges for the Garden, 150
Rustic Chair and Table, 101
Rustic Mosaic, 66
SADDLES, PACK-SADDLES, 392
Salts, Metal, and their Uses, 338
Saws, Band, 19, 70; Whibley's Revolving-Table Band-Saw, 673, 787; Circular, 138, 202, 231; Amateur's Bench for Circular, 206; Fitting to Lathe, 513; Machine Saw and Drill, 558; Portable, 502, 746
Scales and Scale Drawing, 41
Scales, Technical, 402
Scene Painting, The Art and Practice of:—Tools and Appliances, 640; Colours, Preparation of Canvas, 698; Subject for First Attempt, Tracing, Painting Sky, Clouds, 721; Flat Colouring, Distances, Reflections, Roads, Shadow Colours, Glazes, Landscape Scenery, Effects in Foliage, 792; Leaves in Foreground, High Lights, Dark Markings, Foreground, Final Touches, 821
Screen, Fire, with Folding Doors, 705
Sculpture, Mechanical Processes of:—Preliminary, Sketch of Processes, 3; Modelling, 50; First Work in Modelling, Subjects, Appliances, etc., Building up and Roughing out, Working on Model, Flesh Modelling, Tools, Finishing, 123; Modelling in Relief, 189; Modelling in Round, Copying Bust, How to Support it, Sketching in Round, Getting Good Surface, Copying Entire Figure Frames for Statuettes and Building them up, 255; Modelling from Nature, from "Life," Life Schools and Studies, Portrait Modelling, Medallions, Busts, Statues and Groups, Ideal Sculpture, Sketches in Dried Clay, Terra-Cottas, 303; Casting Plaster, Manufacture Plaster, Different Kinds and Uses, Waste-Moulding, Inner and Outer Moulds, Separating from the Clay Model, Washing Mould, Making Cast, Chipping out, 349; Casting in Plaster, Repairing Injuries in Casting, Plaster Spatulas, Toned and Coloured Casts, Moulding High Reliefs, Casting Medallions, Working in Mould, Moulding from Round, Precautions against Discoloration in Cast, 398; Casting in Plaster, Working on Plaster, Tools, Wax Moulding, 500; Casting from Nature in Plaster of Paris, Waste Moulding, Moulding Face and Parts of Human Figure, Taking Mask after Death, Casting Animals, Leaves, Fruit, etc., 578; Piece and Elastic Moulding, Clay Squeezes, Mending and Cleaning Casts, Painting, Gilding, Silvering, and Bronzing on Plaster, 659; Carving in Marble, Kinds of Marble, Tools, Sharpening Tools, Stopping Holes in Marble, Removing Discolorations, Polishing, 740 [57
Sewing Mach. adapted for Fret Mach.,
Sewing Machines, Star Discs for, 432
Shop, 12, 27, 43, 59, 75, 91, 111, 127, 143, 159, 175, 191, 207, 223, 243, 259, 275, 291, 307, 323, 339, 355, 371, 387, 403, 419, 435, 455, 471, 487, 503, 519, 535, 551, 567, 583, 599, 615, 631, 647, 667, 682, 699, 715, 731, 747, 762, 780, 796,
Shoring Up, 318 [810, 826, 842
Signalling in Compass Steering, 411
Signalling, New System Marine, 330
Size, to Prevent "Frothing," 694
Slate Composition, 402
Soap Making, 817
Soldering Bolt, 566 [Iron, 714
Soldering, Hot-Water Pipe Chair for
Soldering Tinning Mixture, 714
Soldering Tool, 567
Speaking-Tube, My, 646
Spectacles, Moro's Adjustable, 110
Staining Floors, 710
Stains, 547, 694
Steel, Tinned, 447
Stencilled Decoration for Ceiling, 134
Stool, Pocket Folding, 434
Strength in Woodwork, 383
Stretching Vellum for Illuminating,
Sulphur Puff, Tait's, 158 [19
Summer-House, 65, 197
Sundials (*see* "Dials")
TINNED STEEL, MANUFACTURE OF,
Tongueing, 166 [447
Tool Cabinet, "Compactum," 42
Tool Holder, 174
Tool-Sharpening Machine, 126
Tools:—Beading and Sash Moulding, 598; Bit and Square Level, 323; Expanding Contre-Bit, 434; Blowpipe, 567; Blowpipe and Fire Chamber combined, 323; Lightning Brace, 306; Bricklayers', 120; for Canoe Building, 6; Centring Disc and Gauge, 615; Drill Chuck, 323; Drill Stock for Clocks, 323; for Grainers, 38, 270; Haft Combination, 322; Handle and Twelve Tools, 306; for Metal Workers, 238, 300, 413; Plier Nut Wrench, 582; Punch, Boll-Centering, 322; Screwdriver, Automatic, 306; Screw-Cutting Stock and Dies, 322; Sculptors', 123, 500, 740; Shears for Metal or Wire, 323; Soldering, 567; Square, Mitre, and Bevel, 58; Surface Plates, 675; T-Square, 625; Upholsterers', 771; Vice Cutting Tool, 323; Grip Vice, 546; Parallel Double-Action Screw Vice, 306; Carvers' Router, 126; Brace, Split Chuck, 338
Trade Notes and Memoranda, 14, 30, 46, 62, 78, 94, 114, 130, 146, 162, 178, 194, 210, 226, 246, 278, 294, 310, 358, 374, 474, 490, 522, 554, 570, 734
Trumpet, Patent Chromatic Double-Slide, 550 [562
Turn-Table for Microscopic Slides,
Turning Patterns, 90
UPHOLSTERERS' TOOLS, 771
Upholstering an Armchair, 409
VELLUM, STRETCHING FOR ILLUMI-
Ventilating Fan, 566 [NATING, 19
Violin, New Form, 486 [and Mute, 242
Violin Bow-Guide, Music-Holder,
WALL DECORATION OF THE FUTURE,
Washer, Greenall's Steam, 614 [2, 10
Watch Balance-Spring, 37
Watch Wearers, Amateurs and Others, Hints for, 102, 286, 394, 679, 743, 838
Water Jet, Eade's Pat. Converging,
Waterproofing Boots, 614 [190
Wax-Ends, 351
Wet Feet, How to Avoid, 614
Winder, A Simple, 380
Window Boxes, 233
Window Frames, Decorative, Cast
Wire, Straightening, 21 [Iron, 689
Wood-Turner's Cutting Dividers, 630
Woodwork, Constructive Strength in, 166, 478
WORK EXHIBITION, 290, 418, 438, 458, 506, 538, 570, 778; Jurors' Awards,
XYLONITE, 787 [794

An Art Supplement is given gratis with this number.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

Vol. II.—No. 53.] SATURDAY, MARCH 22, 1890. [Price One Penny.

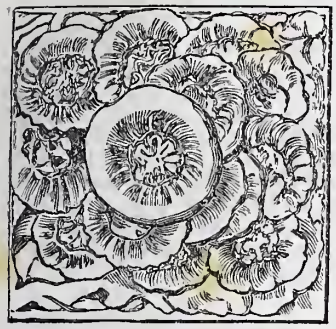


Fig. 2.—Tile produced with Brush.

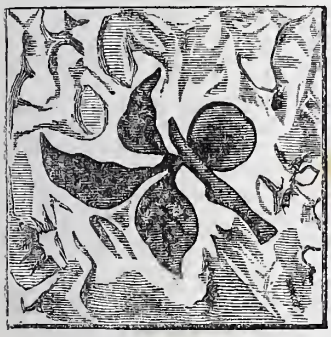


Fig. 3.—Tile produced by Stencil.

Fig. 4.—Tile produced by Combing.

Fig. 5.—Tile produced with Brush. All of the Tiles represented above are Varnished and Coloured.

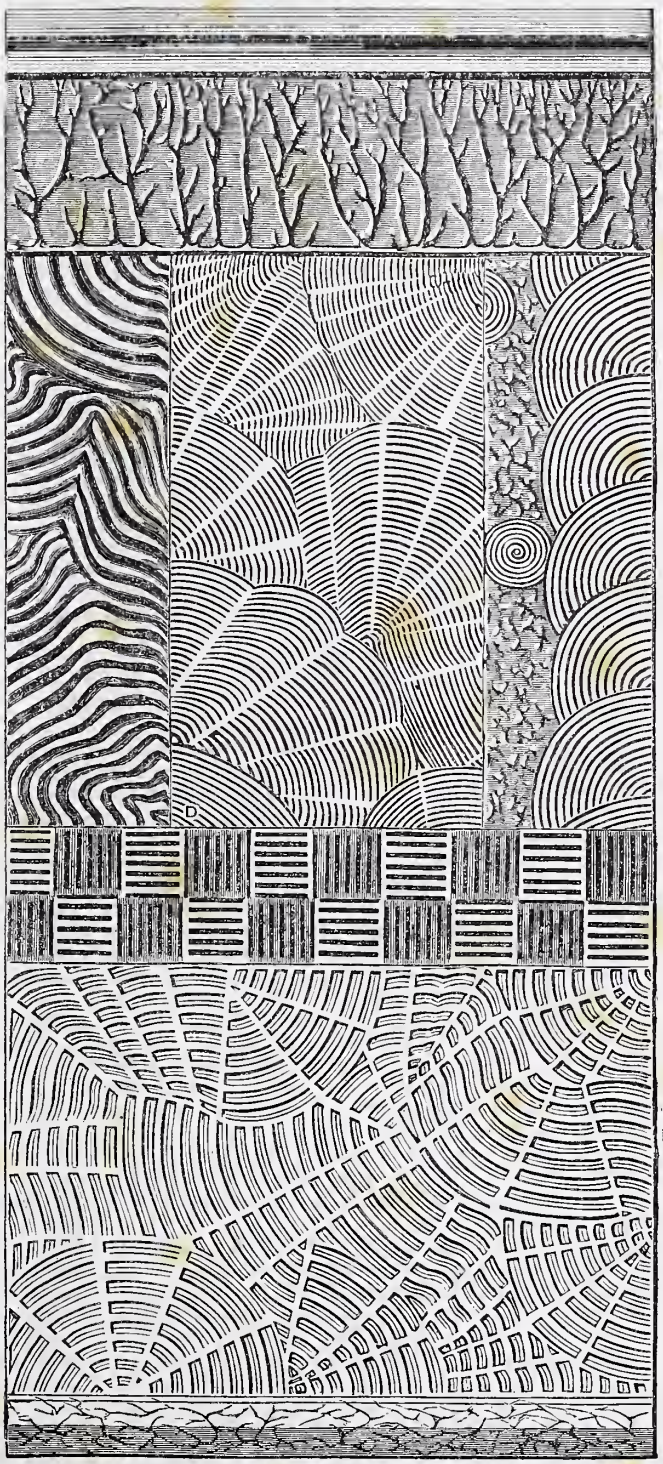


Fig. 1.—Various Styles of Manipulation of Church's Wall Decorator—A, Arboresque Pattern, produced by Suction; B, C, Combed Styles; D, D, Combed Panels; E, Basket-work; F, Graduated Skirting.

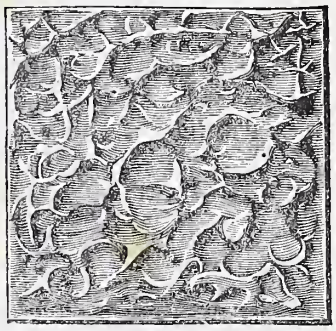


Fig. 6.—Tile produced by Stippling.

Fig. 7.—Tile produced with Brush.

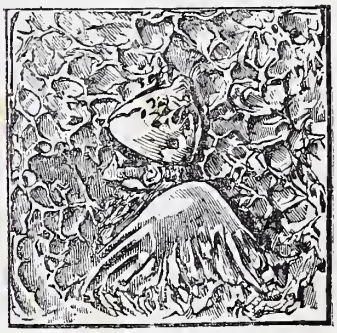


Fig. 8.—Tile produced by Modelling.

Fig. 9.—Tile produced with Brush. All of the Tiles represented above are Varnished and Coloured.

THE WALL DECORATION OF THE FUTURE.

BY H. A.

How to make the house beautiful and keep it so, at a cost moderate enough to suit the purses of nearly every householder, and, at the same time, *not* abrogate the recognised laws of sanitation, has been a problem awaiting solution, and forcing itself more and more to the front of domestic considerations, commensurately with every advance in the standard of comfort of all people of civilised countries.

In this age of marvellous productive energy, artistic skill, stimulated by the presence of countless ever-increasing labour-saving devices, is perpetually bringing before us something both new and beautiful to add to the enrichment and comfort of our homes. And perhaps it is safe to say that there has been no more distinctly-marked advance in any one branch of industrial effort than is to be found in the industries generally devoted to the production of materials for interior decoration of our homes. Yet, while we have gained artistically, the cost of our most effective work has debarred the majority from reaping any advantage, whilst, for the most part, sanitary claims have not had the requisite attention their importance imperatively demand. The object of this article is to bring before the readers of WORK a new product for decorating walls and ceilings that embraces the three essential points mentioned—viz., sanitation, economy, and capability of artistic manipulation of the highest order

The product in question is known in this country as "Church's Wall Decorator," and is the invention of Mr. M. B. Church, of Grand Rapids, Michigan, U.S.A. It has only recently been introduced into this country, and is made by the Church Manufacturing Company, of 127, Pomeroy Street, Hatcham, London, S.E. It has met with enormous success in the United States during the last fifteen years, and to-day the sales are larger than ever, the leading hotels, theatres, public halls, as well as private houses in the great cities, adopting it in preference to anything yet discovered, and mainly, be it noted, on account of its sanitary and economical claims, combined with its artistic possibilities.

Church's Wall Decorator is prepared in the form of a fine powder, and is put up in 7-lb. tins, at 3s. per tin. It is made in eighteen different beautiful tints and white. The base of the material is composed mainly of sulphate of lime, known as gypsum or alabaster, which has been calcined by subjecting it to great heat in retorts till its water of crystallisation is driven off. The other ingredients being added, the whole is ground or crushed by a unique system of milling, also invented and patented by Mr. Church. This patent process separates, polishes, and preserves the atomic crystals of which the base is composed, and tints them without colour enough to hide their lustre. Single crystals, under a powerful glass, are transparent, and, in a body, are opaque like snow. It is easily mixed, being made ready for use by simply adding boiling water, and when used for plain tinting, or as a flat paint, is brushed on with an ordinary distemper brush; but the Company manufactures a special brush, which is strongly recommended for rapid and effective work. It may be well to point out here that ordinary distempers are only inert powders held together temporarily with animal glue or size, which is a ready absorbent of moisture, and soon rots and softens, causing general discoloration and disintegration of the particles. Church's Wall Decorator, on the contrary, hardens and improves with age; the dampness of the English climate is entirely in its favour. It forms a porous rock cement on any surface to which it may be applied, and the colours, having been ground in, and becoming chemically united in the mixing, form solid tints which do not fade. When used as a flat paint, it can be spread over walls and ceilings so fine that, whilst each coat forms a hard porous shell, fifty coats need not produce a surface thicker than ordinary card-paper. Coat after coat can be brushed on without removing the old coat, for the coats never scale or come off. Thus the unpleasant labour of washing walls and ceilings is largely avoided, the surfaces only requiring dusting down prior to each new application of the Decorator.

We now come to consider the various ways of working Church's Wall Decorator in heavy relief. Beautiful effects can be obtained in stalactites or heavy stippling, moulding, heavy or light fluting, scrolls and figures in tints, tiling, glossing, or flashing, bronzing or metallising, blending with stippling and wood-ceiling decorations. Space will only permit us to outline some few of these various modes of working the Decorator, and we then pass on to the general directions for producing these effects.

The decorated frieze with the arboresque pattern is obtained by applying the Decorator thick, and then laying a small flat block of wood on to the composition, removing it immediately; a handsome pattern can be thus obtained in endless variety. The heavy combing, or corrugated work, is done by using a comb with every alternate tooth removed. The cut illustrating basket-work is also obtained by the graining-comb. The more delicate combing is very much admired for walls and panels. The roughened effect is simply the result of the application of a covered wooden block. The specimens given in the illustration to show tile-work are rapidly done, and admit of countless designs. The Decorator takes varnish beautifully, and handsome satin or leather-like effects can be thus introduced.

To Blend a Ceiling in Two Colours.—Mix a small quantity of the colour desired in the centre, and a larger quantity of the deeper tint. Begin in the centre with a light tint, and gradually shade into a stronger tint at the edges. Arrange staging so that the workmen can reach every part of the ceiling, which is easily done by using four step ladders with planks laid across. Commence in the centre and cover a circle of from 5 ft. to 6 ft.; then add a small quantity of the deeper tint, and blend outward from the circle for a small stretch. Keep on adding the deeper colour stretch by stretch until the whole ceiling is covered. By this means a beautiful blend is obtained with any two colours.

For Stippling, Wall Relief-Work, Tiling, etc.—First cover the walls with an ordinary coat, and let it dry. If a light stipple is required, mix four measures of the powder with two and one half measures of boiling water. *Stir thoroughly* till every particle is dissolved, then add one measure of cold water, mix well, and allow to cool. Then brush on, freely passing a full brush several times over the surface, working in strips across the narrowest way of the wall. The stippling is generally done by another hand immediately following the work of the painter, using a soft stippling-brush. Should a coarse stipple be required, mix the material thicker.

For Combing mix the same as for stippling. Use a common graining-comb with the alternate teeth broken out. Draw the comb in a slanting direction, which prevents the teeth from scraping the material clean off the wall where the teeth pass.

For Tile-work mix two measures of the powder to one measure of hot water; stir thoroughly till cool, without adding any cold water. The wall must be worked in small sections. Put on a very heavy coat and stipple with a common stippling-brush. Then block the material off in squares the size of ordinary tiles while it is soft, using a straight-edge and pencil. When this has become thoroughly dried, put on a coat of good quick-drying varnish (oak). When dry, shade and colour the blocks out with tube colours, and varnish as desired. A nice effect is obtained by passing a cloth over the blocks before the varnish is set; this wipes the colour off the raised parts, leaving the background darker, and giving effective lights and shades. Any design can be worked in the tile while the Decorator is soft, only limited by the artistic skill of the workman.

After applying the Decorator, dry as quickly as possible by circulation of air, and by fire, etc., in damp weather. Brushes must be kept in good condition to ensure good work, and should never be left standing in the material all night, but should be washed clean with clear water.

Dry colours can be added to the Decorator, to deepen tints for borders, etc.; but only use strong colours, so as not to weaken the cement. Stencil figures or lining can be put on by simply using clear varnish, and beautiful effects can be obtained by using the various tints over one another with stencils.

The fullest directions are given on the label round each tin of Church's Wall Decorator, but it may also be mentioned here that perhaps the first living authority on gesso-work states that the smooth and even consistency of this material, combined with its simple mixing, makes it the most suitable product yet invented for this art.

In conclusion, we may inform the reader that a cheaper grade, suitable in every way for plain tinting and light stippling, is also made by the same company, and is known as Alabastine. It is put up in 7-lb. tins at 1s. 9d., and, as a general guide, it may be calculated that one pound of Alabastine will cover seven or eight square yards, two coats, on the average wall where there is not much suction.

OUR ART SUPPLEMENT.

DESIGN SHEET FOR WOOD CARVING.

WE give with this number a design sheet, specially prepared for us by the Guild and School of Handicraft, on the application of art and craft to various materials. The accompanying sheet deals with art work in its relation to wood by means of carving, cutting, chipping, incising, engraving, or modelling with the chisel. Hereafter we may take other materials, such as iron-work, wrought or cast, bronze-work, embossed copper and brass-work, tile-painting, clay or plaster-work, gesso-work, flat surface painting, leather-work, etc., in order to show by means of examples and explanatory context what should be the

right relation of design to material, and what eminent craftsmen or artists at different times have sought to do.

The first thing to be noticed in the accompanying sheet is that most of the work is old work; and from the point of view of the designs this is an advantage, for old designs in matters relating to craftsmanship are better, fuller in character and vigour, with rare exceptions, than modern ones; besides, they have always a style of their own. For confirmation of this the student should go and see for himself and study at South Kensington, or at the Bethnal Green Museum, such specimens of carving and the treatment of furniture as he would find there.

The next thing to be noted is that the design of any part or a piece of work is always made in relation to, and in subordination to, the whole design. An old craftsman never carved a panel first and then worked it into a mantel-top or cabinet; he first designed his cabinet, and then treated the carving or applied ornament in subordination to it, and he never created ornament for the sake of ornament, as is so often seen nowadays. It was a famous aphorism of the great architect Pugin that "you may ornament your construction—you may not construct your ornament"; and this applies to wood-carving, or any minor art, just as much as to architecture.

Another thing noticeable by reference to the sheet is, that in the old work, *e.g.*, the old French cabinet, the man who made the mouldings was the man who carved the carving, and often designed the whole thing; there was not such sub-division of labour into cabinet-makers, carvers, polishers, turners, etc., as there is at the present day, and the result was that the work, if often not so technically finished in its mouldings or planed surfaces, was a much more pleasing and satisfactory object.

As regards the different methods of workmanship applied to wood-work, the Italian design in the corner shows a very beautiful manner of getting an effect by outlining the design firmly into the wood, rubbing in colour of different tints, and then oiling or polishing the whole. In our own English Elizabethan carving, on the other hand (*e.g.*, instance of the mantelpiece at Queen's College, Cambridge), the effect is got by very flat cutting, leaving larger portions of background.

Italian carving, such as is shown in the three feathery leaves from an old chest, was based mostly on gesso-work. That is to say, the Italians designed and treated carving as they treated gesso-work—in smooth and slightly relieved surfaces—their method frequently being to coat their carving over with gesso, and model in it. It is to mediæval England, France, and Germany, however, that the workman carver of to-day should look for his best examples and studies, see the patera of the lion's head on the sheet, and a portion of the carving of the Black Prince's tomb at Canterbury Cathedral, one of the most beautiful pieces of work ever done in carving for dignity and refinement. It is to such guides as these that the student and craftsman should chiefly apply himself.

Those who are eager to pursue a line of study in this direction may possibly find it of use to them to put themselves in connection with the Guild and School of Handicraft, which they can do by communicating with the Hon. Director, 34, Commercial Street, E., stating at the same time the line of work they are engaged in, and what it is they wish to study.

THE MECHANICAL PROCESSES OF SCULPTURE.

MODELLING—CASTING—CARVING.

BY MARK MALLETT.

PRELIMINARY OBSERVATIONS—A GENERAL SKETCH OF THE SUCCESSIVE PROCESSES.

It is not supposed that the papers to be given under this title will make a Phidias or a Michael Angelo of whoever reads them—in the making of an immortal sculptor something more than a knowledge of mechanical processes is demanded. He must have the divine gift of genius and artistic knowledge. But apart from any view to the highest ranges of art, an acquaintance with such matters as modelling in clay, casting in plaster, and carving in marble and stone, will be of practical value to very many persons; whilst others may find in them pleasing and interesting pursuits. These mechanical processes are as capable of being taught by printed directions and diagrams as are any other ordinary handicrafts.

Some persons there are who suppose that when a sculptor sets about making a statue he simply takes his hammer and chisel, and hews it at once from a block of marble; and true it is that this has been done by some sculptors. Michael Angelo is recorded to have worked in this manner. But such is not the ordinary method of proceeding. Ordinary sculptors are not Michael Angelos, and cannot tread in his footsteps; they proceed in a more cautious and systematic manner. According to the usual practice, a marble statue is the outcome of three distinct mechanical processes—modelling, casting, and carving; whilst at the different stages of its growth it appears in three totally different materials—clay, plaster, and marble.

The work is first modelled—that is, built up in plastic clay, in which material alterations can be freely made; when completed in this, and when no further improvements seem desirable, it is cast in plaster, and the clay model destroyed; and from the plaster cast a fac-simile in marble is afterwards carved.

This is the ordinary course in fine art sculpture. In some inferior departments, as often in architectural sculpture, the carver may hew out his figure from the block with nothing more to guide him than a rough drawing. But this is work in which rapid execution rather than excellence is the thing desired. It is scarcely to be expected that anything really good can be produced by such crude and hasty means. Even Michael Angelo, great as were his powers, found it desirable to make small anatomical studies of his subjects before he attempted to hew them from marble. And it may be questioned whether, after all, either he or the world gained anything by his daring manner of working. Had he been content, like other sculptors, to make clay models, meaner hands might have hewn away much of the hard marble for him, and those numerous works might have been completed which he, tired of the vast labour he had taken upon himself, threw aside unfinished.

To those who have imagined the sculptor as working wholly in that noble material, marble, there may seem something degrading in the idea that his chief employment is really among common clay. Such is, however, the case. It is in the clay model that he exercises his artistic skill, his powers of imitation and invention, or shows his sense of beauty. The carving in marble is mere copying, and can be, and is, mainly left to workmen.

Those who know nothing of modelling naturally think that handling wet clay must be dirty and disagreeable. This, however, is a mistaken notion. A pure clay, such as the pipe-clay generally used, is both cleanly and pleasant to the touch; it does not roughen the hands, it easily washes off, and takes with it all dirt. It looks not unlike putty, and is used a trifle softer than putty is used by glaziers. For medallions and other works closely attached to a background, the natural cohesion of the clay affords sufficient support; but for busts, statues, and the like, a framework of wood or metal has to be provided to bear the weight of the clay.

In the case of a bust (that most frequent subject with the sculptor, whether professional or amateur), this frame is a very simple affair. It is generally an upright piece of wood, with a short cross-arm at its top to support the head. Round this frame the modeller builds his mass of clay, laying on and pressing down new pieces with his hands, and occasionally using a large wooden tool. For this first stage he likes his clay to be very soft and plastic, and does not at present attempt to get any near approach to form. When he leaves it, after building it up, it is but a wild caricature of a human head and shoulders.

It is allowed to rest for some hours, that the clay may to a certain extent stiffen, and when he again comes to it, though still sufficiently pliable to be readily moulded, it will be sufficiently set to allow him to lay on more clay without displacing the surface, and to give some approach to the broader and more obvious forms. And thus he will proceed, mostly during the earlier stages with his thumbs, and afterwards with a freer use of his wooden tools, to build and fashion it into shape, till every form is correct, and till he has brought the surface to a proper degree of finish.

All this time he has had to keep his model damp. Were it allowed to get dry, the clay composing it would become too hard to be worked upon, and then shrink and crack. It is kept damp till the time comes for casting it in plaster, and, before casting, the last thing done is usually sprinkling water upon it.

No sooner is the clay model finished than the sculptor is desirous of converting it into plaster. The soft clay is liable to many accidents, and needs constant care, whereas the plaster cast is comparatively secure, and can take care of itself. Plaster of Paris is therefore spread over every part of the surface, to form a mould. From this mould the clay model is dug out and thrown aside; the mould is washed and more plaster poured into it, and this forms the cast. When the mould has been chipped away, the model reappears in all its details, only, instead of the soft, dull, grey clay, it now appears in hard and dazzling white plaster.

To transfer the form from clay to plaster is a thing that may be done quickly and easily, but not so when the form has again to be transferred from plaster to marble. This is always a slow and difficult operation, notwithstanding that in modern times it has been facilitated by improvements in the pointing-machine. This machine is an apparatus—of which more will be said in the proper place—which enables measurements to be taken from the plaster model, and recorded on the marble with mathematical accuracy, thus enabling the workman to hew

away superfluous material with more freedom and rapidity than would otherwise be possible.

The workman who does this is called a "pointer," and when he has chipped away the block of superfluous marble, the more artistic carver comes with his chisels, his rasps, and drills, and gradually works down the hard surface till he has copied into it every detail of the plaster model. Finally, he gives a beautiful surface by rubbing with wet sand. Busy sculptors—men of note and much employment—rarely have time for much carving, and leave it to skilled workmen, only, perhaps, putting some few corrections and finishing touches to the marble.

This brief sketch of the phases through which a marble bust passes is intended to give those who have previously known little on the subject so much of general knowledge as may enable them more fully to understand the practical details of the different processes, which will be dealt with in future papers.

It has, perhaps, been too much assumed, in the above sketch, that modelling and casting are merely means to the production of a work in marble; but this has been for convenience, and because a work in marble is commonly regarded as the highest and most important outcome of the sculptor's art, rather than from any wish to ignore the fact that modelling and casting have their uses, apart from any intention of marble work. We are quite aware that probably more persons would wish to obtain a competent knowledge of those processes with a view to other ends, and shall bear this in mind as we go on.

CHINA AND GLASS RIVETING.

BY W. E. DAW, JUNIOR.

Its Suitability for Amateurs—Materials Required—The Drill: How to Make it—Brass Wire Flattened on one Side—Marking Holes on Plate—How to Work Drill—How to Make the Rivets—Filling up Holes—Where to Buy Materials—Conclusion.

The art of mending broken china or glass by clasps, or rivets, of brass wire is eminently suitable for amateurs, for not only is it very easy to learn, but the materials are inexpensive, and the work is soon done.

Having said this, hoping to encourage some one to take up the pursuit, let us consider, first, the materials required.

We shall need a drill, some diamond bits, a pair of combined cutting and holding nippers, some brass wire, and a little plaster of Paris. This completes the list.

By referring to Fig. 1 you will see the drill is a steel rod, moved by tapes fastened to a piece of wood, which plays up and down. This can be bought, or the amateur can make it for himself:—Get a steel rod about 14 in. long, tapering at one end. Sometimes worn-out cotton spindles can be bought very cheap; these answer splendidly, as they are already tapering. Take it to a blacksmith (if you cannot do this yourself) and have a piece cut off the other end and a hole drilled through to take the tape. Turn up a piece of box or ebony, about $2\frac{1}{4}$ in. by 1 in., as shown at B. When you have got it to the proper size, drill a hole through the middle slightly smaller than the steel rod, so that it will hammer on tightly. Be careful to make this hole true, or it will wobble. Drill first one side at the centre mark, and then the other; or, perhaps, the better way will be to hammer on and true up in the lathe. Now take another piece of the same wood, and turn to your own fancy to about 7 in. or 8 in. long, and $\frac{3}{4}$ in. thick, as at C; drill a hole through this also, but larger than the steel rod, so that it will play up and down easily (this is for the fingers to take hold off, to give motion to the drill); pass the steel rod through this, hammer the ball on to about

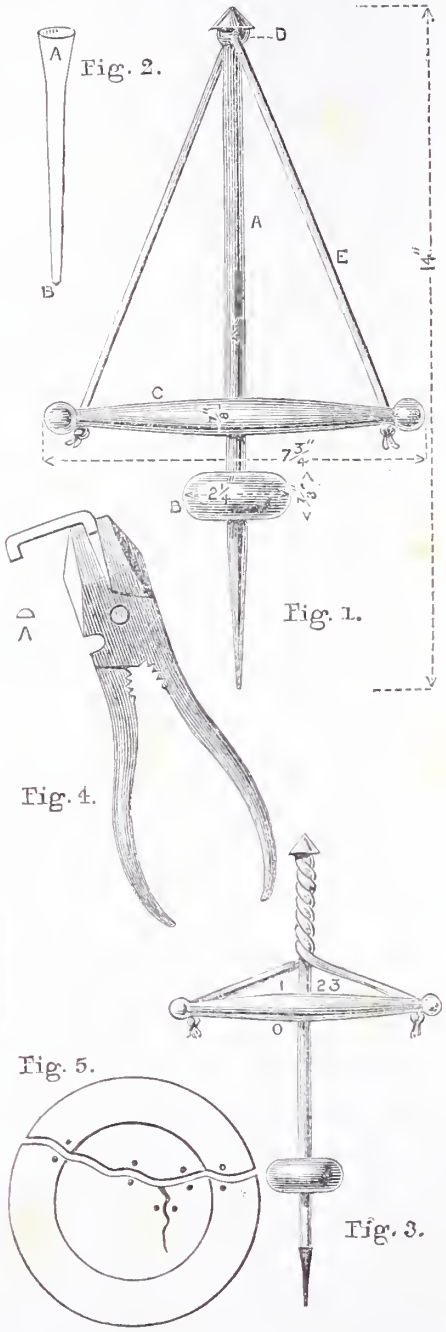


Fig. 1.—Drill for China and Glass Riveting, showing Dimensions. Fig. 2.—Diamond Drill Bit. Fig. 3.—Drill wound up to commence Drilling. Fig. 4.—Nippers for bending Wire. Fig. 5.—Plate drilled for Riveting.

one-fourth of the rod, tie one end of a piece of tape or leather to one end of the finger-piece (or drill a hole in each end, and tie the tape in a knot underneath), pass the tape through the hole D in the rod, fasten the other end, and the drill is complete.

The drill bits (Fig. 2) are pieces of tin made to fit tightly on the steel rod of the drill, with a rough diamond point cemented in the other end. As these require a little practice to set properly, the beginner had better buy them ready-made—at any rate, at first.

The brass wire used is about 12 to 16 B.W.G., mostly the latter size, and it must be flattened on one side, either by file or scraping with an old knife. A quick way of doing it is to hold the brass wire down on the right thigh with the blade of the knife, and draw sharply with the left hand past the knife two or three times, when sufficient will be taken off for the purpose; but I must caution the beginner not to do this without he has an apron, or something over his knee, as the wire gets very hot, and he *may* find a hole somewhere when he has finished.

Now we are ready to begin. Suppose we have a plate, as in the illustration, with a piece broken out, and cracked also; join the plate, and turn bottom upwards, as we shall rivet the wrong side, so that it may not show when hung on the wall, or when in use. Now mark, with a steel point dipped in oil, on both sides of the break and crack where the rivets are to go. I may say the old oil off an oilstone, or hone, is the very best thing to mark with, as it makes a black spot which is easily seen. Be careful to make the rivet holes exactly opposite each other. Now take the drill, to which you have fastened an appropriate-sized bit (for a small plate you will, of course, use a small gauge of wire and small bits; for a larger plate, thicker wire, and proportionate-sized bit); take one of the pieces of the plate, and having broken the glaze, either with the diamond or a steel drill set in a handle and sharpened on a hone, grasp the wood handle of the drill with the thumb and first finger on the left side of the steel rod, and the second and third fingers on the other side; twist the tape round the rod, as in Fig. 3; press slightly, when it will uncoil, and, by raising the hand at the proper moment, coil in the opposite direction. It will, perhaps, not be easy at first to get a continuous motion, but it will soon come. It is a similar action to the treadle of a lathe, only performed with the hand instead of the foot. Practise at first without the bit upon a piece of wood. Drill as deep as the article will allow, using plenty of oil. Having drilled all the holes in one piece, proceed in the same way with the other; then take some of the prepared wire, and turn down at right angles with the nippers one end about $\frac{1}{16}$ in. or $\frac{1}{8}$ in., according to the depth of your holes, keeping the flat side of the wire underneath; place this in one hole, and carefully mark where the bend ought to come; cut off, and turn down the other end. When you have finished all the rivets, proceed to fix, when, if properly made, they ought to fit tightly; in fact, it will be all the better if they require a slight tap with a small hammer, but see to it that none of the ends are so long as to prevent the rivets lying flat on the plate.

Mix a little plaster of Paris with water, and fill up all the holes, and also the cracks, if there be any.

The plate is now completed, and, if carefully done, will hardly show upon the right side, and also be very strong, and, if required, will stand everyday usage for a considerable time.

Some, perhaps, will be glad to know where to buy the diamond bits and other materials; in that case, I can strongly recommend Mr. E. Claxton, Tower Street, King's Lynn. Everything required can be obtained of him, and he is very reasonable in his charges.

CANOE BUILDING IN WOOD.

BY AN OLD OARSMAN.

VARIOUS MODES OF BUILDING—TIMBER—TOOLS—ROB ROY CANOE—SHEER BODY AND HALF BREADTH PLANS.

EVERY man should be able to *build* his own canoe as well as paddle it, and with this view the following remarks are penned, and in the hope that numerous men will construct and navigate their own craft.

There are several methods of canoe building: *i.e.*, clincher, carvel, riband carvel, dowel, and diagonal, each of which has its merits for the usual purposes to which the boat when constructed is to be put.

Clincher or Clinch Build (Fig. 1).—In this the planks are nailed edge to edge, each overlapping the other some half inch, and then fixed with copper or other metal nails, though copper is by far the best; and when the planking is all in place, the timbers are fitted in, nailed, and *roughed* in their places. Before nailing, the under plank is chamfered off at an angle to allow the plank when nailed to take its proper curve.

Carvel Building (Fig. 2).—In this the planks are fitted edge to edge *upon* the timbers, which have been fitted in their places before, and when perfectly secure they are caulked in some way or other to make them watertight: some are puttied, some have cotton or oakum riven between the planks, others have white lead only, or a thin sheet of indiarubber so that a tight seam may be ensured.

Riband Carvel (Figs. 3, 3 A, and 3 B).—In this method of building the planks are tacked on to the building moulds edge to edge and closely fitted, then ribands of clean straight-grained oak, chestnut, or cedar, $1\frac{1}{2}$ in. wide and from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. thick, are placed along the inside of the joint in the planks, when they are nailed to both edges of the two planks and the nails clenched inside, the nails being driven from the outside; but to ensure a tight joint, lengths of linen or calico running the entire length of the joint in the planks are laid on and well varnished or painted, so that they cover the entire under side of the riband or batten. The result of this plan, when finished, is a very neat strong joint with an almost perfectly smooth outer surface; when all the planks and ribands are fitted in and nailed, the timbers are fitted and nailed in; these timbers should be about $\frac{3}{8}$ in. on the side by $\frac{3}{4}$ in. moulded.

Dowel Building (Fig. 4).—This is used where thicker planking is required, and is done much the same as carvel, inasmuch as the planks are fitted edge to edge, but as

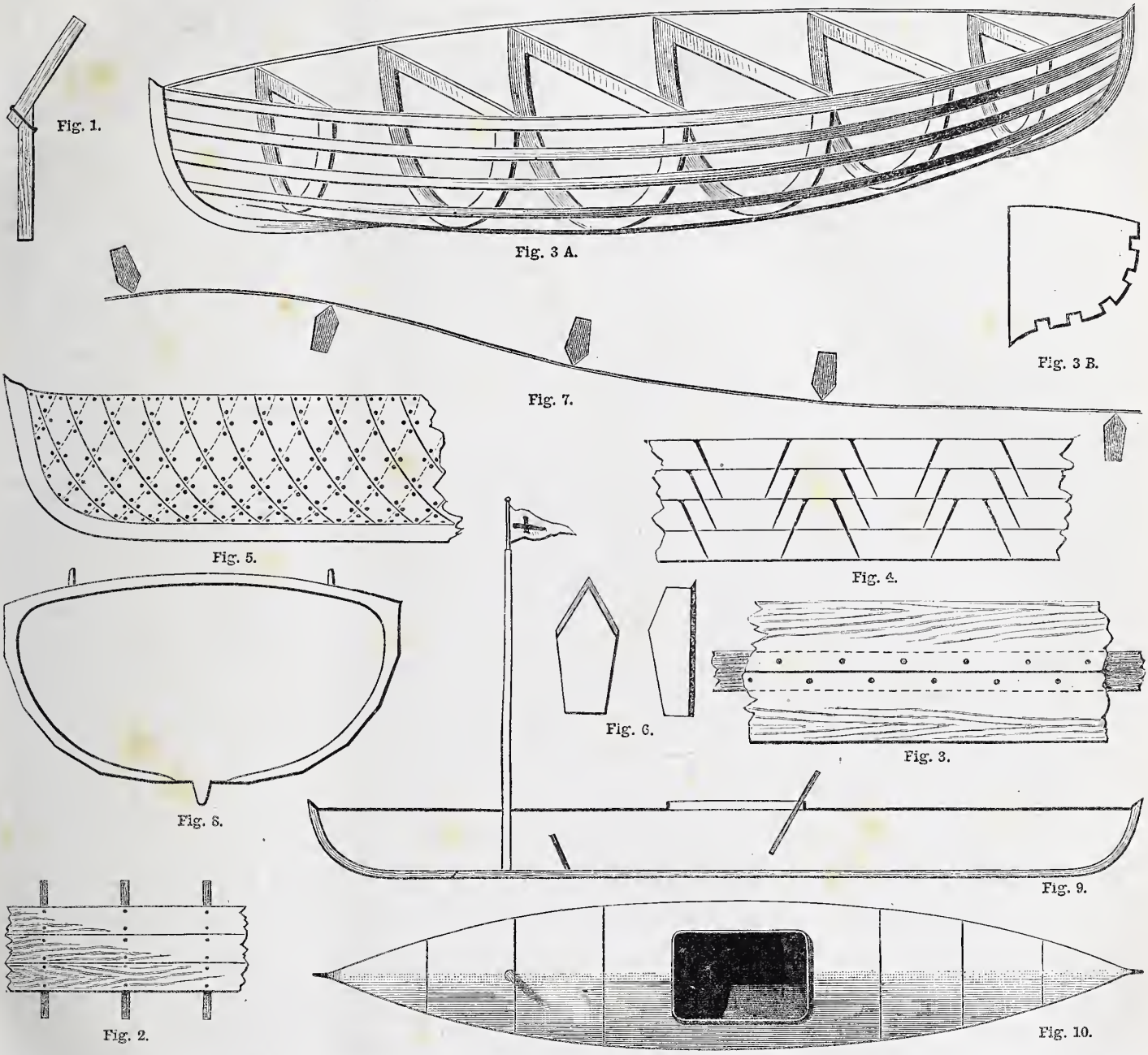


Fig. 1.—Chamfer of Inner Plank to take next Plank. Fig. 2.—Carvel Building. Fig. 3.—Planks screwed or nailed to Riband. Fig. 3 A.—Frames and Ribands in place for Riband Carvel Building. Fig. 3 B.—Frame or Mould Cut to take Ribands. Fig. 4.—Dowel Building. Fig. 5.—Diagonal Building. Fig. 6.—Weights for Drawing. Fig. 7.—Spline held in place by Weights. Fig. 8.—Midship Cross Section showing Coamings of Well. Fig. 9.—Rob Roy Canoe: Sheer Plan. Fig. 10.—Deck Plan, showing places of Timbers for support of Deck.

succeeding planks are fitted, nails are driven through the planks from the upper edge into the plank beneath, but each should be driven *diagonally*, in a different direction to that before it; of course long nails are required for this plan, and when the skin is completely formed the timbers are fitted in; generally they are simple lengths of wood, or battens which have been steamed, and are forced into place and nailed there. When they dry they are very strong, as the grain is continuous and easily takes the strain.

Diagonal Building (Fig. 5).—In this the planks are laid in two thicknesses, the first from the keel to the gunwale at an angle of about 45°, the next across it at an angle, or else longitudinally, over the moulds; the outer skin is nailed to the inner skin with nails at each corner, where they cross each other; the best-looking work is with the outer skin longitudinal, but the strongest is when both skins are diagonal.

Oak.—Having decided on the method of planking you intend adopting, you should next determine on the wood you intend employing, as some kinds are so much heavier than others, and for a canoe would be too cumbersome. Undoubtedly oak is the best for all purposes, knocking about in foreign countries or our own coasts; but when weight is an object, a lighter wood should be used. Below is given a table of the weights of various woods, a cubic foot of each kind having been carefully weighed:—Spanish mahogany, 55 lbs.; oak, 50 lbs.; Honduras mahogany, 40 lbs.; yellow deal, 33 lbs.; cedar, 30 lbs. Therefore a canoe built of oak would be about half as much heavier than one built of cedar: a very important difference in a day's paddle or long journey.

Cedar.—This wood is very apt to split when much exposed to the hot sun, is a very nice-looking light wood, easily worked, and for most purposes is found sufficiently strong; but if the canoe built of this wood gets aground on a rock or a snag, in all probability the plank will be split by the mere efforts to get her off, causing motion which will do the damage. In selecting this wood for a canoe it should be entirely free from knots and shakes, though small sound knots will not do much harm.

Red pine is a wood, hard, heavy, and full of turpentine, and though not often used in light boats, it is very durable if the wood has been carefully selected so as to be sound and straight in the grain; occasionally fishing and ships' boats are built of this wood, and with very good results.

Yellow pine, or *spruce*, is sometimes used for canoe building, but is far more commonly used for the spars and paddles, being both very light and strong; it is also close grained and quite free from knots. If on a journey with your mast up you come in contact with a tree, bridge, or other obstruction, the spruce mast will break short off at the deck, without bursting it and the beams, carlings, etc., all to smash, which would certainly be the case with any other hard and tough wood.

Honduras mahogany is a good wood, being strong, hard, and handsome; it is nearly everlasting, as hardly any insects will touch it; in weight it is about a sixth lighter than oak, though Spanish mahogany is rather heavier.

Spanish chestnut is often used for timber of canoes, being hard, strong, and capable of standing shocks and strains, and is long in decaying.

Birch is a very useful wood for light work and strength combined, such as in beams, timbers, carlings, coamings, or in such positions.

Ash is another most necessary wood for canoe building, as it is the very best thing you can get for coamings to the hatches, for rubbing pieces or bilge keels, or for wales round the vessel; sometimes it has been used for stem and stern posts.

Tools Required for Building a Boat or Canoe with.

Planes.
Jack, smoothing, rabbet, pair of match, round sole, beads.

Chisels.
Firmer, mortise, and others of various widths and sizes.

Saws.
Rip, panel, tenon, compass (fine), hack.

Gouges of Various Sizes.
Draw knives, spokeshaves, mallets, hammers of various weights.

Bits.
Brace and sets of quill centre and American, from 1 in. downwards.

Gimlets, rose, counter-sinks, a driver and broach, Archimedean drills, scrapers, bradawls, screw compass, adze, axe, hatchet, chalk line and chalk, punches, pincers, rooving-iron, nippers, hand-vice, a small handy anvil, 2 ft. rule, a steel roll-up measure with scale marked on it. This is very useful for measuring the bilge of the boat. Compass and square, straight-edge, cramps, both of wood and iron, for holding the planks in place whilst fitting and nailing, a work bench fitted with a powerful vice—or a substitute may be made with a plank 2 to 4 in. thick by 9 to 12 in. wide by 12 to 18 ft. long, screwed to three strong trestles of the same height. A long bench of this kind is exceedingly useful for planing up the planks on.

All tools should be kept very sharp, and if a plane or saw is rusty or dirty, chalk it.

The old Rob Roy canoe appears the best kind for an amateur to construct, that being the original of all our canoes; then when well advanced in the management of a Rob Roy, the amateur may proceed to construct any of the other varieties, such as a Ringleader (single or double), a Nautilus, a Pearl, a Mersey or Humber, Canadian or American canoe, various sorts of which are used for paddling, paddling and sailing, or simply for sailing; some travelling canoes are used for sleeping on board, being provided with tents for the purpose, but a man had better begin at the commencement, and thus cannot do better than build a pure Rob Roy, the measurements of which are 14 ft. in length, 28 in. in width, and 9 in. in depth from keel to deck amidships, but the best guide for the depth is the length of the foot, as when under the deck there should be sufficient room for the foot to turn easily, otherwise the toe and heel may get firmly set fast, which would be a source of the greatest danger in case of a turn over, as a man could hardly extricate himself from such a position when in the water; at least a foot in the clear is the best depth to adopt. A Rob Roy canoe when complete for use should not weigh more than from 60 to 70 pounds; some are much lighter than this when built expressly for lightness, but 70 pounds is not too much for an average man to manage, and carry round any gate or lock he may meet with, and if grass has to be crossed it is very easy to drag the canoe over it by the painter.

Having decided on the class of canoe you intend building, you must proceed to make drawings of the design, which is supposed to be for a Rob Roy.

To do this you must procure a drawing board, about 24 in., some drawing pins, a sheet of cartridge paper, a pair of dividers, a T square, a 2 ft. rule with $\frac{1}{8}$ths and $\frac{1}{16}$ths in. marked, a scale divided from $\frac{1}{2}$ in. to the foot up to 2 in. (this may be on the edge of a parallel rule), some curves of various shapes, which you can easily make yourself of sycamore, pear, mahogany, or other wood, splines or battens, of same woods, or deal, with which to put in the water lines or other longitudinal lines, and three or four weights (Fig. 6), which can easily be cast in lead from a pattern of your own making, and be shod with some hard wood screwed firmly to the lead with three screws, the point having a small notch in it to take the spline, as shown in Fig. 6. In using the splines, one is placed on the spot where the line starts from, and a weight is rested on it; it is then bent so as to intersect the next point, when it is secured by another weight, and so on to the end (as in Fig. 7), where the spline is adjusted so as to exactly touch the points through which the line will go; a pencil or drawing pen with Indian ink is run along it, making the desired line.

Every design for a canoe or other vessel always consists of three separate plans, neither of which can be worked from unless in conjunction with the other, and each must be so correctly drawn that every part of the three plans must correspond exactly with each other. These three plans are known as the sheer, body, and half-breadth plans. The longitudinal vertical section shows the outline of the length of the boat, and is known as the sheer plan (Fig. 9); the vertical cross-section at various distances along the sheer plan is known as the body plan; the longitudinal transverse section of the canoe at the deck line, the water line, and other positions parallel to the water line is called the half-breadth plan.

It is not necessary here to enter into too many technicalities, but to proceed with a description of making the design for a Rob Roy canoe. The commencement is made by drawing in the sheer plan (Fig. 9), which contains the length, depth, sheer, and outline in general of the canoe. The load water line is first marked on the plan; the length the canoe is intended to be is then marked off to scale on this load water line, and from it the intended free board at the lowest point amidships; the height of the stem and sternpost is marked off, and from these points the sheer is marked in by a spline or batten touching each of these three points; you next determine the depth your canoe is to be: this must be measured from the top of the gunwale to the top of the keel, and then a line is put in below this to show the full draught of water to the under side of the keel band. You can if you like put in other lines to show the different water lines at different depths of immersion. The sheer plan being completed, you commence on the body plan, the paper being of sufficient size to admit its being drawn on one side of it. To begin with, draw a perpendicular line, which is the dividing line between the fore and aft sections: the largest is the midship section, which is in general about midway between the stern and sternposts, but sometimes it is some space aft of the exact midships, and in general should be so, as the weight of a man's body is usually in the after part of a canoe, and then there should be the greatest power of floatation or breadth to support the cargo, *i.e.*, the greatest area.

The line of greatest draught should be drawn in from the same plan, and the intended thickness of the keel should also be put in; the beam, both on water line and deck, can now be put in with the curves, the midship section (Fig. 8) having been decided on; the breadth of beam at the water line and on deck must be marked in with curves or splines, bearing in mind that it is only necessary to draw in half the fore breadths on one side and half the

after breadths on the other: these are best put in by pricking them off on the perpendicular lines with dividers.

Having finished the sheer and body plans, the next thing to do is to draw in half the half-breadth plan: this is done by drawing two perpendicular lines to represent the total length of the vessel over all, taking the length from the sheer plan, the half breadth being placed exactly under it. The place of the midship section (Fig. 8) having been decided on, usually somewhat aft of the exact midships, it is drawn from the sheer plan right down through the sheer plan to the middle of the base line of the half-breadth plan. You can also mark in as many other sections as may be thought necessary; the deck line can now be run in with a spline, the beam being taken from the body plan; next you mark off with the dividers the distances of various bow and stern sections on the deck line, and run them in with a spline; you can then mark off the water lines on the half-breadth plan from the body plan, and having these points all shown, take a spline, and making it touch all the positions shown, draw in the curves.

It is not necessary to enter into too many technicalities in the design for a canoe, as these can be ascertained from most books on boat and yacht building if one wishes to construct larger and more important vessels, where much greater exactitude is required, but what is given above is quite sufficient to enable an amateur to build a simple Rob Roy canoe.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

INTRODUCTION—ABBOTT'S MAKESHIFT HIVE.

I HAVE been asked to write simple and comprehensive instructions as to the manufacture of those appliances for bee-keeping which can be made at home by a man of ordinary mechanical skill. I may, therefore, explain at once that my aim in the following pages will be to make things as simple as possible, so that they will be understood by all. At the same time, I will endeavour to show the principles which govern things, so that any person can do that which is most suitable to his own pocket and requirements.

Bee-keeping has now become a science—or, more properly, a science and art combined. The bee master is a king amongst his tiny subjects, as absolute as the Czar of Russia or the Shah of Persia—far more absolute, indeed, than the most despotic monarch would ever dare to be among men. He regulates the affairs of their household, arranges their marriages, the strength of their forces, the proportion of males to females, their comfort in summer and in winter. He partakes of the fruits of their labour, and causes them to procure far more honey than their natural instinct would prompt.

All these powers, and several others, are due to the invention and perfection of the bar-framed hives.

I suppose in the early ages of the world's history a savage of more than ordinary intelligence must have had his curiosity aroused by seeing numerous buzzing insects enter the hollow trunk of some decayed tree. He may have been induced to examine the tree more closely, perhaps to split it open with his stone axe. If the reception he got was not too warm, he would have been amply repaid for his trouble by obtaining his first taste of honey, which, after the manner of savages, he would surely pronounce "Good."

But his stock of this delicious food would depend on chance discoveries in the forest, and accordingly, when he saw a cluster of bees clinging on to some branch or tree, he would be tempted to imprison them—perhaps in his hat, if he had one, which appears likely to be the origin of the straw skep. This method of keeping bees was developed, and became almost universal until quite recently. Then science stepped in, and calculated that from ten to twenty pounds of honey were consumed by the bees in manufacturing one pound of wax, and as honey and wax were about the same price then, it was evidently a loss of about two thousand per cent. to the bee-keeper. The idea struck somebody that if he gave the bees a lump of wax, they might be induced to utilise that and save the honey, but they would not touch it. Then he thought of reducing the wax to thin sheets, but the bees would not touch it even in that condition. The next step was to impress the foundation of the cells upon the sheet of wax, and the bees were found to take kindly to it in this condition, to draw it out into perfect combs for brood and honey. The modern bee-keeper, therefore, supplies his bees with sheets of comb foundation, which can be purchased at a cheap rate, and will save at least ten times its cost.

One of the advantages of the movable frame hive is the facility with which comb foundation can be fixed in it, but it is only a minor advantage, for with a little management foundation can be fixed in almost any hive. The principal is the ease with which all the combs and the health and condition of the inmates can be examined.

It is sometimes found that the queen of a colony has got lost by some means, and if there are no eggs or very young larvæ with which to make a new queen, the fate of the colony is doomed except a new queen is provided, and the bee-keeper could scarcely ascertain the loss of the queen were he to use the ordinary skep hives. Again, towards winter some colonies have more than enough stores, while others, if left to themselves, would die of starvation before the spring came. But the bee-keeper averts that catastrophe by giving to the weak ones some of the superfluous stores of the others. This shows not alone the advantage of the movable frame hive, but the necessity of having all the frames in an apiary interchangeable. Sometimes we obtain stocks from other apiaries, which, if their frames were not fitted to our hives, would reduce their value considerably. All this points to the fact that there should be a standard size of frame used throughout the country.

The British Bee-Keepers' Association has recommended as a standard, frames 14 in. long and $8\frac{1}{2}$ in. deep, the top bar being 17 in. long, $\frac{3}{8}$ in. thick, and $\frac{7}{8}$ in. wide; the sides $\frac{1}{4}$ in. thick and $\frac{7}{8}$ in. wide; and the bottom $\frac{1}{8}$ in. thick, the width being about $\frac{1}{2}$ in.

These are the sizes recommended by the Association, but the important thing is the external dimensions of the frames, and the thickness of the stuff of which they are made is immaterial—within limits, of course. I always make the top bars $\frac{1}{2}$ in. thick, and the sides nearly $\frac{3}{8}$ in., the bottom being $\frac{1}{4}$ in.

Fig. 1 is a fully-dimensioned diagram of a frame that is now before me, which I can recommend as being easily made and thoroughly efficient. The external dimensions are those recommended by the Association, but the wood is somewhat stouter, as I find it much easier to put together than when it is very fragile. The frame is hung from the sides of the hive by the extending lugs of the top bar. A few more data, and we can proceed to the construction of our first hive. It has been found out that bees build their combs $\frac{7}{8}$ in. thick, and that they require a space of about $\frac{1}{4}$ in. at each side of them to move about in. This would make it requisite to allow $1\frac{3}{8}$ in. for each comb or frame. A little more, however, is generally allowed—viz., $1\frac{1}{2}$ in. slack, or, to be more accurate, $1\frac{9}{20}$ in.

The internal dimensions of our hive are, therefore, fixed for us: $8\frac{1}{2}$ in. deep, thus allowing the thickness of the top bar under the frames for the bees to move about in; $14\frac{1}{2}$ in. long, which allows $\frac{1}{4}$ in. at each end of the frames for the passage of the bees; and $1\frac{9}{20}$ in. wide for every frame we intend to use. The general number of frames employed is ten, which, with two dummies of equal thickness, would be twelve. $1\frac{9}{20}$ in. multiplied by 12 would give us, say, $17\frac{1}{2}$ in.; therefore the dimensions of our hive inside will be $14\frac{1}{2}$ in. × $17\frac{1}{2}$ in. × $8\frac{1}{2}$ in. I may remark that the ordinary 9-in. boards come in very handy in the construction of hives.

A few more particulars must be kept in mind. If a space much larger than a quarter of an inch is left in the hive, the bees will begin to build comb in it, and if smaller chinks are left, they will stop them up with a glutinous substance, called propolis, obtained from some trees; and this is not alone messy, but it wastes the time which the bees might employ in collecting honey. If any parts of the hive have to be moved—*e.g.* the frames or dummies—their contact with the fixed portions should be as small as possible—mere lines, if practicable, for this will prevent them being stuck firmly with the propolis.

If any person tries to fasten the edge of a thin ruler to a piece of board with glue, he will have a practical illustration of the difficulty of fastening two small surfaces together with a sticky substance. Other requirements will suggest themselves as we proceed; for the present I will pass on, as I can imagine some to be impatient at this long preamble.

The Tools required for Hive Building will vary very considerably with the talent and power of accommodation of the workman. I have seen a man do nicer and better work with a jack plane and saw, with hammer and square, than another could do with a whole shopful of tools.

A fairly complete set would include the following items: jack, smoothing, and trying planes; shooting board; hand and tenon saws; square, 9 in. long; two chisels, 1 in. and $\frac{1}{2}$ in.; marking gauge; hammer, awls, screwdriver, and rule.

This is not a very extensive kit, and yet I think I have mentioned everything that is absolutely necessary. In the course of this series I hope to describe a few more tools and appliances, including a circular saw, which, if not absolutely necessary, comes as near being so as anything could possibly be.

The first hive I will describe is a modification of

ABBOTT'S MAKESHIFT HIVE.

It consists of a box $14\frac{1}{2}$ in. long, $17\frac{1}{2}$ in. wide, and with the long sides $8\frac{1}{2}$ in. deep, while the others are 9 in. deep, all inside measurements. To make it, procure 7 ft. of wood 9 in. wide. Yellow pine is undoubtedly the best wood for hive making, but red deal, or

even white deal, would stand a long time, if dry and well painted. The thickness of the wood used may vary, but, as a general rule, $\frac{3}{4}$ in. planed, which will then measure about $\frac{5}{8}$ in., may be employed for most parts of hives, except where otherwise specified.

The seven feet of wood being planed, a length of $35\frac{1}{4}$ in. may be cut off; one edge of this is then shot true with the trying plane, and bevelled to an angle of about 45°, leaving about an eighth flat, as seen in Fig. 2. Then set the gauge to $8\frac{1}{2}$ in., and mark a line on the board that distance from the bevelled edge. Run the saw a little outside the mark, and with the trying plane true the edge square to the surface until the mark is reached. Cut the piece into two, each $17\frac{5}{8}$ in. long, and lay one over the other, having the bevels out. If the pieces are placed exactly over one another, the edges will be found to coincide; but, except the square was true and the sawing carefully done, the ends will not be exactly even. The pieces should therefore be clamped together, if necessary, with two screws passing through them, and the ends shot at right angles to the sides and surfaces with the trying plane and shooting board. The pieces will now, probably, be only $17\frac{1}{2}$ in. long, but if they are longer it makes no matter; they may be taken asunder and the screw-holes plugged, either now or afterwards, with wooden plugs glued in.

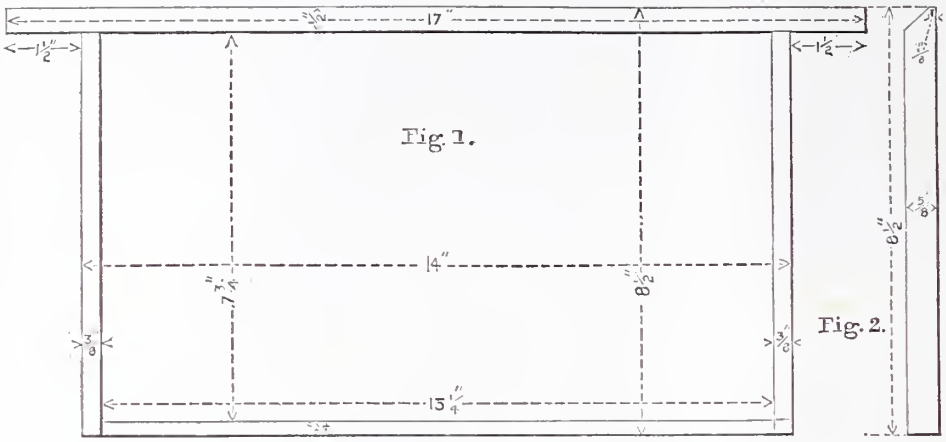


Fig. 1.—Frame fully dimensioned. Fig. 2.—Long Side of Makeshift Hive: section.

The remainder of the board, measuring a little more than 4 ft., may have its edges now shot, and two pieces, each measuring 16 in., cut from it. One of these may now have a space cut for a doorway 4 in. at each side of the centre and $\frac{3}{8}$ in. high, making the doorway thus 8 in. long and $\frac{3}{8}$ in. high.

Lines may now be drawn with the pencil and square $7\frac{1}{4}$ in. towards each side from the centre of these boards, thus having the lines $14\frac{1}{2}$ in. apart. With an awl bore holes a quarter of an inch outside these lines, and the hive is ready to be nailed together.

Bring the inside edges of the ends of the long pieces (having the bevels turned out) to the pencil lines marked out on the short ones, and put a nail about the middle of each board, being careful to have the lower edges of the boards on the same level. The nails used had best be cut joiners' brads, $1\frac{1}{2}$ in. long.

It is good practice to anoint the ends of the boards with white lead before they are nailed up, as it preserves the wood, and makes the joint almost air-tight. The box should now be laid on a perfectly flat surface, or looked at across the top edges, to see whether it is in winding, and if not, the remaining nails, four or five at each corner, may be added.

As the inside width corresponds with the lines pencilled out, it will be $14\frac{1}{2}$ in., just right to suit the frames. If the ends of the short pieces be now smoothed off on a level with the sides, the hive may be considered complete; but one thing is evidently wanting yet: there is nothing to prevent the frames from touching one side and being half an inch from the other side of the box.

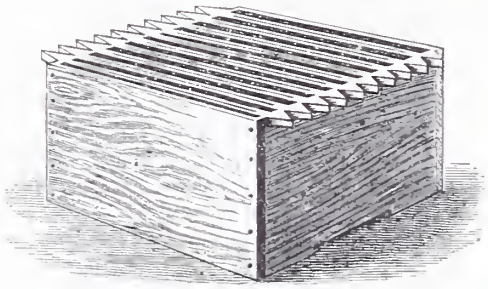


Fig. 4.—Abbott's Makeshift Hive shown with Frames, but without Stops for Ends: the Door is inside.

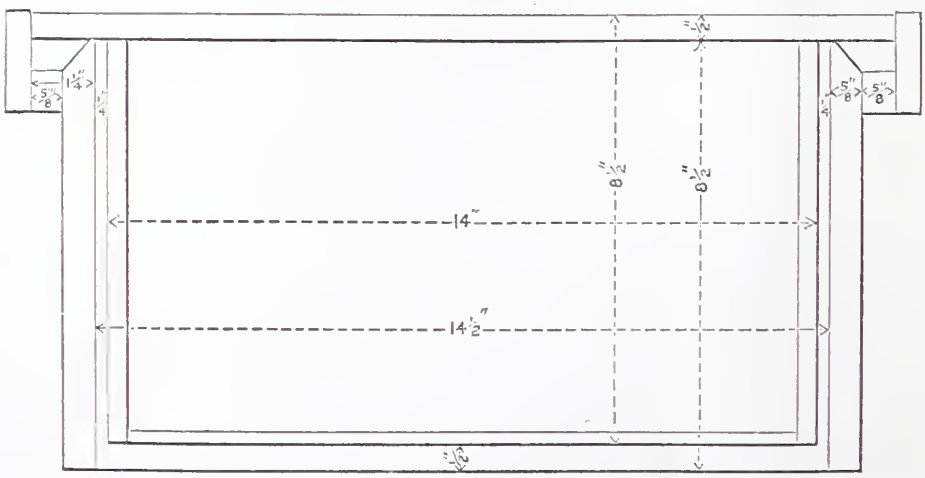


Fig. 3.—Section through Hive, showing Frame in place and two Stops for Top Bar.

This is prevented by having stops at each end, as is shown in Fig. 3. For these stops the remaining piece of board will come in useful. The top bar is 3 in. longer than the frame. It, therefore, extends $1\frac{1}{2}$ in. at each side of it, or $1\frac{1}{4}$ in. from the inner surface of the hive. As the side is $\frac{5}{8}$ in. thick, it extends $\frac{5}{8}$ in. outside the outside surface of the hive. Accordingly, a strip that thickness and an inch wide is nailed to the edge of the hive, and another, which may be any thickness, and about 2 in. wide, is nailed over that again, so that the end of the top bar abuts against it. This, at each side, will confine the top bar, and keep the frame in place exactly a quarter of an inch from each inner surface of the hive.

To any bee-keeper this hive is only a makeshift, as it is properly called, but it possesses over the ordinary skep the enormous advantage of movable combs, and the frames are of the standard size. It is supposed to sit on a board for a bottom, and to be covered with the quilt, with a board or waterproof cloth to keep out the rain. It would scarcely, however, be used for any length of time, its chief function being to hold a swarm until a proper hive was prepared.

I have not described how the frames can be made, postponing that to a later date. For the present the beginner might purchase half a dozen frames for a shilling, which will start him, and give him an idea of how they ought to look.

In my next paper I will show how to make a comfortable double-walled hive, with roof and all the necessities for a prosperous stock.

DESIGN FOR A CASE IN FRETWORK TO HOLD NUMBERS OF "WORK."

BY J. W. GLEESON-WHITE.

A READING-CASE to hold the current numbers of a serial work has many points that commend it to people who admire order. When WORK itself is cut open—not torn apart by that worst of all paper-cutters, an open and more or less grimy hand—it yields eight separate pieces, all betraying an impish tendency to crease themselves, tear themselves, grease themselves, and become generally dissipated and unlovely in appearance. Then some are apt to fall out, and even if not entirely lost, rarely again find their proper place in the ordered sequence of its pages. To those who frequently refer to "continued" articles, or are bidden to look at the columns of previous numbers for advice on the point under discussion, it is a great help to speedy reference if the rightful numerical order of the various pages is faithfully kept intact. Now, if the number be at once carefully cut and placed under an elastic string in a portfolio or reading-case specially prepared for it, not only can it be read with more pleasure, but the parts are kept clean and uncreased for subsequent binding into volumes. People who borrow odd numbers are the worst enemies of all both to books and their owners. For however the subscriber treats his purchase, it is nothing to the way loaned books suffer.

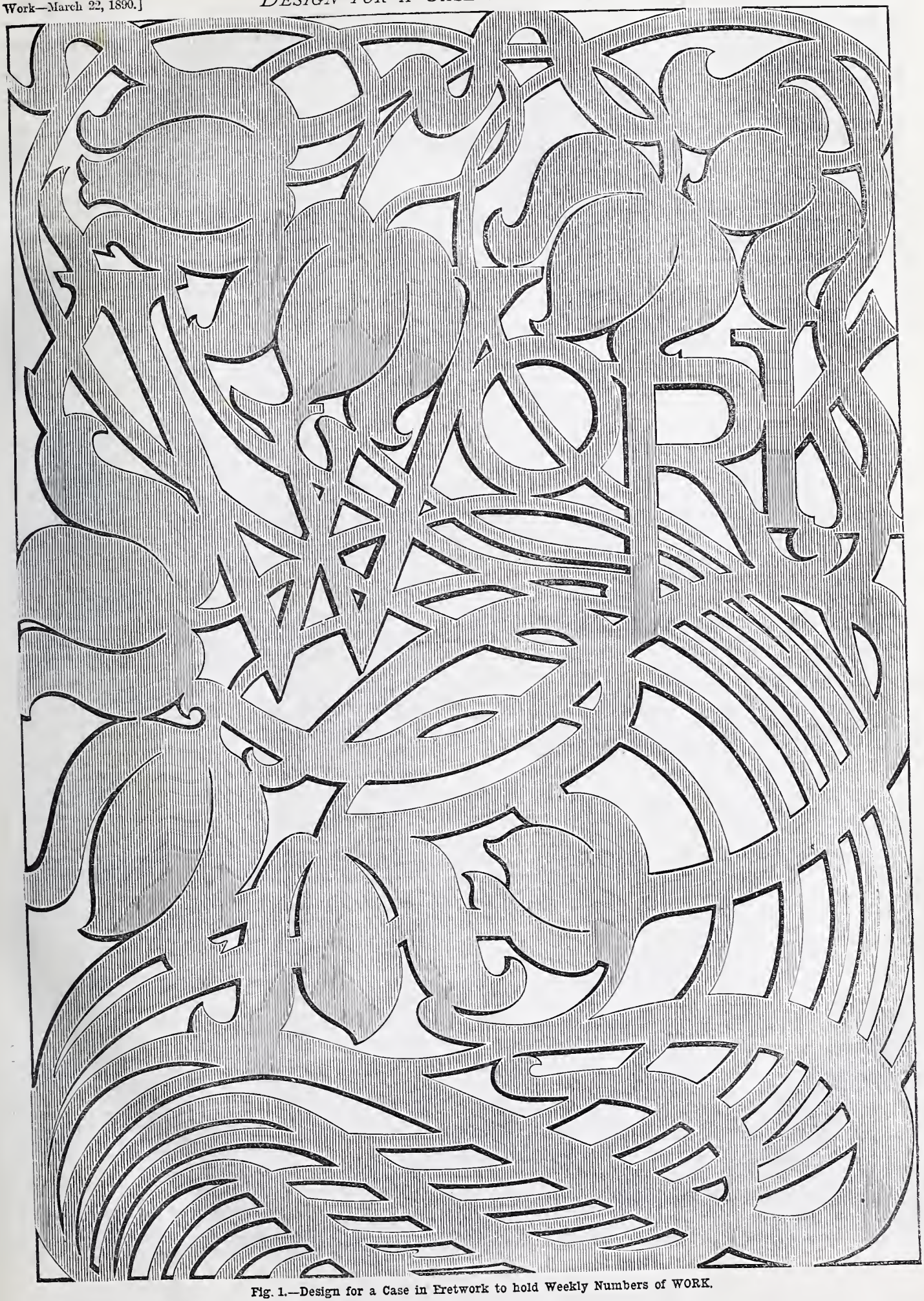


Fig. 1.—Design for a Case in Fretwork to hold Weekly Numbers of WORK.

To wreak the utmost indignities upon a borrowed magazine is a savage sport of otherwise irreproachable people. This, being a vice, is, as we said at the beginning of this article, naturally old enough to have become improved. In the "Philobiblion" of Richard de Bury (A.D. 1281-1345), he speaks of careless readers in the outspoken fashion of his day :—"You will, perhaps, see," he writes, "a stiff-necked youth lounging sluggishly in his study; while the frost pinches him in winter time, oppressed with cold, his watery nose drops, nor does he take the trouble to wipe it with his handkerchief till it has moistened the book beneath it with its vile dew." "He distributes innumerable straws in various places. He is not ashamed to eat fruit and cheese over an open book, and to transfer his empty cup from side to side over it; and because he has not his alms bag at hand, he leaves the rest of the fragments on his book." But to quote the ghastly picture the old Bishop of Durham sets forth is needless. In Morley's Shilling Library a reprint of his famous treatise is obtainable, yet those who are likely to buy

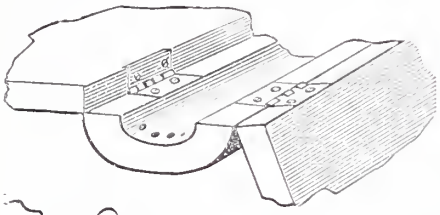


Fig. 2.—Construction of Back, showing Connection with sides.

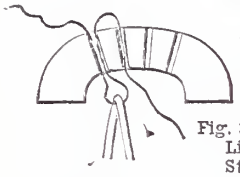


Fig. 3.—Section of Back in Line of Perforations for Strings.

it will probably be the very ones who can read its scathing satire with innocent consciences.

But to return to the subject. In order to lend a helping hand to readers of Work who buy their favourite serial in weekly numbers to keep it clean and without damage while in constant use at and after the date of publication, I have given in Fig. 1 a design for a suitable and appropriate case in fretwork, capable of holding several numbers, and this will be shortly followed by a companion design for a blotting-case, for the benefit of the numerous fret sawyers who have expressed a wish for such a design. In making covers for books, or blotting-cases with fretwork panels, the difficulty has been to construct a neat, yet strong, article. On an Indian blotting-case of sandal-wood inlaid with ivory and silver, I observed a rather clever adaptation of joinery to book binding that may commend itself to readers of Work. Its covers were hinged to a solid piece of wood, grooved as in Fig. 2.

The back of this piece was rounded after the manner of a book; the whole middle of its back was that of the thickness of the two covers (plus the groove to receive the after contents), each plain surface at either side of the said groove being the exact thickness of the covers. The panels were hinged in the usual way (as shown in Fig. 2), and thus were as lasting as ordinary cabinet work. To keep the contents in place—in the one I saw the porous paper used for blotting was made into a book, and cemented to its place—elastic strings should be inserted. For a blotting-book, one such would suffice, but for a reading-case, four to eight would probably be needed. I should suggest holes drilled carefully (as in Fig. 3) at the top and bottom of the solid back. Then fine elastic might be secured, as there indicated, by means of the thin wire—known as flower wire—sold in penny reels. To pass the elastic itself through these holes is almost impossible, and appears clumsy, even if it can be managed, but to secure the loops of elastic with stitches (so to speak) of this fine wire is quite feasible.

Although the panel design that is given here, as well as that which is yet to be given, are, for obvious reasons, represented without the wide margin of plain wood, essential alike to their appearance and their stability, it must not be forgotten that the uncut border is an absolutely integral part of the scheme. Whether for blotting-case or a reading cover for current numbers, the case should be at least a trifle larger than the whole page of Work: say an eighth to a quarter of an inch extra all round. The plan of making the blotting bookcase entirely of wood has been noticed above, but it will be as well to describe the usual methods.

In this case the panels are simply ornamental additions to an ordinary portfolio of card or millboard, with a joint of either leather or bookbinders' cloth. Full instructions to make these will be found on pages 138-9, Vol. I., of this periodical. For such a purpose it were best to choose very thin wood: either the thin "three-ply" sold for fretcutters, or a home-made substitute formed of two or three layers of thick veneer arranged with the grains crossing each other. This substance, an eighth of an inch thick at the most, will be strong enough for all its requirements, and neither clumsy when made up nor difficult to saw. In such thin wood, at least two panels may be cut at one sawing, with average care to keep the saw blade perfectly vertical. A good method of securing a rigid substance is to paste a piece of thick paper on both sides, and lay it under pressure between the two panels. After it is cut, a thin-bladed knife will split the paper itself, while the portion adhering to the upper surface of the lower panel is easily removed by damping it. Although this cardboard foundation is much less sturdy than the alternative described above, it is much easier to make, and less clumsy when finished, and, for a blotting-book, pleasanter to use. I have blotting-cases made in this way that after ten years' use show little signs of wear, so in view of the transitory nature of fretwork generally it may be held sufficient. The panels should be applied to the portfolio (previously covered with a suitable texture to contrast well with the wood), and left to dry under heavy pressure.

As the alternative modes of manufacture have now been placed before the reader, the one being to the mind of the writer better suited for a receptacle for weekly numbers, and the other for a blotting-book, the would-be maker must now be left to take his choice in the matter of making.

The various processes of fret-cutting, finishing, and the making of the portfolios themselves, being already amply discussed in these pages, it will suffice to refer possible workers to Vol. I. for any details that are by chance or design omitted here.

For all purposes such as these, where fretwork is to be handled frequently and liable to close examination, it should be neatly finished, and the rough saw cuts polished smooth with a small file.

The whole cover should be lined with silk or paper. While the colour is a matter of choice, yet for blotting-books, black staining, with a subsequent polish, is obviously the most suitable. The letters might in either case be gilded if the taste of the maker prefers them to be made more apparent.

In place of a drawing of the finished case, for which room could ill be spared, it is hard to give an idea of its finished effect, but that it is pleasant enough I can vouch by actual experience.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

1.—Church's Wall Decorator.

I wish for a few moments to call the attention of the readers of Work to the article and illustrations with which this, the first number of the second volume, is commenced. The paper is descriptive of a new process for the decoration of the surfaces of walls and wood, and the engravings by which it is accompanied exhibit very clearly some of the varied effects that may be produced. It is aptly entitled "The Wall Decoration of the Future," and so it undoubtedly is, by reason of its cheapness, the rapidity with which it can be done, and the beauty of its appearance when finished, satisfying the eye in every respect by the forms with which the surface is diversified and the colours with which it is enduced, ranging from a delicacy of tint to a richness and depth of tone that cannot be surpassed by any other preparation in the form of a pigment. The writer of the article has told his readers what it is, and how the work is done, and it remains for me merely to say that I have seen a house in the south of London decorated by the process from cellar to attic, and that I was, in every way, impressed and satisfied with what I saw. With regard to its cost, the painter who was at work in the house told me that a room in which we were standing—to paint which in oil colour would have cost about £2—had been done in the course of about six hours, the material used costing about 10d. Further, he took a piece of wood about 3 ft. long and 15 in. wide, and in ten minutes he had mixed the material necessary for the work, painted the panel, and combed the surface with a graining-comb, producing a corrugated appearance, rich in effects of light and shade. Further, he had only been acquainted with the process for three weeks, and yet had attained sufficient facility in its use to work with the confidence and rapidity that he then exhibited. No amateur workman can fail to carry it out well, much less any professional worker in paint or plaster; and I trust I have now said enough to occasion readers in every town of the United Kingdom to apply to "The Church Manufacturing Company," 127, Pomeroy Street, Hatcham, S.E., for specimens of the colours employed and sample tins of the "Wall Decorator," or the cheaper "Alabastine," and to try them for themselves under the instructions conveyed in the article to which I have already made reference. I trust it may prove the means of making many a workman's dwelling more attractive as a home, by the triple charm of colour, cleanliness, and help towards better sanitation.

2.—The Britannia Company's Patent Dovetailing Machine.

In the first volume of this magazine I was enabled, by the courtesy of the Britannia Company, to call attention to their powerful patent saw, and to give a brief description of it, with an

illustration. I am now further permitted to call the attention of my readers to a simple but highly efficient appliance for dovetailing, known as the "Britannia Company's Patent Dovetailing Machine," which is illustrated in Figs. 1, 2, and 3, given herewith, the nature and the work done by its aid being further shown in Fig. 4. Every workman who has been accustomed to cut dovetailing well knows the care and accuracy that are required to ensure perfect work, and how much the time taken up in its performance must be abridged by the use of machinery capable of producing the same result, and that in shops where much of this kind of work is done, the cost of it must be considerably reduced, when it is said that an apparatus of ordinary size, as shown in the illustration, is supplied by the Britannia Company, Colchester, for £2 2s. I will now proceed to give the Company's description of the machine itself, and the method of dovetailing by its aid:—"First, fit a well-seasoned pine board about 24 in. by 18 in. and ⅜ in. thick, strengthened with clamps at each end, upon the saw-table, with a mahogany spline fitting the groove in

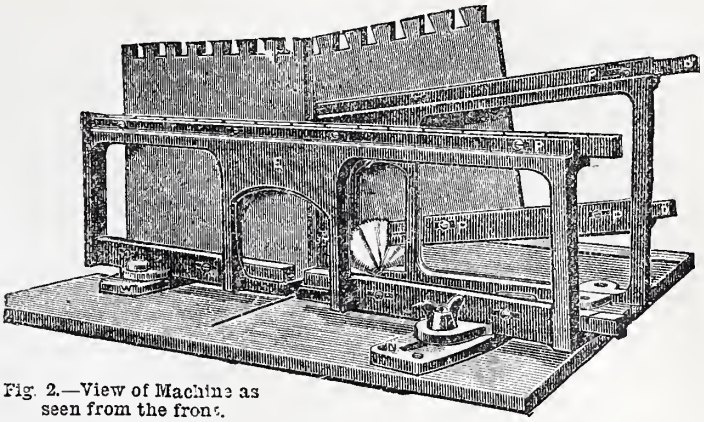


Fig. 2.—View of Machine as seen from the front.

Fig. 1.—Patent Saw with Dovetailing Machine on Saw-Table and in use.

mortises, place the wood upon the inclined plane, having adjusted the table so that the saw will cut the correct depth. Bring the front edge of wood up to the end of the gauge, holding the marker in the left hand so that it falls into the various slots as the wood passes up the incline." The positions of the operator, the movable table, the frames, gauges, inclined plane, wood, marker, and saw are all very clearly indicated in Fig. 1.

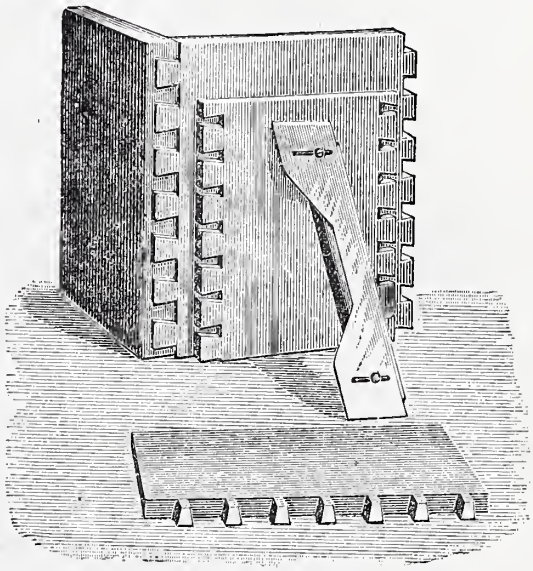
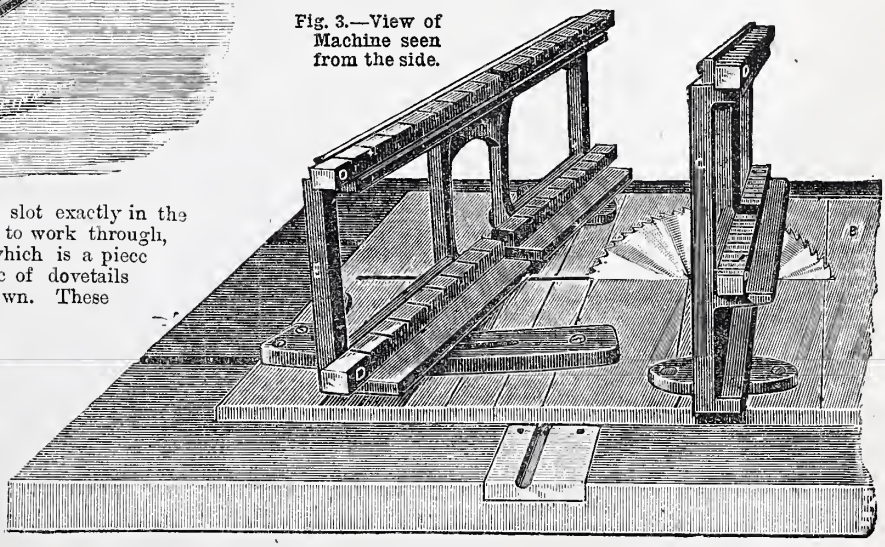


Fig. 4.—Examples of Dovetailing done by Machine.

"When one row of cuts has been made, turn the wood round and take the marker in the right hand and follow each cut up the incline until the cuts are completed. To cut the tenons or pins, adjust the saw-table so that the saw cuts the required depth. Fix the gauge, D, on the lower ledge of platform, E, the inner end of gauge forming the distance for the first cut." Of course, it will be understood that the cuts only are made

Fig. 3.—View of Machine seen from the side.



your saw-table, ensuring an accurate movement, with a slot exactly in the centre of the two frames when in their places, for the saw to work through, as shown in Fig. 1. Fix on the gauge, D (Fig. 3)—which is a piece of wood with slots at intervals, according to the size of dovetails required—upon platform, P (Fig. 2), of frames, as shown. These gauges are generally fixed upon the lower ledge, but for some work the upper ledge may be more convenient. A set of these gauges can easily be made by any amateur, or are supplied with the dovetailer. The appliance W (Fig. 2) is to be fixed upon the board as shown, so that the saw may run clear when the movable frame is at either end of the segment. Put in the screw at W through the frame, E (Fig. 2), and screw down, so as to allow the frame, E, to move backward and forward. The frame, N, is to be fixed, as shown, 2¾ in. from square line of saw. To cut the

by the saw. The clearance of the mortises and the wood intervening between the pins must be effected in the usual manner with a chisel. The merit of the entire appliance lies in the presentation of the edges of the wood to the saw in such a manner and in such a position that the saw kerfs, first in one direction and then in the other, are made with such sure and certain regularity of distance and direction, and perfect parallelism, that an operator who is comparatively an unskilled hand can be enabled to perform work which, if done by the hand, must be the outcome of long practice combined with the utmost care in execution. THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Saw Hammering.—T. O. (*Bootle*) writes to J. N. (*Sheffield*):—"I am very thankful for your kind offer on page 715, Vol. I. Regarding my late questions in WORK about saw hammering, I should like to know how to hammer a huckle and a twist from a hand-saw, and the description of the hammers for the job, and their weight. I might say I have an anvil, or, properly speaking, a hammerer's anvil. Please describe the different effect the various hammers have on the plate or on the saw."

Band Saws.—A. X. E. (*Nottingham*) writes:—"I have read the letters of A. R. (*Scorrier*) on brazing hand saws in 'Shop,' but I think I have the advantage with Duncan's machine. Of course I have to use gas and he uses charcoal, etc. C. D. Moninger, St. Anne Works, Clerkenwell, makes a similar machine to Duncan's, but I have had no experience of it. Moninger's band saws I have used, and I can recommend them as being of good quality."

Varnishes.—G. W. D. (*Ventnor*) sends the following recipes in varnishes:—"*A fine clear varnish.*—Dissolve gum mastic with spirits of wine to the thickness required. Another fine clear varnish is made by dissolving gum mastic (bruised) in spirits of wine; thin down to the thickness required with Venice turpentine; strain. *A transparent varnish.*—Gum sandarach dissolved in spirits of wine; add Strasburg turpentine to the thickness required for use; strain. *A paper varnish.*—Venice turpentine dissolved to the thickness required with spirits of turpentine; strain. *A white varnish for water-colour drawing, maps, etc.*—Canada balsam dissolved with not quite the same quantity of Venice turpentine; strain. *Cabinet varnish.*—A fine clear varnish. 3½ oz. of gum mastic well dissolved with 1 pint of naphtha, and strained through muslin. *A useful varnish.*—2 oz. of gum seedlac, well diluted to the thickness required. Strain through fine muslin. *A varnish once used wanted again.*—Steep well together a pint of methylated spirits in alkanet root, shellac, 2 oz.; gum benzoin, 2 oz.; gum thus, 2 oz. Dissolve these gums well together with the spirits by gentle heat, and strain through muslin."

A Useful Size for Water Colours, Maps, Print, etc.—G. W. D. (*Ventnor*) sends the following:—"Isinglass or gelatine, well boiled down, is useful, but parchment shaving, well boiled down and strained, when cold should be a thin jelly. *To prepare water colours for varnishing.*—With flat camel-hair brush lightly stroke through once, beginning at the top and working downward. When perfectly dry, another coat, working your brush more freely; when dry, if you give it the third, your work will be attended with better results. The same brush, washed out and dried, will answer all purposes."

A Paste to Keep from Souring.—G. W. D. (*Ventnor*) recommends sugar of lead. "Corrosive of sublimate was formerly introduced with paste when called on to repaper our old thatched houses, covered with ivy, etc., which give such refuge to insects and other vermin, as a preventive against them. Both being acids may assist to preserve; but both are poisons. Well dissolve a spoonful of alum (powdered) with small quantity of boiling water; allow this to cool. Mix this with a tablespoonful—more of each, if required—of flour into a well-heaten batter. Slowly pour boiling water, stirring till it turns. If not successful, small quantity of cold water in saucepan to keep from burning your paste, which slowly heat, stirring all the time until it becomes stiff. You will then have a paste that will keep from souring."

Folding Chair Rivets.—To. Po. writes:—"If CABINET MAKER (*Rawtenstall*) has any difficulty in getting his folding chair rivets and washers (proper bright and smooth ones, that will not rust or cut the wood so easily), if he will write to me (care of Editor), I shall be pleased to help him, knowing from actual experience how hard it is to get them, as, many shops do not keep the kind, even near where the folding chairs are made in thousands. The rivets are about 3d. per lb.; washers 1½d. to 3d. per gross, according to size and weight. I have mislaid the exact address, but expect to be in the neighbourhood again soon; I will take note. If 2 in. clear of head will do him, I could spare 3 or 4 lbs. or so, but they are just slightly rusting, being kept in a damp place."

Treatment of Cuts.—J. C. K. (*London, N.W.*) writes:—"MEDICUS seems to have overlooked the distinct statement that the treatment of cuts by French polish, and using pins to close the wounds, was offered as the best in cases of emergency. Glue, of which MEDICUS speaks as if it had been proposed by me, is, of course, to be condemned as likely to lead to blood-poisoning. He gives the regular course of hospital procedure: admirable, but not always available. Forty years is my long experience in cases of serious accidents, and their treatment when far away from a hospital. When near one, I have sent the men there to have their wounds dressed. Let some one who has suffered by the treatment named for emergent cases speak for himself, as to the harm or good resulting from the treatment which MEDICUS calls 'bad.'"

Printers' Ink.—PARAFFIN (*Cardiff*) writes:—"In WORK, page 715, Vol. I., appears some very strong remarks from M. D. C., in reply to a statement of H. L. B., about thinning down printers' ink with paraffin. If M. D. C. cannot understand how to mix the two articles together so as to be able to use the mixture, it is a great pity that he should sneer at one who knows more than himself. Allow me, sir, to say, as a working printer, that for years past I have never used anything else than paraffin for thinning down my ink. On a cold, frosty morning, when the rollers and ink slab are as hard and smooth as the ice outside, a drop or two of paraffin on the slab puts all right, and in five minutes I am able to run the machine. If I want to turn out a poster quickly, and so that the ink shall not stick one sheet to another, a few drops of paraffin is the very best drier I can get. If I have a job of colour work, with ink so stiff that the brayer will break almost before moving it, paraffin cures the difficulty. In fact, sir, I consider that the use of paraffin gives me about six or eight hours per week more working time. As regards poster writing, I am not a practical hand at that, but the principal poster writer in this town, a man who writes twelve to fourteen sheet bills for the theatres, etc., always fetches away our empty ink tins of all colours, and mixes the remains with paraffin until he has it so thin that it is almost as liquid as the paraffin itself, and he uses nothing else with it, whilst his written posters are the talk of the town. He tells me that nothing beats printers' ink well mixed with paraffin for poster writing. M. D. C. asks what to mix with printers' ink to keep it from working stickier or leaving brush marks. I reply—paraffin."

Copying Fretwork Patterns.—FRED (*Camberwell*) writes:—"I have hit upon a plan I think is very simple, and, what is more, you can make as many copies as you like. Take a piece of an old round blind-roller, and glue two or three thicknesses of cloth round it, and put a long nail in each end, which serves as a handle. You now want ink; this you can make with lamphlack and size mixed together to thickness of a thin paste. Put a little of your ink on a slab and roll your roller over it, so as to get the cloth covered with ink. When this is done, roll it over the piece of fretwork you have cut out and lay a piece of paper on it and rub it over lightly, and you have an exact copy. You can take off three or four with once inking the patterns. I have done this for some months, and find it very satisfactory."

About WORK.—H. A. B. (*Tunbridge*) writes:—"For the encouragement of others, not only to buy WORK but also to carefully peruse it from beginning to end, let me state how it came unexpectedly to my assistance when I wished to help a young friend to make an electroscope. Every one who does not know how to handle gold leaf finds a difficulty in doing so; when you cut it, it sticks to the scissors; when you touch it, it sticks to your fingers, it crumples up, it twists about and goes everywhere but where you want it to. Such was the experience of my young friend, and he turned to me for advice. I immediately looked to my text books and found the usual instructions how to make an electroscope: 'fasten two strips of gold leaf,' etc., but no instructions how to manipulate the gold leaf. But I was certain I had read somewhere what I wanted to know, so I turned back to the early numbers of WORK, and at last came to No. 8, and on page 118, Vol., I I found what I was in search of, 'Gold Leaf and How to Use It.' Although it refers to gilding picture frames, etc., yet I found what was lacking in my electrical text books, and was able to help my young friend over his difficulty. Had I only read, as some do, what concerns my trade, I should have lost what was at the moment most useful information. So I would say to all workers, do not turn away from WORK, even if you do not find it touches upon your particular branch of the trade, for you may find as I did—useful information in a tip given for a trade which has little in common with your own."

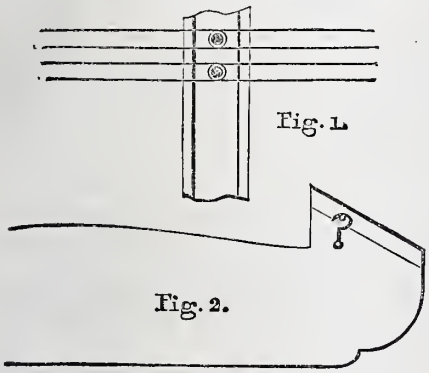
Wire Thread Fret Saws.—W. E. C. (*Wakefield*) writes:—"I have been a subscriber to WORK from the first, and I am very much interested in fretwork, therefore have noted the inquiries from time to time about the new wire fret saws. As soon as I saw your notice in WORK I sent off at once to one of the persons mentioned for a sample dozen (7d.). I received them in due course, and the tradesman from whom I got them kindly intimated in his letter that if they did not give satisfaction he would exchange them for something else, but I am afraid that if I sent them to him now he would object to do so. I have given them a fair and diligent and careful trial, and am now strongly of opinion that both the saws and the idea of the principle on which they are made are worthless, and I find that it is simply impossible to cut fine and delicate work with them. I took the trouble last night to cut you two samples of fretwork, which I enclose for your opinion. The panel on the right-hand side is cut with the new wire thread saw (No. 2), and that on the left with a No. 2 Star saw, and I think you will see there is no comparison in the quality of the two samples sent. I have sent all the waste in the recesses just as cut, so that you can better judge the work; and in doing the small bit of fret that I send you I broke no less than six of the new wire saws, but the other (Star saw) was no worse. I cut the sample with a machine on the principle of the Britannia Company No. 8 machine. I bought part of the castings and the working parts from them, and then made the machine myself. I enclose you photos of the machine, wherehy you will see I have made great changes in their machine, and improved it in several parts. In the first place, I cut all the castings, etc., away from the front of the saw, so as to leave a clear course for getting the saws in and out; made the table on an entirely different principle; reversed the tightening screw from bottom to top; at far end of saw I made a new cam and driver; and gave the saw a much longer stroke and several smaller improvements. And I have no hesitation in saying that there is no machine in the market to equal it in freedom of working, case in running, and the quality of its work. I omitted to say that the saws are too thick, which would prevent fine work being done with them, and that they are liable to run to either side in cutting." [It is clear from your experience and specimen of fret cutting sent that the ordinary fret saws are better for fret cutting than the wire thread fret saws, for the reason that the former cut in one direction only, the latter rasping the wood away on either side of the saw as it goes through it, as well as making the saw cut. Your adaptation of the fret machine appears from the photos sent to be ingenious and useful. I cannot engrave them, but if you like to write a paper on approval, showing the improvements you have made, with illustrative diagrams, I will consider it with a view to publication.—ED.]

Saw Hammering.—J. W. W. (*Hull*) writes:—"I see on page 715, Vol. I., that J. N. (*Sheffield*) promises to give any information on saw hammering that any of us would like. I am a circular sawyer by trade, but got lamed last June, and now having got to work, they (our firm) have given me the job of saw sharpening. But the difficulty is how to hammer the saws when they are not true, or have black eyes in them, for if I hit the saw where the lump may be, I throw the saw out in another place. I have made every inquiry as to the whereabouts of getting the information I require, but the saw hammerers will not tell me, they thinking that it would be taking a living out of their hands. Will J. N. kindly help me?"

Preparation of Artist's Canvas.—AN AMATEUR ARTIST writes:—"Several of your subscribers ask how to prepare canvas for painting on. The following is a method I have used for years, and find it answers well. It is quite as durable as that prepared by colourmen and much cheaper. Take a piece, say a yard, of any sort of canvas. You can get it from 3d. per yard. Stretch it tight on a rough strong frame. I keep one on purpose. Small tacks will fasten it on. Put it on just smooth at first, and tighten it up by drawing one tack at a time, and tightening up till you can stretch it no more. I use pliers to remove the tacks, and to draw the canvas tight. When done, size the one side with thin glue or patent size. Put it on the same side as the frame, but do not let the size go under the frame, or it will stick it down. This causes a little waste round the edges, but not much. Let this dry hard. Take a lump of bees-wax and well rub over the surface over the size. Let every part be gone over. Lay the frame on a level board or table with a piece of woollen cloth or ironing blanket underneath. Have a smoothing iron made hot enough to smooth, but not burn. Place this down gently at first, or it will stick, but when the wax melts the iron will run smoothly over the surface. Rub it over till quite smooth. All lumps or unevenness in the canvas will be pressed into the other side. It should now be even as a shirt collar. Take white lead, well thinned with turps and toned with ochre or umber, and paint the surface over. If the lead be lumpy or skinny, strain it. When dry you will have a surface to paint on equal to anything you can buy. Of course you cut it off the old frame, and refix it, the right side out, to a new frame."

Casting in Brass.—BRASS (*Wolverhampton*) writes:—"H. B. (*Jarrow-on-Tyne*) (page 779, Vol. I.) asks some one to get him a casting in brass from a mahogany pattern which he has made. I shall be pleased to do so for him if he will forward the pattern to me. He does not say if he requires it finished in any manner: I presume he will do that himself; if not, and he will say how he wants it done, I will try and do it for him. As the casting is for making an impression upon the back of a book, it will, I think, only want filling up smooth and level."

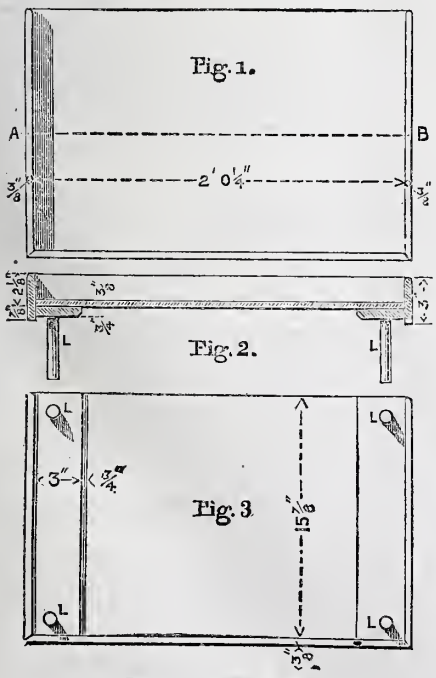
Dulcimer Making.—F. K. (*Hinckley*) writes:—"I should be much obliged if you would allow me to make a few suggestions for those intending to make a dulcimer. An amateur will find that if he does not get all his tuning pegs and hitch pins accurate, the work looks slovenly. Also he will find great difficulty in tuning. It is hard to tune one string to two notes; it is harder to get the four in unison to two notes. I should suggest that instead of separate bridges one long bridge of ¾ in. beech be used, perforated same as inside bridges with smaller holes—distance can easily be measured—to allow the strings to pass through, instead of



Dulcimer Stringing.

the strings passing straight over. Hitch pins should be driven in the centre of the bridge, the strings from each side simply passed round the pin, and tuning pegs on each side of the instrument, as in Fig. 1. Brass wire is to be put down each side of the bridge, same as blocks. Two pins will be sufficient for four strings. This is for the left-hand bridge; it is immaterial for the right-hand, but the strings passing over this should be tuned from left-hand side. I would also suggest that the facing of the dulcimer (Fig. 7, page 597, Vol. I.) should be left higher at the sides—just a little higher than the tuning pegs. A strip should be screwed on the side of the blocks and a lid hinged to this to cover the blocks, thus hiding any irregularities. This will save veneering and polishing the blocks. Facing and lids can be made of any fancy woods, carved or inlaid to suit fancy. Back facing to be left same as front facing."

Invalid's Bed Tray.—W. R. E. (*Lanarth*) writes:—"Enclosed you will find a sketch for invalid's bed tray. It has been proved by friends of mine to be very useful. It might prove so to a good many readers of WORK."



Invalid's Bed Tray.

An Easily-Made Fret Machine.—W. R. S. (*Brixton*) writes, in reply to EAST WINDOW (*Stockport*) (see page 716, Vol. I.):—"You ask me to explain what I mean by saying that the throw of the machine will be double the distance from centre to centre of the piece marked C. This is a mistake of mine, and for which I beg to apologise. I should have said, the throw of the machine will be double the distance that the bottom of the piece marked C is placed from the centre of the wheel."

An Easily-Made Fret Machine.—W. R. S. (*Brixton*) writes:—"In No. 47 of WORK, page 747, Vol. I., F. D. (*Luton*) says that the claims advanced for the above were in his opinion all false. The claims are that it has a vertical stroke, is easily constructed, and that it can be made for a few shillings. He then goes on to say that his machine has a just claim to the above recommendations, and that it gives a perfectly vertical stroke. I am very much obliged to F. D. for specifying his machine as though it were a great improvement on mine, when in point of fact it is an exact copy of mine, with the exception of the treadle, which, while being the only part that is original, is not at all suitable, as it is not sufficiently under the control of the operator. The claims I put forward are justified. My machine has a perfectly vertical stroke. F. D. says that his machine has one also: this is quite true, being a copy of mine; so much for his assertion that mine has not a vertical stroke. My machine can be constructed by any person of ordinary ability, and who is able to handle a few tools, and it can be made for a few shillings; in fact, the cost of mine was about 1s. 6d. I do not care to waste my time by replying to letters such as that of F. D., but I shall always be happy to give any information which is genuinely asked for. I may add that several people have called to see my machine, and I am prepared to show it to any one who cares to call at my address, which the Editor has."

Portable Electric Lamps.—The Britannia Company write:—"We have some of these, and are making an apparatus—dynamo and foot power, to charge them—without the mess of a battery."

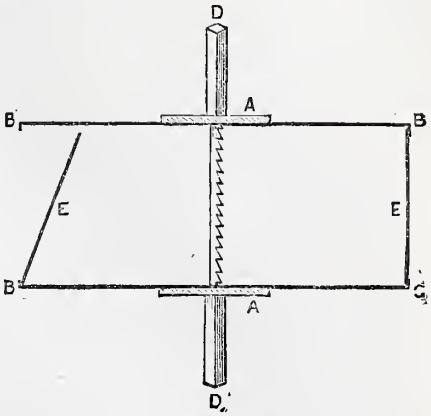
Boots and Shoes.—H. G. (*Bishopsgate*) writes, in answer to G. R. (see page 715, Vol. I.):—"I must say that his idea of boot and shoe making must be very vague; he wants me to answer a dozen items in 'Shop,' each one embracing a different branch of the trade. If he does not know how to build 1½ heel or round an innersole, I am sure he cannot make a wide welt, hand-stitched, or turn a shoe inside out, not if I described how it is done. I should advise G. R. to be a laster instead of a bootman—that is, making men's and women's boots on iron lasts—which is much easier to learn. Three parts of the boots and shoes that are made and sold in the United Kingdom are made on iron lasts, the prices ranging from 1s. 6d. to 50s. I am sorry I cannot tell him how to commence, as it would take up too much space in 'Shop.' You can buy men's and women's uppers of all descriptions, from 2s. upwards, from Nappir or Andrew, in Whitechapel Road; or Carter, Kingsland Road; or Beasley, Wilson Street, Finsbury, so I don't think it worth your while to try and cut them yourself."

Simple Incubators.—R. S. (*Withington*) writes:—"Like several of your correspondents, I a manxious to learn more respecting the 'Simple Incubator' that W. L. in page 557, Vol. I., writes about. I have experimented in making a simple incubator, and consequently I am not so puzzled about it as some of your readers seem to be. I procured an old bacon box from a grocer for a shilling. The top had been broken up, so I turned the box bottom upwards. I then made one end to take out, so as to act as a door. I placed this in a spare bedroom, put the pots inside as directed, and commenced work. The lamp used was an ordinary paraffin lamp, of tin. The thermometer was placed between the flannels where the eggs were supposed to be. The heat aimed at—103 degrees Fahrenheit. After two or three days' trial, I found that the apparatus would work with just moderate variations in the heat. One important point is that the lamp must not be too near the top pot or it will not burn well. If the apparatus were accurately constructed, I believe that no hot air should escape between the two pots, but after spreading itself over the bottom of the top pot, should find its escape under the lower edge of the bottom pot. The greatest defect seems to be the want of a regulator, and there is a very serious omission—there is no provision for moistening the eggs while hatching. Possibly W. L. believes that eggs will hatch all right without the moisture. I belong to the opposite school. If W. L. or any of your readers will explain how to make a regulator for the 'Simple Incubator,' and how to keep the eggs moist, he will confer a boon on many an amateur operator in hatching."

Steatite Burners.—F. B. (*London, E.C.*) writes:—"Allow me to supplement a few remarks in 'Shop' (see page 789, Vol. I.) regarding steatite burners. Messrs. William Sugg & Co., Limited, Westminster, are manufacturers of steatite burners. If H. W. L. (*Ealing*) requires lump steatite in larger quantities, I can offer same to advantage, being agent for a German pit owner."

Painting Magic Lantern Slides.—F. B. (*London, E.C.*) writes in reply to P. M. C. (*Finsbury Park*):—"The Silicine glass painting process offers several advantages as compared with the method described by OPIFEX. The glass does not require any special preparation before beginning to paint, while shades may be put in or several tints laid over each other, as soon as the underlying surface has become perfectly dry."

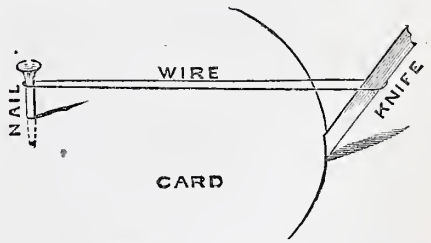
Useful Scroll Saw.—ARTIST IN WOOD writes in reply to VERDANT (see WORK, December 29, 1889):—"The size of fly wheel is 19 in., weight about 40 lb., thickness of shaft ¾ in. if made of steel; if of iron ⅞ in. Crank 2 in. from centre of shaft to centre of pin. That will give 4 in. stroke to the saw; it may be made to give a stroke of 4½ in. Length of irons for slides to work in 3 in.; length of slides 11 in. The slides are slit with a saw made for cutting iron, the same as a common bow-saw handle, and a bit of wire $\frac{3}{32}$ in. put through slide and saw blade to fix it. The frame is made to take down quickly for inside work. Top and bottom 3 ft. 2 in. long, 3 ft. 1 in. thick, side long enough to bend top and bottom woods, and so strain the saw. The saw blade is 16 in. long, ⅝ in. wide, ground thin at the back. Groves' make of saws are the best I have used. They cost 7s. per dozen. A A are pieces of inch wood to strengthen the frame and receive ends of slides. A washer is put in at the joint for end of



Useful Scroll Saw.

slide to rest on. B, bit of iron or tin 5 in. bent and made fast on end of top and bottom woods to keep the stretcher woods in their place. D, D, slides; C, joint made fast; E, E, stretchers."

Cutting Circles out of Cardboard.—A CONSTANT READER (*London, W.*) writes:—"Will the Editor of WORK or any correspondent inform me how to cut circles out of cardboard? Is there any machine made to cut them various sizes, such as a cheap horizontal compass with a movable cutter? I have been told of a washer-cutter, but this machine is too clumsy, and also too expensive. What I require is a fixed centre that does not move, so as to make the hole in the centre of the circumference so large that the true centre is lost in cutting a second circle out of the same piece of cardboard. I have tried ordinary compasses, but these do not cut, only tear the cardboard, and leave a rough edge, and make too large a hole in twisting round to allow of a second circle to be struck with the same centre. I may explain that I cover



Cutting Cardboard Circles.

these circles of cardboard with velvet and place ornamental plates in the centre, which is cut out to the size of the back of the plate to be so mounted."—[I have found a very convenient method for cutting true circles in card as follows:—I have a board 36 by 30; it is the back of a large drawing-board, but kitchen table would do as well. I take my straw board, and drive a French round nail in centre on to board, and draw a piece of thin wire across as shown round a mount-cutter's knife blade, with keen edges sharpened upon oilstone. You can cut circle to any size you like, and with a little practice you will cut it as clean as the best machine, and with care your centre hole should not be enlarged the slightest.]

An Easily-Made Fret Machine.—F. W. (*Bradford*) writes:—"In answer to C. J. D. (*Glasgow*) (see page 332, Vol. I.), I think the reason his machine will not work is that the connecting rod (or that part that joins the vertical rod to the crank pin) is too short. It should be not less than 1½ times the length of the stroke, and as much longer as the space will admit, the reason being a lessening of friction. If the connecting rod be long enough, it will not matter if the vertical rod is not quite over the centre of fly-wheel."

II.—Questions Answered by Editor and Staff.

Small Printing Press.—H. J. (*Bexhill*).—If H. J. requires a small-sized press not to exceed 3½ in. by 5½ in., we should recommend him to buy a No. 1 Model self-inking press, £3 10s., from the Model Printing Press Company, 96, Farringdon Street, E.C., who make several larger sizes at proportionate prices. The cost of fitting up for amateur printing depends entirely upon the quantity and variety of type required, and the class of work intended to be done. The above company will give an estimate. If H. J. contemplates attempting to print cuts or zinco blocks, we should advise him to buy a small "Albion" hand-press, second-hand (the smallest will print 12 in. by 10 in.), which will cost far less, for the size, than these "Croppers." He can also obtain type, galleys, chases, and frames, and cases, second-hand, from Esson's, Fetter Lane, or Morton's, City Road, who may also have presses for sale. A line to Mr. Hawkins, explaining your wants, addressed care of C. Morton, as above, would, we think, ensure your procuring exactly what you require: as being a thoroughly practical compositor and printer, possessing good taste in the selection of founts, his advice would be valuable. Mention this journal.—J. W. H.

Glass Pen.—W. D. P. (*Sheffield*) and S. J. H. (*Blackburn*).—I cannot now refer to the number in which the glass pen is mentioned. But the "Note" was jotted down about August or July last. The *Moniteur Industriel* is a weekly paper published in Brussels, and you can get it direct, or through Trübner, of Ludgate Hill, E.C.—J.

Pattern Making.—R. R. M. (*Newcastle-on-Tyne*).—"Pattern Making," by a Foreman Pattern Maker, published by Lockwood, Ludgate Hill, E.C.—J.

Fret Polishing.—Amateur (*North Kensington*).—I do not exactly know whether you want to be told anything beyond the filling, or whether you write for general information on polishing and finishing fretwork. While congratulating you on your success in the competitions you refer to, I may remind you not to attach too much importance to the fact that you have surpassed others, as I am afraid you are inclined to. It would be a pity were you to allow yourself to think that no improvement could be made on your present work, for I presume that your competitors were all youthful, and however meritorious your and their work might be, it would probably have been "nowhere" by the side of more advanced fret-cutters' specimens. Your having gained the prizes shows that you have ability which may be fostered, while your letter shows you have a good deal to learn. Perhaps this seems rather "straight" talk, and not quite so nice as a few complimentary remarks on your skill. It will, however, be more useful, and I do not hesitate to criticise your methods, as you are evidently one whom it is worth teaching. First of all, I do not like the method you adopt for getting the pattern off the wood. If you will use water, do not let it "soak" into the wood. The less you wet this the better. I prefer to remove the pattern by rubbing down with glass-paper, though it is more laborious. By doing this the grain of the wood is not raised. The cuts are left clean and sharp from the saw. I am sorry I cannot agree with your belief that the work is improved by rubbing down without a block, and I am afraid you would not get any one who is a judge of good fretwork to consider that the appearance is improved by such treatment. I don't wonder at your not liking the filling of beeswax and plaster of Paris, but you must remember that any filling is difficult to use after the fret is cut, for the stuff gets into corners and over the edges in a very troublesome manner. Undoubtedly the best results are got by part polishing the wood before fretting, and finishing it afterwards. I fancy you understand something about polishing, so I need only tell you to oil the wood before filling and not after. The nicest filling is fine whiting mixed with some colouring matter to suit the colour of the wood, and made into a paste with turps, oil, water, or polish according to circumstances, which can hardly be enlarged on just now, but which will be fully considered in articles on polishing. The grain may also be effectively stopped by going over the wood with spirit varnish or French polish thickened by the addition of shellac. The surface must, of course, be lightly rubbed down afterwards, and finished in the usual manner. I think if you will put these hints into practice, you will not only find that your work looks better, but that it is done with less trouble than by pursuing the course you have hitherto. Yes, there is no doubt that oak which is merely oiled looks very nice. Let us hear from you any time when practical advice will be of assistance to you, and persevere till you become an A1 artist in fretwork.—D. A.

Clog Irons.—H. F. (*Chorley*).—Clog irons are sold wholesale by Sumner & Co., Staleybridge, near Manchester; Ellis & Sons, Broughton Road, Salford; and Josiah Grimshaw, Leeds. I cannot take upon myself to say which is the best and cheapest house to buy from, but you will find these firms reliable, and no doubt you will be able to form your own opinion as to the merits of the goods they supply. If you write to them you may as well tell them you got their names and addresses from Work.—D. A.

Case-hardening Iron.—Ajax (*Edinburgh*) asks for "a recipe for case-hardening iron as used by the *Times*." I really do not understand this question. What iron is referred to? and what has the *Times* got to do with it? Case-hardening cast iron, wrought iron, or steel, is done by heating and chilling the surface suddenly; there are many recipes. For iron, perhaps the best (and I am astonished to find it is so little known and used) is the Bower-Barff process. The iron, cast or wrought, is heated to redness, and then subjected to steam in an oven. When cool, the surface is found to be converted into the black (or magnetic) oxide of iron to the depth of about $\frac{1}{32}$ of an inch of extreme hardness—and is also rustless—that is incapable of being changed to the red oxide. Iron so treated, therefore, will stand the weather, without painting for ages; it even resists the weaker acids, and dilute solutions of the stronger ones; a file will not touch it, and it will even, if of a proper angle, cut glass like a diamond.—J. W. H.

Cylinder.—H. M. (*Hichambrook*).—Your cylinder will require ports ⅝ in. wide, the steam ports $\frac{3}{16}$ in. long, exhaust port ⅜ in. long, distance between ports $\frac{3}{16}$ in. You could form the steam-ways with brass pipe screwed into the piece where steam ports are cut, and the other end turned and soldered into cylinder (Fig. 1). Its disadvantages are too long in stroke. The ends screw on, and you would have a difficulty in getting piston rod central. The covers are generally recessed ¼ in. or more; you would waste that amount of steam at each

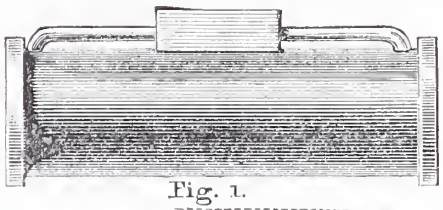


Fig. 1.

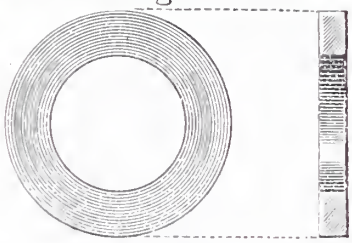


Fig. 2.

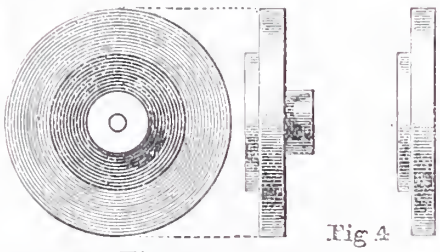


Fig. 3. Fig. 4

Parts of Cylinder.

end of the stroke, without you could fill up the recess. I would advise you to make the stroke 4 in., allowing for thickness of piston and steam-ways, and fix flanges on as described. They would be better made from castings, as they should be ¼ in. thick; (see Figs. 2, 3, and 4). If you turn your own patterns they won't cost much. It would drive a sewing machine or a 3-in. lathe, for iron turning, but not for wood turning, and would require a boiler 2 ft. long and 1 ft. diameter.—E.

Boring in Glass.—H. A. (*Bow*).—You will be able to get a ⅜-in. hole bored in a piece of glass by almost any glass beveller. Any shop fitter would get it done for you. You must make your own arrangement about price. No respectable man will overcharge you. In case you do not know any one in the glass line you might ask Mr. Andrew Gibson, Garden Walk, Great Eastern Street, E.C., if he will bore the hole for you.—D. A.

V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—J. D. (*Glossop*); Apprentice; H. C. T. (*Holloway*); G. W. (*Snodland*); Black Stone; Perplexed; G. V. (*London, S.W.*); Thomaso; F. T. (*London, N.*); W. M. (*London, N.*); Centumgraph; W. N. L. (*Birmingham*); F. J. A. (*London, N.*); A Constant Reader; Anxious; T. D. G. (*Highgate*); A. S. (*London, W.*); Amateur Organ Builder; W. H. H. (*Huddersfield*); Musical; S. R. G. (*Liverpool*); A. T. E. (*Norwich*); H. G. (*Bishop-gate*); J. G. (*Birmingham*); F. N. (*Smethwick*); Wheelwright (*St. Ives*); Stove Maker (*St. Day*); S. H. D. (*Newtown*); A. B. C. (*Birmingham*); T. T. (*Kilburn*); Apprentice; G. T. (*Chatham*); R. S. T. (*Leeds*); C. W. (*Devon*); Amateur; T. J. (*Dudley*); E. G. (*Leyton*); E. G. H. (*Minehead*); G. T. (*Twickenham*); Fog Signal; G. L. (*Sheffield*); W. G. (*Cardiff*); S. J. (*Compstall*); R. M. (*Sheffield*); Markam; A. J. T. (*Holborn*); S. W. (*Camberwell, S.E.*); Electric; S. T. (*Newcastle-on-Tyne*); Canoe Builder (*London, N.W.*); Mit (*Rochester*); C. C. (*Darlington*); Solway; W. H. R. (*London, W.*); F. B. (*London, W.*); J. J. (*Carlisle*); Chair; Tommy Tod; W. H. (*Bury*); Silicine; A Subscriber from the First; T. F. (*Preston*); J. G. K. (*Manchester*); Orthopædist, Inventor.

Trade Note.

Andrew Carnegie, it is said, will furnish the money to rebuild the public library destroyed by the flood at Johnstown, Pa. This is a very commendable act on his part, since there are no claims on him for doing it. It must be a satisfaction to a man of Mr. Carnegie's means to unload some of it, where he can see it do good while he is living. His heirs will not quarrel over the money that goes to rebuild that library, and it will go right on doing good after he is dead. If men would consider the example of the late Peter Cooper, who was one of the happiest men in New York, there would be more public libraries built from overflowing pockets and fewer from the bequests of wills.—*American Machinist.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	.. .. ..	1s. 8d.
6 months, "	.. .. ..	3s. 3d.
12 months, "	.. .. ..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to Cassell and Company, Limited.

Terms for the Insertion of Advertisements in each Weekly Issue.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [34 R

Complete Fount of Rubber Type.—Two alphabets, to form any word or name, box, pad, ink, and holder, post free, 1s. 6d.; extra alphabets, 6d. per set; figures, 3d. Business, address, and pocket stamps equally cheap.—W. C. Prestridge, Manufacturer, Cumberland Street, Bristol. Established 1870. [20 R

Notice.—We take in Exchange Lathes and various tools for better. Catalogue, 6 stamps. List of Second-hand, 2d.—Britannia Co., Colchester.

Largest Stock of Engineers' and Mechanics' Lathes, Shapers, etc. Stocks and Dies. Forges, etc.—Britannia Co., 100, Houndsditch, London.

Call and select from our stock at 100, Houndsditch; but all letters addressed Britannia Tool Factory, Colchester.

Britannia Co. supply Gas or Steam Engines, and fit up workshops complete. Terms, Cash or easy terms. [24 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. Pool, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—Pool, Nottingham. [27 R

Lindon, Patent Agent, 2, S. John St., Liverpool. [29 R

A Pretty Photo Mount.—6s. 6d., free; handwork. Size, 10 in. by 7 in. State if for cabinet or carte.—Orders to Norman Maclean, Harwood Street, Sheffield. [30 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is Lunt's, 297, Hackney Road, London, E. Send stamp for reduced price list. [31 R

"Roll Call" Pipes.—Healthful, Luxurious, Thirstless Anti-nicotines. Briars. Post free, 1s. 8d.—Allen Dewsnap, 65, Pikes Lane, Glossop. [32 R

Twenty Fretwork Patterns, free, 6d.; Swiss Saws, 1s. 1d. per gross, free. Fretwork instructions, Tool and Pattern Lists, with specimen design, gratis.—W. Ellicott, Launceston.

Splendid D Concert Flute for disposal; cork joints, screw head, tuning slide, 8 G. S. pillar keys; very handsome and imposing instrument. Only 16s. 6d., exceptional bargain, and cannot fail to please.—Debois, 34, Hill Street, Ipswich. [1 S

Electro Motors for driving lathes or light machinery. Price 40s. Photos on application.—1, York Villas, Hargrave Park Road, N. [2 S

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields, etc. Each packet, 1s. 100 Decorator's Stencils, 2s. 6d. All post free. Lists free.—F. Coulthard, East Cliff Terrace, Bournemouth. [3 S

Model Work. Castings, models, etc. Illustrated list, 4d.—Stiffin & Co., 324, Essex Road, London, N. [4 S

Wooden Fly Wheel.—Sale or exchange, suitable for driving lathe by hand-power. Cheap.—F. Sutton, Hairdresser, Dorchester. [5 S

Materials for Violin Making from Briggs and Tarr, Violin, Violoncello, and Double Bass Makers, Commercial Street, Leeds. [28 R

Sideboard, with drawers and cupboard (August, 1889), partly made in walnut, with timber sufficient to complete. The walnut cost £5, and is of the very best quality and thoroughly seasoned. What offers?—J. G., 43, Greek Street, Soho, W. [6 S

The "Postable" Floral Tripod (see Work, Jan. 25th), post free, 1s. 6d.; pair, 2s. 9d. Bamboos supplied.—S. J. Eaton & Co., 3, New Inn Yard, Tottenham Court Road, W. [7 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

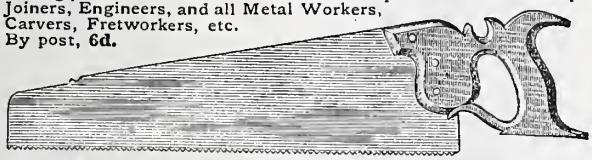
BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

TOOLS.

Buy from the MAKERS, the Oldest Established and the Best House in London.

NOTE.—Our New Illustrated 200-Page Catalogue is now ready, containing 700 Illustrations of all the Latest Improved Tools for Carpenters, Joiners, Engineers, and all Metal Workers, Carvers, Fretworkers, etc. **By post, 6d.**



OUR NOTED CAST-STEEL HAND-SAWS.

18 in.	20 in.	24 in.	26 in.	28 in.	Rip or Half Rip.
3/9	4/-	4/9	5/-	6/6	CARRIAGE PAID.

NOTE THE ADDRESS:— **MOSELEY & SON, 323, High Holborn, W.C.**

SCIENTIFIC & ELECTRICAL MATERIALS.

LARGE STOCK of Appliances and Materials for the Construction of **Electric, Optical,** and **Scientific Apparatus.** ELECTRIC BELLS, INDICATORS, WIRES, TERMINALS, CARBONS, BATTERIES, LENSES, AND FITTINGS. Electric Catalogue, 100 pages, 4 stamps.

PRICE, TALBOT, & CO., LTD. (*Late* H. DALE & Co., Ltd.) **26, LUDGATE HILL, LONDON, E.C.**

Specialty for Photographic Cameras, Lenses, Stands, Sensitised Paper and Dry Plates. New Patent Aneroid Barometers and Thermometers. Electric Light. Every New Invention or Appliance. **Buy of the Actual Manufacturers,** and get full Scientific Knowledge, and **Save** all Intermediate Profits. Send for ILLUSTRATED CATALOGUES of any branch of SCIENCE—A GUIDE TO BUYERS.

WATERPROOF FLUID GLUE.

(Patent.)

By post, **1s. 3d.** *and* **8d.**

WATERPROOF GLUE CO., 62, Dale Street, LIVERPOOL.

Part 1, Ready March 25, price 7d.

Gleanings from Popular Authors. With about 400 ORIGINAL ILLUSTRATIONS.

*** With **Part 1** will be GIVEN a copy of FREDERICK BARNARD'S Celebrated Picture "*The Two Wetters*," handsomely printed in tints.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

RUBBER STAMPS.

H. SAVAGE, Manufacturer and Patentee.

Rubber Stamps, Rubber-faced Type. The "Climax" and other Dating Stamps. Patent Ink Pads, &c. &c.

Makers of Boxes, Mounts, Presses, Vulcanizing and Moulding Machines, Brass Turned Ovals and other Shapes.

MATERIAL and all Supplies for the Trade. State your requirements to

H. SAVAGE, 33, CHEAPSIDE, LONDON.

TO INVENTORS.

If you have an idea for an invention **PATENT** it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.
37, CHANCERY LANE, LONDON, E.C.

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

ESTABLISHED 1861.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

J. H. SKINNER & CO., EAST DEREHAM, NORFOLK.

MANUFACTURERS AND IMPORTERS OF

PHOTOGRAPHIC APPARATUS AND FRETWORK MATERIALS.

Timber Yards, Sawing and Planing Mills covering about Two Acres near Railway Station.

J. H. S. & CO. have now a large Factory with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description, from the cheapest to the most expensive.

The process is simplicity itself. **Full Instructions supplied with each set.**

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

Every Set is carefully examined before being sent out, and guaranteed to be in working order.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase money.

Better Sets, 10s. 6d., 21s., 42s., 100s., and upwards. Complete Catalogue of Photographic Apparatus, one stamp. **J. H. SKINNER & CO., EAST DEREHAM, NORFOLK.**

Wholesale Agent for London—J. MOTHERSILL, 60, Holloway Road, N., and 6, Southampton Row, where Samples may be seen.

J. H. S. & CO. keep regularly in stock about **120,000 FEET OF FRETWOOD,** solid and 3-ply, veneers, &c., besides a very large quantity of Logs, Planks, and Boards, Carving and Turning Wood, &c., and **200,000 FULL-SIZE DESIGNS for Fretwork, Wood Carving, &c.,** besides an immense Stock of Joiners' Tool Chests, Fretwork Outfits, Drills, Saw Frames, Hand and Treadle Machines, Saw Blades, &c. &c.

Specialities for 1888 & 1889.—Books of New Designs. FRETWORK No. 1, containing 12 Large Sheets, price 1s. No. 2, containing 20 Sheets of larger and more elaborate Patterns, 2s. 6d. Book of Wood Carving Designs, containing 14 Patterns, price 1s.; these are all New Patterns, not sold in any other form, and would, if sold separately, cost three or four times the amount charged. Fretworker's Handbook and Workshop Guide, price 1s. New Designs. All Patterns greatly reduced in price.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, 48 Saws, Awl, File, 4 Designs (with sufficient planed Wood, gratis), and 1s. Handbook on Fretwork, price 3s. 6d., carriage paid. 12 feet Assorted Planed Fretwood, 3s. 6d.

☞ Special Fretwork Design, in commemoration of Her Majesty's Jubilee, size, 30 in. by 26 in., price 2s. 6d.

JUST PUBLISHED, NEW CATALOGUE of Machines, Saws, Designs, Wood, &c., 56 pages, 600 Illustrations, with Instructions, 4d., post free. Good Fret Saws, 1s. 4d. per gross; best ditto, 1s. 9d. per gross.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

MELLIN'S FOOD

For INFANTS and INVALIDS.

MURIEL A. TURNOUR. *Aged 1 year and 6 months.*

The Honorable Mrs. Turnour writes:—

19th February, 1889.

"She was a most delicate child, and I quite despaired of rearing her; she could not digest any Milk Food. I consulted a Physician when she was four months old, and he told me to give her 'MELLIN'S FOOD.' From that time until she was eighteen months old she was fed entirely on it, and became perfectly healthy and strong."

Samples, Pamphlet, and Prospectus post free on application to

G. MELLIN, [4003

MARLBORO' WORKS, PECKHAM, S.E.

FRETWORK AND CARVING.

Highest Award—Gold Medal for Tools and Patterns.

Machines, Designs, Tools, Wood, Mirrors, Hinges and Fittings, Varnish, etc.

T. N. writes:—"I got a First Prize from one of your Designs."

R. W. A.:—"Received your Catalogue today, and consider it the best I have seen."

R. B. M.:—"Machine to hand, am highly pleased with it."

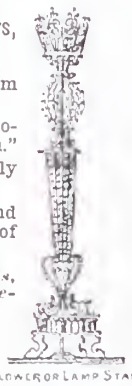
J. A. S.:—"I have taken Eight First and One Second Prize with various patterns of yours."

Illustrated Catalogue of all Tools, Wood, etc., and 500 Miniature Designs, free for Six Stamps.

No. 731

Occasional Table. Size 26½ x 13 ins.

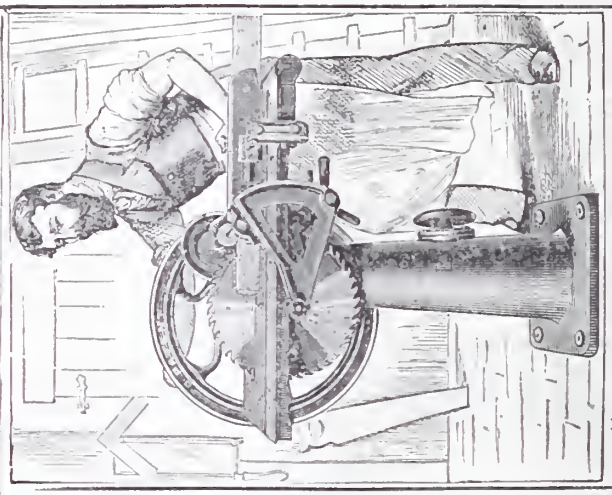
No. 730.



Flower or Lamp Stand. Size 44 x 12 ins.

Harger Brothers,

SETTLE, YORKS.



"THE LEXTON"

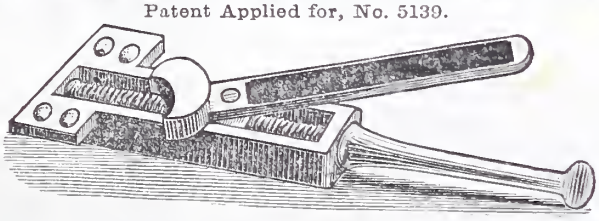
New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

NURSE'S REGULATOR.

Patent Applied for, No. 5139.



For adjusting the Irons of all English Pattern Bench Planes. Can be easily fitted to any Smooth, Jack, or Try Plane, without alteration of Irons already in use. Price 2s. each; post free, 2s. 3d.

Price Lists free by post on application to Sole Makers.

CHARLES NURSE and CO.,

PLANE MAKERS AND TOOL MERCHANTS,

182, Walworth Road, London, S.E.

(Established 1841.)

ENGRAVERS' AND ETCHERS' PLATES, TOOLS, AND MATERIALS.

OF BEST MATERIAL AND WORKMANSHIP.

COPPER PLATES from ½d. per square inch; STEEL PLATES from 1d. per square inch; GRAVERS, 3s. doz.; GRAVER HANDLES, 3s. 6d. doz.; THREADED GRAVERS, 1s. each; PLAIN, FLAT, OR ROUND GRAVERS, Set of 10, 2s.; ETCHING POINTS, 1s. and 2s. each; MEZZOTINT SCRAPERS, 7s. doz.; THREE SQUARE SCRAPERS OR BURNISHERS, in Handle, 2s. and 3s. each, and all kinds of Tools and Materials. Lists Free.

JOHN SELLERS & SONS,

151, ARUNDEL STREET, SHEFFIELD.

London Agents: J. DONNISON & SON, 20, Wormwood Street, City.

Fretwork and Carving.

GOLD MEDALS AWARDED TO OUR CUSTOMERS.

No. 845.

Just out—Lists Nos. 41 and 40 of Latest Designs, with Instructions for Fret Cutting, free on application; Complete Catalogue, Nos. 39 and 38, of Designs, Machines, Tools, and Materials, with 1,400 Engravings, 9d.; Book on Wood-Carving, for the Guidance of Beginners, with 50 illustrations, 9d.; Five Sporting Photo-frames, No. 845, including illustrated one, 2d., free. Please quote numbers of Designs when ordering.

All Designs greatly Reduced in Price.

HENRY ZILLES & CO., *Publishers of* "The Amateur," 24 and 26, Wilson Street, Finsbury, LONDON, E.C.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 54.] SATURDAY, MARCH 29, 1890. [PRICE ONE PENNY.

THE ART OF DIALLING AND CONSTRUCTION OF SUN-DIALS.

HOW TO SET OUT AND MAKE HORIZONTAL SUN-DIALS.

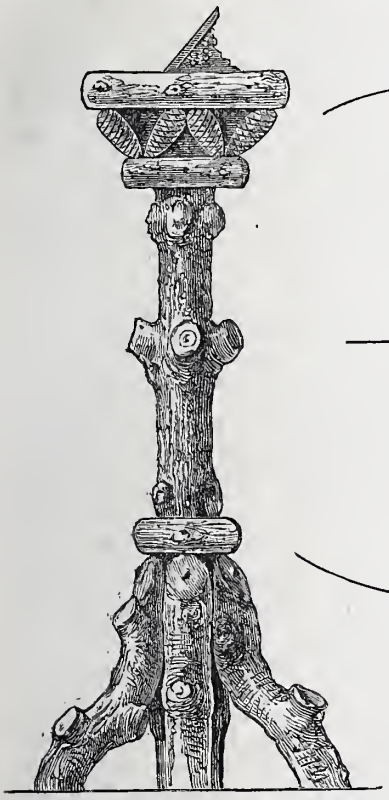


Fig. 5.—Design for Rustic Pedestal for Horizontal Sun-Dial.

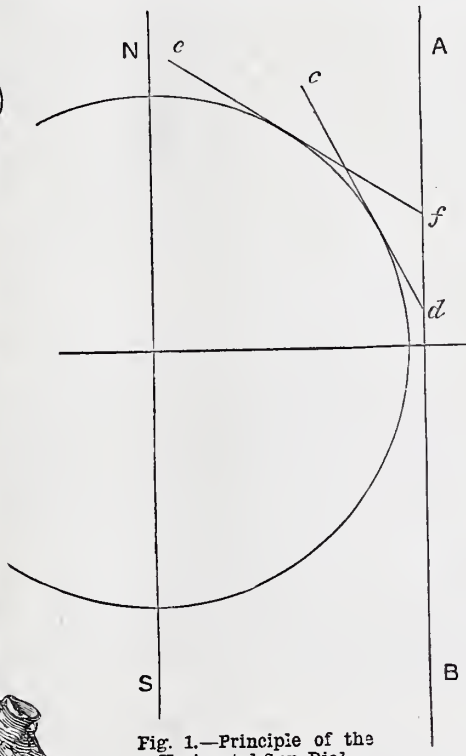


Fig. 1.—Principle of the Horizontal Sun-Dial.

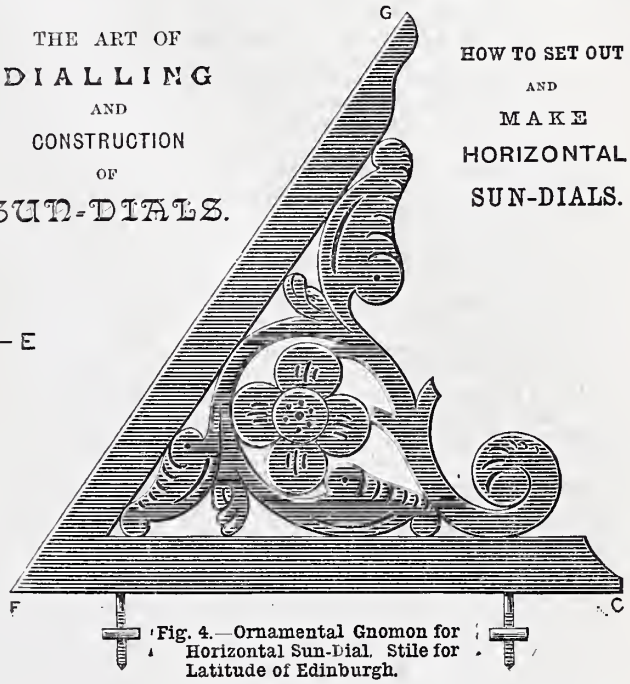


Fig. 4.—Ornamental Gnomon for Horizontal Sun-Dial. Stile for Latitude of Edinburgh.

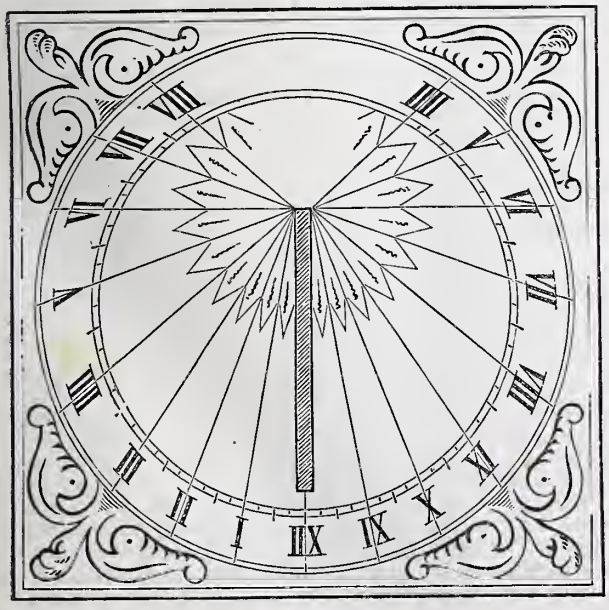


Fig. 3.—A Horizontal Sun-Dial.

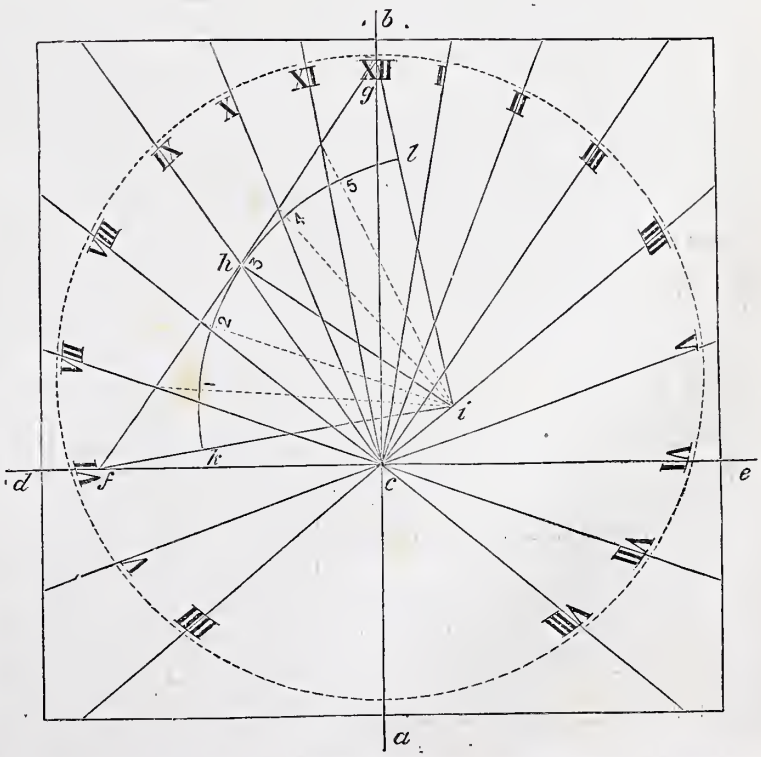


Fig. 2.—Mode of Setting Out Horizontal Sun-Dial for the Latitude of Edinburgh.

THE ART OF DIALLING AND CONSTRUCTION OF SUN-DIALS.

BY ARTHUR YORKE.

How to Set Out and Make Horizontal Sun-Dials.

Facts about Sun-dials—Different Kinds of Dials—Principles of Dialling—Laying out a Horizontal Dial—The Gnomon—Difference of Time between Sun and Clock—Materials for Making Dials—Pedestals—A Rustic Pedestal.

SUN-DIALS, for the construction of which I am going to give practical directions, date as timekeepers from a very respectable antiquity. According to Pliny, they were invented by Anaximander 550 years B.C. From our received Biblical chronology, however, they must have been known in the East considerably earlier. Some 250 years after the above date they were introduced at Rome, where at a later period—under the emperors—they became so much the fashion that no public building was without one.

Possibly from their having been associated with heathen temples, the early Christians seemed to have looked on them with disfavour, for they are said not to have been used on churches till the seventh century; through the Middle Ages, however, and till the general adoption of clocks, almost every church had its sun-dial.

Dials can be, and have been, constructed to suit almost every position in which it is possible for the rays of the sun to fall upon them; even moon-dials have not been unknown; but the only dials reasonably simple in their construction, or of much practical use, are the horizontal and the vertical. Vertical dials are those usually affixed to the walls of buildings, and of these, that made to face the direct south is the most simple, the most symmetrical in appearance, and the most valuable as a time-teller. The south dial points the hours from 6 to 6; the east dial points the morning hours only; the west dial those of the afternoon; whilst the north dial indicates merely three hours of the summer days before the south dial begins and after it ceases to act. Declining and reclining dials are complex in their construction and but little used. I shall, therefore, omit all further mention of them.

But of all the dials, the horizontal must be considered the most complete, since it continues to tell the hours (always considering the skies to be clear) as long as the sun is fairly above the horizon. Dials of this kind we generally see of small size and mounted on pedestals; yet the largest dial in the world—proudly styled by its maker "The Prince of Dials"—is one of this kind. It is at Delhi, India, and has a gnomon or indicator 118 ft. long. It is of solid masonry, the stile—that edge of the gnomon by which the shadow is cast—and the circle on which the hours are marked being of white marble. It was made at the beginning of last century by the Rajah Jeysing.

To enter into any profound dissertation on the theory of dialling would be out of place in a practical article like the present. It needs only to be said that in all dials the edge of the gnomon by which the shadow is cast is presumed to represent the axis of the earth, and must always be parallel to that axis. The gnomon, it is perhaps unnecessary to remark, is the projecting feature of the dial—the word simply signifies "that which indicates;" the upper edge of it, that by which the shadow is cast, is technically termed the "stile;" whilst its lower edge, that which lies upon the face of the dial, is termed the "sub-stile." In a horizontal dial the face is presumed to represent the plane of the natural horizon, and must be parallel with that plane; in other words, it must be a true level. But the face of a vertical dial must always be at right angles to the plane of the horizon; in other words, it must be upright.

As the direction of the earth's axis will always remain the same, whilst the direction of the plane of the horizon will constantly vary as we approach to or recede from the Equator, the angle formed by the two must needs be a varying one, and it will be obvious that dials made for places in different latitudes cannot have similar gnomons. As we approach the Equator, the angle at which the stile of a horizontal dial rises will become less; as we recede from it that angle will increase. This may be most readily demonstrated by a diagram. Fig. 1 represents a portion of the earth; E is the Equator, N S is the earth's axis, A B is a line drawn parallel to the axis, *c d* represents the plane of the horizon at a point comparatively near to the Equator, *e f* will be the plane of the horizon at a point more remote from the Equator. The angles formed at *d* and *f* will be the angles for the gnomons of horizontal dials for those two points respectively.

It is with horizontal dials only that we have at present to deal. These have been mentioned as the most complete, and they are so for this reason—they serve to tell the time throughout the whole day, which, at its longest, may in this country be said to extend from 4 a.m. to 8 p.m., whereas even a south vertical dial will tell the time from 6 to 6 only. The method of setting out a horizontal dial is shown in Fig. 2. Since we shall not require to construct our dial on exactly the same scale as that of Rajah Jeysing, we shall do well to take a piece of paper on which we can make our drawing to the size of our actual work; we shall then have merely to trace it off on our dial-plate.

We first draw the line, *a b* (Fig. 2), through the centre of the paper. This will represent the meridian, and will be the line on which the sun will appear at 12 o'clock. At slightly more than one-third of the distance from *a* to *b*, we then draw a second line, *d e*, bisecting the first at right angles, as at *c*. As we call *a b* our 12 o'clock line, we may call this our 6 o'clock line.

This done, we have to ascertain the latitude of the place for which we intend our sun-dial. The orthodox way to do this is by working out a simple problem on the terrestial globe; but it is not every one who has globes or who knows how to use them, and it will be sufficient for all practical purposes if we look at our position, or that of any more important place of which the latitude is virtually the same, in a gazetteer or in the index to an atlas.

We now at any suitable point on *d e*, as at *f*, set off a line, *f g*, which will form with *f e* an angle equal to the latitude. Let us say that our dial is for the latitude of Edinburgh, which we have found to be 55° 57′ 3″. For our purpose, we may call it 56 degrees; we, therefore, make our angle one of 56 degrees. Were our dial for London, of which the latitude is 51° 30′ 8″, we should make our angle equal to 51½ degrees. Possibly, the diallist may have a rule marked with a "scale of hours;" if so, he will merely have to set off his points from it on the line, *f g*, and draw his hour lines through them from *c* to the edge of the paper; he will then have his morning hour lines, that is, the lines along which the shadows will fall at the hours between 6 a.m. and noon. But let us presume that he will not have this convenience, and that he will have to proceed in the manner indicated in the diagram. From the centre of *f g*, a perpendicular, *h i*, equal to half its length, is let fall, and lines are drawn joining *f i* and *g i*; then with *i* as a centre, and *i h* as radius, a quadrant is described from *k* to *l*. This has to be divided into six equal parts as at 1, 2, 3, 4, 5. From *i* lines are drawn through these points till they cut the line, *f g*, and through the points of intersection so formed other lines are drawn from *c* to the edge of the paper, as at *c*VII., *c*VIII., *c*IX., *c*X., *c*XI. These are the morning hour lines required. To these the afternoon hour lines will exactly correspond, and may be measured off from them, or traced off by folding the paper down the meridian line: IV. and V. in the morning, and VII. and VIII. in the evening, have as their hour lines mere continuations of the afternoon and morning lines opposite to to them, as may be seen in the diagram.

Half and quarter-hour lines are ascertained by sub-divisions on *k l*, by merely continuing the process which gives the hour lines.

It is usual on a horizontal dial for appearance and ease of reference to place the numerals which denote the hours in a circle. This has been done in Fig. 2; but it should be remembered that this is no necessary part of the dial. As a matter of theory, the gnomon is regarded as a mere line without thickness, but in practice, it must be more or less thick according to material and size; and to make the circle look true, it will be necessary before drawing it to cut the paper plan in two down the meridian line, and paste the two parts together again, leaving a space between them as wide as the thickness of the gnomon. In the illustration, Fig. 3, it will be seen that this has been done.

The gnomon for the dial before us, as regards its essential feature—that is, the angle at which its stile inclines to the face of the dial—will be a repetition of the triangle, *g f c*, Fig. 2. If we could take that triangle and place it upright on the plan with the angle, *f*, on point *c*, and with the line, *f c*, extending along the meridian in the direction of *b*, it would, in theory, be all that we should require to complete our work. In Fig. 4, a gnomon for the latitude required (56 degrees) has been drawn separately, and for convenience and reference marked with the same letters, G, F, C. It is not drawn to the same or to any scale, being required large that the ornamental design may be properly shown, but a gnomon ought to be of such dimensions as fairly to throw its shadow to the circle of numerals. It will be observed in Fig. 3 that the stile is left perfectly straight. The stile is the business part: this edge it is which marks the time by casting its shadow, and whilst it matters little into what decorative forms we cut the under part of the gnomon, this must always remain a right line.

Mention has been made above of the 12 o'clock line or meridian, as the line at which the sun appears daily at 12 o'clock; but this must be taken as being only approximately correct. If the apparent path of the sun were in the Equator instead of in the Ecliptic, he would (though there are some other trifling disturbing influences) come pretty regularly to this line each day at 12, and the dial would be as simple a time-teller as the clock, and, in most cases,

far more accurate, but since he does move in the Ecliptic, and since the plane of the Ecliptic is not parallel to that of the Equator, there are but four days in the year when he is actually in the meridian at 12 o'clock, these being March 20th, June 21st, September 23rd, and December 21st. On the 1st of November, the dial will point to noon a quarter of an hour too soon. The difference between sun and clock is calculated and given in most almanacks, and should be ascertained before correcting a clock by the dial on any except the days mentioned. Moreover, if we propose to fix our dial by the sun, we shall do well to choose one of these four days for so doing.

Since a horizontal dial will in almost every case be fixed on a pedestal where its face will scarcely be seen except by those who go to consult it, that face is scarcely a subject for elaborate ornamentation. The gnomon only will be conspicuous, and this it is and the pedestal which should be made decorative. Brass or copper is, as a rule, the best material for the face of a horizontal dial. If, when upon a stone pedestal, the face is of the same, and the lines, etc., are incised, water will be apt to stand in them to the injury of the stone, which will especially suffer in frosty weather; whilst if the lines are simply painted on the freestone they will not be permanent. Slate is better for the purpose than freestone, since on this the lines will need to be little more than scratched, so that they will not hold water; but even this is less satisfactory than metal. On a piece of stout sheet copper a non-professional worker can readily incise his lines with a graver, and if ornament is desired, much may be done in that direction with punches. The face of a horizontal dial is drawn in Fig. 3.

On a slate dial a gnomon of the same, cemented into a groove cut for the purpose, might be made to serve; but exposed as is this feature of the horizontal dial to injury, this material can scarcely be recommended. It would, indeed, have the advantage of being perfectly rigid, but it would run much danger of being broken sooner or later. A metal gnomon is far superior, and one that is cast is to be preferred to one cut from sheet metal. Sheet metal is too apt to bend, and if true time is to be told, the stile must remain true. Any one who can handle tools can cut a pattern of his gnomon in thin wood or in lead and have it cast in brass, which will cost but a few pence, since he can file and finish it up himself. Fig. 4 is an ornamental gnomon intended for casting. The brass gnomon will probably be fixed to the dial with screws and nuts, as shown in Fig. 4, otherwise it should be hard-soldered.

The best pedestal for a horizontal dial is undoubtedly a stone one, set on a good foundation of masonry. This will least be in danger of getting out of the perpendicular, and thus rendering the dial useless as a time-teller. But comparatively few among those who may wish to play the diallist, and who may desire to do all the work in connection with their own hands, will be able to hew or set up a stone pedestal. I, therefore, give a design for one in rustic woodwork (Fig. 5) which will be within the capacity of a far wider circle of workers. As the design is rendered so clearly that its construction cannot be mistaken, those who wish to make one will find little difficulty in carrying it out. The upright will best be of larch, though any other straight piece of rough wood will do, and it should be let into the ground a couple of feet and well rammed with stones so that it may be in little danger of displacement. The four rough struts at its base, which should also be let some distance into the ground, will do much towards keeping it firm. The top should be a slab of oak by preference, not less than 3 in. thick, that it may stand solidly, and be in no danger of warping. The hollow moulding beneath the top is ornamented with fir cones.

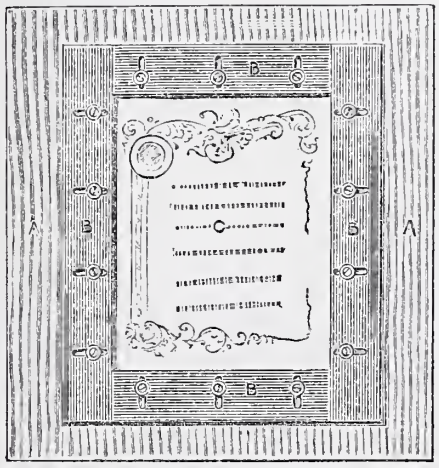
A dial needs to be fixed with exactness, and that its face lies level, may be proved by the spirit level or the mason's plummet. The gnomon must be exactly upright, and in a line due north and south. It can be fixed by a compass, or otherwise by the sun on one of those days upon which he comes punctually to the meridian.

The writer hopes to give shortly a second paper dealing with vertical dials.

STRETCHING VELLUM FOR ILLUMINATING.

BY LANCELOT L. HASLOPE.

Some years ago I commenced to illuminate a book, the pages of which were of vellum.



Mode of Stretching Vellum for Illuminating—A A, Drawing Boards; B B B B, Brass Plates; C, Sheet of Vellum stretched.

I had not got far with the first sheet before I found, to my great disgust, that when a body of colour was laid on, as, for instance, in a highly ornamented capital letter, when the vellum was dried it "cockled," so that the effect was entirely spoiled. I could get no assistance in my difficulties from artists' colourmen, nor from the authorities at the British Museum. I was, therefore, thrown entirely on my own resources. I had purchased my vellum cut into sheets $9\frac{1}{2}$ in. by $7\frac{1}{2}$ in., and the problem to be solved was how to stretch these sheets so as to get a perfectly smooth surface to work on that would remain smooth after the painting was finished. The difficulty was intensified by the fact that both sides of the vellum had to be illuminated, and consequently each sheet had to be stretched twice. I will not weary my readers by recounting all the experiments I made, and which all resulted in failure, until I fortunately hit upon the following simple plan, which fully answered all my requirements.

I procured a drawing-board $14\frac{3}{4}$ in. by $15\frac{1}{2}$ in., and four pieces of rolled brass, quite flat, two of them 12 in. by $1\frac{3}{4}$ in., and the other two 7 in. by $1\frac{3}{4}$ in.; the thickness of the brass was about $\frac{1}{8}$ in. Four slots were cut about $2\frac{1}{2}$ in. apart in each of the long pieces, and three slots in the shorter ones; the length of the slots was 1 in. Brass screws, with a washer under the head of each, went down through the slots, and screwed into sockets let into the back of the drawing-board. To use this board, the pieces of brass plates are drawn back as far as they will go, and the sheet of vellum laid in the middle of them. As vellum absorbs moisture very readily, it is only necessary to take the board into a damp atmosphere such as a cellar for about ten minutes or a quarter of an hour, and it will have expanded sufficiently. The pieces of brass should now be pushed inwards until they rest for about $\frac{1}{5}$ in. on the sides of the vellum, and firmly screwed down. If the board be now removed into a warm room, the vellum will become perfectly flat, and present as good a surface as any artist could possibly desire. When one side is finished, the screws may be loosened, and the vellum stretched with the other side upwards. The advantage of this method is that the face of the vellum is entirely uninjured. As an immense amount of work was put on these sheets, it was worth my while to go to some trouble to make my drawing-board quite complete, but when one sheet of a size only has to be illuminated, a much simpler apparatus might be adopted. For instance, the pieces of brass might be represented by strips of fretwood, and the slots might be omitted, the pieces of wood being merely screwed down into a board with a common wood screw. In this case they should be first of all fastened down into their places, and then removed to allow of the vellum being put under them; they must be screwed down finally while still in the damp atmosphere. If no other means of damping the vellum are available, it might be held over hot water for a short time, though this plan would require a good deal of caution, for fear of injuring the vellum. A very slight amount of damping is sufficient to render the sheets quite flat when dried.

HOW TO MEND A BROKEN BAND SAW.

BY ONE WHO HAS DONE IT.

I notice that a reader of Work has asked for instructions how to mend broken band saws, and also the cause of their breaking. I am afraid I cannot satisfy him as to the cause, unless it is that the tension is too tight, but they are liable to break even when the greatest care is taken to prevent it. I have had them run for days together without breaking, and I have also had them break before cutting six inches; but fortunately they are very easily brazed together if one only knows the way. I formerly sent them to London to be brazed, but the inconvenience of having to stand still a day or two every time they were sent led me to try my hand at them myself, and after trying several different ways, I found that the one I am about to describe was the easiest and simplest, as well as being the cheapest. The apparatus required can be made by any one, and after it has been made you can mend a saw in half an hour, and be at work with it again.

The first thing required is a trestle, as in Fig. 2, made from a piece of 7 in. by 3 in. batten about 3 feet long, edged up, as shown, and mounted on four legs about 3 feet high. On the top edge, at A, cut a notch about 6 inches long and 3 inches

deep. Make four wood buttons, as at B. These are best made of hard wood. They are (as will be seen by sketch) to hold the saw in position, as at C C (Fig. 2).

You will next require two pairs of heavy tongs, same as those used by blacksmiths, but with very thick heavy jaws, so as to hold the heat. They must also be made true, so as to grasp the saw firmly the whole width, and not at one edge only.

All the rest of the necessary appliances are a good flat file (the same as circular saws are sharpened with are best), some spelter, which can be obtained at any ironmonger's—or brass filings will do equally as

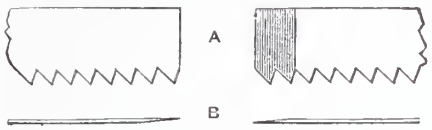


Fig. 1.—Ends of Band Saw fitted ready for Brazing—A, Plan; B, Section.

well—and some borax, powdered; but in buying the latter, it is best to get the stone borax and powder it yourself, as you know then that it is pure. Now, having got all the apparatus together, we will proceed to work.

In the first place, take the broken saw, and laying it on the floor between the legs of the trestle, bring one end up along the top, and passing it under one of the buttons, screw down tight, with the end of the saw level with the end of the top of trestle. Then file a bevel the length of two teeth off to a feather edge, as shown in Fig. 1. When that is done, reverse the saw, and do the same with the other end, but take care and file the bevel the other side of saw, so that when the two ends are brought together the saw is no thicker there than anywhere else. This requires some practice with the file, as the bevel should be perfectly flat and come to a sharp edge, but not thin enough to turn it. However, it is easy enough to any one who has been in the habit of using a file. When the bevels are perfect, place the saw on the floor again between the trestle legs, and bring the two ends over top of

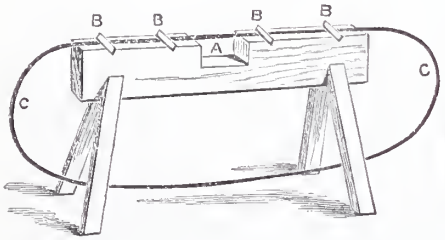


Fig. 2.—Trestle for Brazing Band Saw—A, Notch in Top for Jaws of Tongs; B, Buttons; C, Saw in Position for Brazing.

trestle under the buttons, so that the laps meet in the centre of the notch A. Then screw all the buttons down tight, keeping the back of saw parallel with side of trestle, and keeping the laps in proper position, so as the teeth of saw intersect. Then wet some of the borax so as to make a stiff paste, and put some underneath and on top of the joint, also a little in the joint. Then take a small quantity of spelter or brass filings, as the case may be, and put as much as will lay in the joint. Also sprinkle a little on top with the borax. All this being done, place one pair of tongs in the fire—a forge is best, but an ordinary fire will do—and heat them to a very red heat; also heat the others to a dull red. Then taking the hottest tongs, slip them carefully over joint and clasp firmly, and when the spelter is melted—which will be in a minute or two—carefully slip off the tongs, and at the same time slip on the cooler ones, and hold tight for about a minute, when the joint will be found to be as strong as any other part of the saw, and, if properly done, only a small thread of brass will be seen on each side.

The only way to find out the proper quantity of spelter is by experience. The least quantity that will do is the best, as it only has to be filed off, but there had better be too much than too little, as if too little, a good strong joint is impossible.

All those who try the above way of mending band saws will be convinced that it is a much better way than doing them with a forge, which speedily draws the temper of the saw and ruins it. The only thing that needs caution is, be sure and get the saw as thin at the splicing as at other places, and also to keep it straight at the back. If these things are not attended to, the saw will never work properly, and will most likely break again very shortly.

I think I have explained everything sufficiently, so that any user of band saws may mend his own if he tries to do so, and I am sure, as in my case, the saving will be considerable, not only in money, but in the saws being better done. At the same time, if there is anything which is not made quite clear, I shall be pleased to rectify it in the "Shop" columns, if any one should express a wish to that effect.

Perhaps some one will say he does not see why it is necessary to have two pairs of tongs, as the first one melts the spelter, which is all that is required; but wait a bit, for I am able to answer your question, as I have said the same myself. The reason is as follows:—If one pair only were used, they would have to be held on the joint till the spelter was solid again, which would be much too long to be comfortable. Well then, say you, what do the second pair want to be hot at all for? Why not use them cold? I have also tried this, and found that using the cold tongs made the saw and spelter so hard that it was a difficult matter to file it off, so I found the better way was, as I have said, to use one pair to melt the spelter, and one pair of hot ones, though cooler than the others, to cool the joint gradually; and as we are told that experience is the best teacher, I can fairly claim to know, having brazed hundreds of joints, both large and small, and my way has been exactly as I have, in the best way I can, described above. Wishing the readers of WORK, and WORK itself, every success, I will now conclude what I hope will be an acceptable paper to many.

BIRD-CAGES: HOW TO MAKE THEM.

BY FRANK HINDS.

HAVING read in "Shop" (Vol. I., p. 509) that some of its readers would like to make a bird-cage, I take it for granted that it is a breeding-cage for canaries that is wanted. I venture to submit drawings of some bird-cages, one of which I intend to make for myself.

I have made several bird-cages for myself. The first consideration is, What kind of dwelling will best conduce to the birds' health and happiness? If birds are kept in a state of confinement, which is not natural to them, it should ever be borne in mind that they are so for the pleasure or profit of those who keep them, and with whom it ought to be a matter of duty to see that they are properly cared for, and rendered as comfortable as circumstances will admit.

In making a bird-cage, four things are necessary—that is, the comfort of the birds, the prevention of vermin that infest cages, the prevention of the birds littering about, and that it should be easy to clean out and feed. Of wooden cages, those are decidedly the best which are made of mahogany, as they are less likely to harbour insects than any other. One of the cages herein described is to be made of mahogany, one to be made of mahogany and stout wire, and the other to be made of all metal, so that those who like to work in metal may be obliged as well as the wood-workers (Vol. I., p. 445). Taking the mahogany one first, I shall not attempt to describe all the getting of the wood, planing, squaring, gauging, and joining; all this has been described before in WORK (Vol. I., pp. 250, 307, 358).

You will see by the illustrations that the cages can be divided into two by a division. This division must be made of wood, so that when it is to be used for two breeding-cages the birds will not be able to see each other, as they are sure to fight, and the hen will not go to nest so soon. You will see that the woodwork is very deep at the bottom, for birds, however tame and familiar, like to have snug corners or sheltered places to which they can occasionally retire and shun observation. This should be at least six inches deep. There is no seed or water outside, for I have found it much better to put the seed and water into the cage. This is better for the birds, for they can get at it all together, and it prevents them littering it about outside.

Now, having got your frame fitted together (not fixed), take all to pieces, and gauge each piece where the wire is to go through.

I will now describe how to make the marker to mark where the holes are to be bored. Get a piece of wood, say, one inch square, and as long as the shortest piece in the cage; gauge it along the centre one side, and mark off half-inches all the way along; and drive small nails in each mark, leaving one-eighth of an inch above; sharpen these to a point (Fig. 5 will show you what I mean). With this marker you can mark all the pieces of mahogany that are to be bored for the wire to go through. I decidedly should have tinned wire, and not brass. You can get any quantity at W. Hughes', 37, Drury Lane, W.C., if you send a small piece of wire the gauge you want, and something like the quantity you may require. It is sold by the pound. The wire must be quite soft when you buy it; it gets hard by keeping. I should not get the wire until I had put the cage together. The way I have straightened the wire is by drawing it between four or five French nails or screws; put one each side of a straight line (Fig. 6 will show you). Having a piece of wood with these nails driven in fixed to the bench, draw the wire through to a mark the length of the wire required, and with a little rub with the hand you will find it quite straight.

To bore the holes, you can make your own drill by getting a small piece of steel wire the same gauge as the tinned; flatten the end, and just file it the same shape as a drill for iron; fix it in the drill-stock, and try it to see if the wire will go through easily. Have it just the length to go through the pieces that the wire is to go right through, and have another drill a

little more than three-quarters of the thickness of the piece of wood where the wire is not to go right through, as every hole must be filled to prevent the insects from getting in.

Having bored all the holes, leaving a space where the two doors are going to swing, the next thing is to put your cage together and fix it. But do not put the bottom on yet; leave that till last. I should nail one or two battens on the bottom to keep it square. Well, having made all good joints, and strong, sand-paper all over, and French polish it (Vol. I., p. 506).

Having got thus far, we will start wiring. Make a template out of 1-inch wood the shape you are going to make the top; let it come within the two wires. Now take a piece of wire the right length (the straightened wire); pass it through the top hole, down through the middle piece, into the bottom rail. Now bend the piece that sticks up over the template, and cut it so that it will go nearly to the bottom of the hole—that is, only bore three-parts through. This is for the two sides. Now for the front and back. These should be passed through the top into bottom, and cut off at the top level with the wood. Now put the horizontal piece in and turn; solder over those pieces where it is left for the doors. And now for the top fronts. Take the template, and cut out room to let the small block half in;

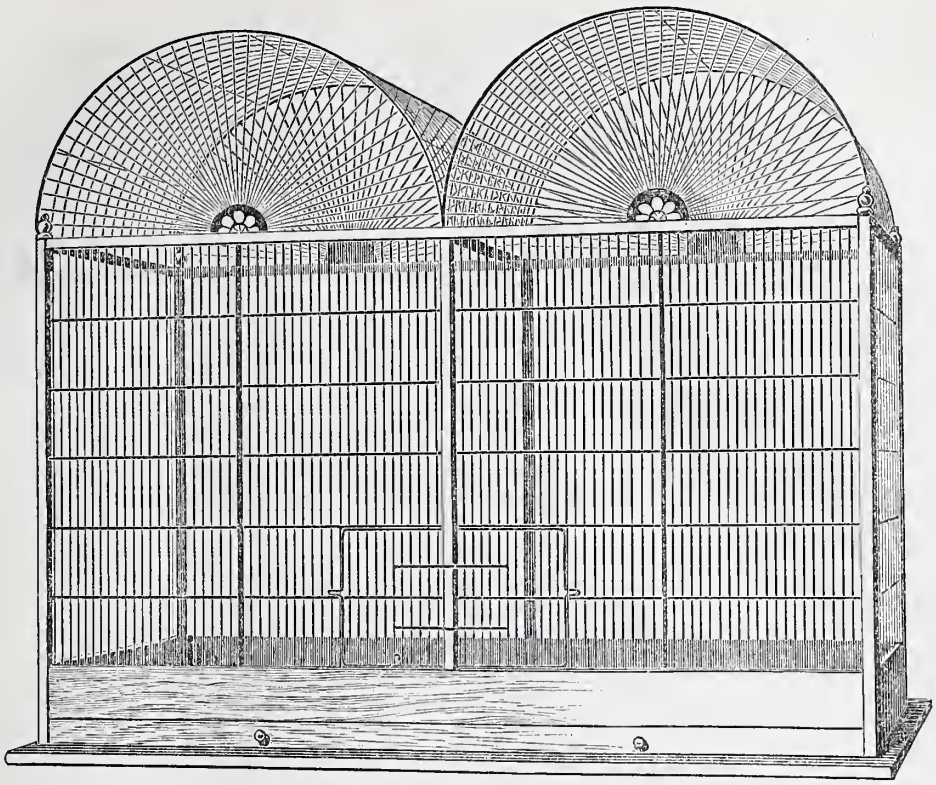


Fig. 1.—Breeding-Cage for Canaries of Wood and Wire.

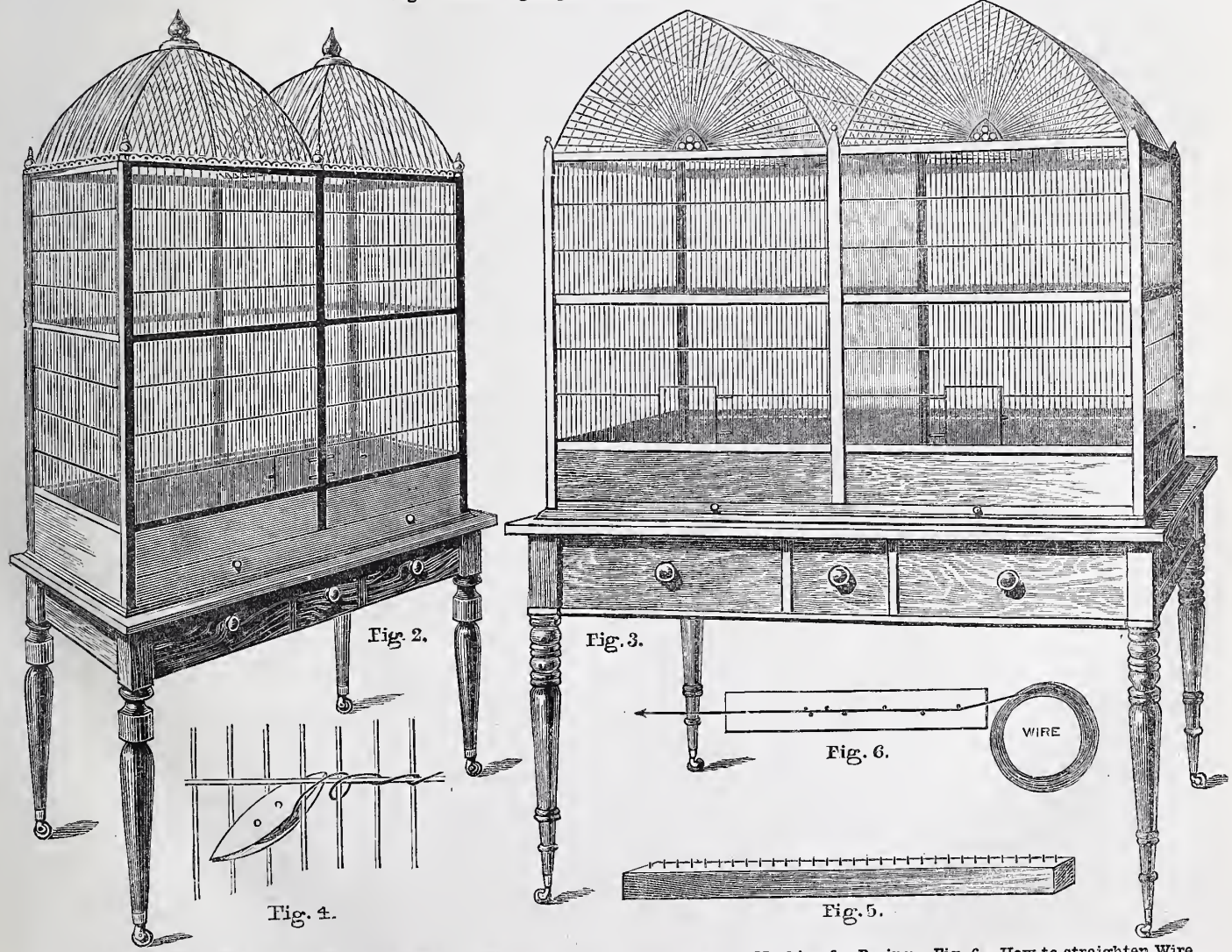


Fig. 2.—Zinc Cage. Fig. 3.—Mahogany Cage. Fig. 4.—Mode of binding Wires. Fig. 5.—Marking for Boring. Fig. 6.—How to straighten Wire.

divide round the outside of the template five-eighths, and draw lines to the centre, and that will give you where to bore the holes. Place a piece of wire round the outside of the template; place wire in the holes; cut them of the right length; bend them over the outside wire, or solder them on, which, I think, is much the best (for soldering, *see* Vol. I., pp. 257, 503); place this on the top of the cage, glue the block on, and put the outside wire into holes bored for them. It is better, perhaps, to leave out three of the wires each end (say, one in the middle and one in the middle of each half); when it is fixed, take three wires long enough to go across the cage, and turn a right angle to go into the holes in the block. Now for binding the horizontal wires to the vertical ones. You can get binding wire at the same place. The way I have done this is: Fill a small bone tatting-shuttle with wire, and pass it through and through with one hand each side (Fig. 4); and when this is all done, and the wires are even apart, and the binding wire is pulled tight, it can be fastened in each post by boring a fine hole. Now make the doors, and fix them on to the centre-post, and fix on the bottom.

To make a metal cage, I should have half-inch angle bar, the joints to be soldered together. The wiring can be done the same as for a wooden cage running a tack of solder along the bottom bar to fix the wires. The whole of the cage could be made of zinc, and japanned before wiring, taking care to oxidise the zinc first with brine, so that the japan may stick.

If many readers wish for a more detailed description of any particular cage or an aviary, I should only be too pleased to give my experience in making canary cages. I have for the last five years made canary breeding and carpentry my hobbies.

BRICKLAYERS' WORK.

BY MUNIC.

Introductory.

Bricklayers' work is the art of erecting buildings, walls, etc., with bricks and mortar; it may be traced back to a very remote period in the history of the world; at the building of the Tower of Babel, 2247 B.C., burnt bricks were used. The Egyptians also employed the Israelites in making and building bricks; these were sun-dried, and mixed with chopped straw to give them greater tenacity; in consequence of the extreme heat and dryness of the climate, they acquired an extraordinary degree of hardness. Vitruvius writes of the Greeks using sun-dried bricks, and recommends them to be kept two years before being used, while the laws of Attica required them to be five years old.

The Romans used bricks extensively; they burnt them of a deep red colour, and the remains of their work which still exist, although over 1,800 years old, are little worse than when first built; it is most probable that the first bricks made in this country were made by the Romans.

Brickwork was not much used in England till after the Norman Conquest, and till the reign of Henry VIII. it did not attain to any great degree of perfection, but at that time many important buildings were erected which are still objects of admiration; the ordinary dwelling houses of this period were built of a timber framework filled in with laths and plaster, or brick panels, and called half timber work. But after the Great Fire of London it was ordained that bricks should be the material of the future city. Then brickwork began to be used in ornamental forms; it was carved and made to take the form which properly belongs to stone, pillars and rich entablatures being formed in it. The bricks of this period were thinner than they are at the present time.

The average size of bricks now made is $9\frac{1}{2}$ in. long, $4\frac{1}{2}$ in. broad, and $2\frac{1}{2}$ to 3 in. thick, some clays contracting more than others.

About the close of last century a duty of 2s. 6d. per thousand was imposed on bricks. This was afterwards raised to 4s. Plain and paving tiles were taxed at 4s. 10d. per thousand, and pan tiles at 12s. 10d. per thousand.

In 1833 the duty on tiles was repealed, and that on bricks raised to 5s. 10d. per thousand, which remained till 1850, when the duty was entirely repealed.

Brick-making.

The process of brick-making varies very much in different parts of the country. In some districts the clay is ground between rollers, in others both rollers and pug mills are used. In the neighbourhood of London it is often passed through a wash mill; there is also great difference in the processes of drying and moulding. The forms of the kilns also differ very much. Some use the Dutch kiln with fire-holes at the sides and ends. In others the furnace is underneath the floor of the kiln; in Staffordshire circular-domed kilns called cupolas are used; in the northern counties a square kiln with arched roof is used, fired at the front; while in some places clamps are used, the fuel either being mixed with the clay, or spread in layers between the bricks.

Strength of Bricks.

Bricks vary very much in strength: in an account of some experiments given in the *Builder*, it was found that out of thirty-five different kinds of bricks which were tested, the average strength of the strongest was from 1,557 lbs. to 2,855 lbs. These bricks varied from $1\frac{1}{2}$ to 3 in. in thickness, and the thinner bricks were stronger, in proportion, than the thickest.

It was also found that out of twenty-five different bricks from various districts, the average weight was about $7\frac{3}{4}$ lbs., and that the heavier bricks were the strongest; machine-made bricks are generally heavier than those made by hand. In some experiments made on the strength of hand and machine-made bricks with a hydraulic press, the pressure required to crack a hand-made brick was from 12 to 13 tons, while machine-made bricks required a pressure of 16 to 17 tons, and the pressure to crush a hand-made brick was from 14 to 25 tons, while machine-made bricks required a pressure of over 40 tons to crush them.

Machine-made bricks are heavier and less porous than hand-made bricks; they are more liable to crack in drying, but, on the other hand, they are much smoother than hand-made bricks.

The properties of good bricks should be soundness, and freedom from admixture of stones, or lime; they should be hard and well burnt throughout, and they should be uniform in size and colour, and should not absorb more water than one-sixth of their weight. The pressed bricks made at Ruabon, and some parts of the midland counties, are almost non-absorbent, and practically impervious to water.

Names of Bricks.

The bricks in general use are known as malms, grey stocks, red stocks, and place bricks; these are also subdivided into cutters, seconds, paviors, pickings, roughs, common, paving bricks, and clinkers.

Malms are made in the neighbourhood of London, and are of a yellow colour; they are used for best face work. Cutters are softer, and are used for gauged arches, and other rubbed work. Red and white Suffolks are also used for this class of work. Grey stocks are good bricks, but not of uniform colour. Red stocks are the ordinary red bricks made in different parts of the country. Place bricks are those left in the clamp after the malms and stocks have been selected. The seconds, paviors, pickings, roughs, and common, are selected after the malms and cutters are taken from the clamp; paving-bricks and clinkers are used for paving floors, etc. Gault bricks, made from Folkestone marl in various parts, are much used for facing; there are also numerous kinds of excellent bricks made in various parts of the country, and which would occupy too much space to be described here.

The colours of bricks are as varied as their names: there are reds, whites, greys, pinks, blues, blacks, the different colours being caused by the varying composition of the clays; thus, bricks made from a clay containing oxide of iron burn red; the Staffordshire clay burns red, but by additional heat being added, the blue colour is obtained.

Digging and Tempering Clay.

In commencing brick-making, the first operation is digging and tempering the clay; the earths or clays for brick-making are of three kinds: pure clay, composed of silica and alumina; marl, which contains a considerable proportion of lime; loam, which is sandy clay. It is seldom that these earths or clays are suitable for brick-making as found in their natural state, the pure clays requiring the addition of sand or loam, while the loam requires the addition of lime; the marl used in the vicinity of London is mixed with chalk ground to the consistency of cream.

The clay is dug in the autumn (the top soil being cast to one side), and wheeled into heaps, where it is left throughout the winter, which causes it to break up and crumble. In the spring it is turned over and tempered either by hand labour or in the pug mill, water being added to render it plastic; during this operation all stones must be picked out; when the clay contains gravel, or a great number of stones, it is washed in a large cistern filled with water, with a fine grating by which the liquid clay can be run off, leaving the stones; it is run into pits and left till sufficiently stiff for use. Some clays contain limestone, and should a piece of this get into a brick, it will sooner or later split it, or blow a piece out of it.

To counteract this evil, cast iron rollers are used in some parts to crush the limestone, and this in some measure remedies the evil.

In railway works, and some yards where the bricks are made by machinery, the clay is dug, passed through rolls into the pug mill, and through the brick machine at once, a mixture of sand or other material being used instead of weathering the clay during the winter; but bricks made in this manner often scale off after being built, causing the work to be refaced in a short

time, although, when the nature of the clay is sufficiently known, by a judicious admixture very good bricks may be made.

The pug mill is a vertical cylinder, with a shaft in the centre, on which are fixed knives or cutters, which, revolving round, kneads the clay, and forces it through an opening at the lower end of the cylinder; it is worked either by steam power or a horse.

After the clay is tempered, either by hand labour or the pug mill, it is laid in heaps, and covered with mats to prevent its becoming too stiff for moulding.

Moulding of Bricks.

The brick mould is a box the size of the brick (or a little larger, to allow for contraction in burning), without top or bottom; it is sometimes made of wood, sometimes of brass, or of wood lined with brass. In the process of moulding, a table is used; the tempered clay is laid on one end of the table; the moulder takes a lump of clay of sufficient size in his hands, dashes it into the mould, pressing it well into the corners, and scrapes the superfluous clay from the top with a piece of wood called a strike. There are two kinds of moulding, known as slop and pallet moulding: in the first kind, the mould is dipped in water, contained in a box in the table, to prevent the clay adhering to the mould; in this case the mould is often carried to the drying floor and the brick turned out of the mould, a second mould being left with the moulder. Sometimes the brick is carried between two boards, instead of taking the mould, depending on the nature of the clay.

In pallet moulding, sand is used instead of water, and the bricks are carried off on one board.

The moulder generally works in a shed called the hovel, although sometimes in the open air. Adjoining the hovel is a level piece of ground called the drying ground. Sometimes a shed with flues underneath is used for drying the bricks more quickly, and preserving them from the weather, as heavy rain on the open ground soon destroys the fresh-moulded bricks.

When a steam engine is on the works, the exhaust steam can be turned under the floor of the drying shed, and utilised for drying the bricks; or, where practicable, the heat, after leaving the kilns, could be collected in a large flue, and, by means of dampers, distributed over the floor of the drying shed.

Drying.

The bricks are carried from the moulders by boys, and laid on the drying ground till one side is sufficiently dry; they are then turned, and when sufficiently hard, are built into walls called hacks, an opening being left between each brick. When the hacks are outside, they are covered with wooden covers, or tiles, to protect them from the rain.

Sometimes a barrow, called a hack barrow, is used to carry the bricks when the drying ground is of great extent, and some clays are sufficiently stiff to be built into the hacks from the barrow. The bricks are laid in two rows on the hack barrow on boards called pallet boards.

A good moulder will make over 1,000 bricks per day in slop moulding, and more than twice that number in pallet moulding, on account of having an assistant to make the lumps of clay ready for putting into the mould. The time required for the bricks to lie on the drying ground is from one to five days, depending on the state of the weather. In the drying shed less time is required; they then remain in the hacks from one to three weeks.

Brick Machines.

It is considered that making bricks by machinery on a small scale is not economical, as the cost of moulding alone is small in proportion to the total cost; but where there is a good bed of clay, and a large demand for the bricks, the use of machinery is to be recommended.

There are many varieties of brick machines, but they may be divided into two classes—wet and dry clay machines. In the former, the bricks are formed from tempered and plastic clay, under moderate pressure. In the latter, the clay is dry, or very slightly wetted, and the pressure is very heavy. Bricks made by the latter method are denser, and shrink less in drying and burning than in the wet clay process. The principle of the wet clay machines is to force the clay through a die, after which it passes between rollers, and is cut off with a wire. In the dry clay machines, the clay is forced into a mould. With ordinary-sized machines of either class, 80,000 to 100,000 bricks per week can be made. Pressed bricks are made by putting the hand or machine-moulded bricks into a metal mould when nearly dry, and, by means of a powerful screw or lever, they are pressed, which puts a very smooth surface upon them.

Polished bricks are rubbed on a bench plated with iron, and dressed with a beater or dresser by hand.

Burning.

After the bricks are thoroughly dry, they are put into the kiln or clamp and burned. The kilns are of various forms as previously named. The bricks are piled into the kilns, leaving a small space between each for the heat to pass through. The fire is applied slowly at first, till the bricks are thoroughly dried, which is known by the steam ceasing to rise; the heat is then increased, and if the kiln is open-topped, the top is covered with soil or sand to retain the heat. As soon as the bricks are sufficiently burnt, the fire-holes and all air-holes are plastered up, and the kiln allowed to cool slowly. The time for firing the kiln varies according to the number and size of the bricks in it. Great care should be used in piling the bricks in the kiln, as, when crossed, the exposed parts are streaked with white, and the parts in contact are red. In clamp burning in the London district, the fuel, which consists of sifted ashes called breeze, is mixed with the clay, a layer of breeze being spread between each course of bricks. The bricks are piled close, and the heat applied as in the kilns. Bricks made without being mixed with breeze are burnt in clamps, the fuel being small coals spread between each course. In the next article, the manufacture of fire-bricks, roofing and paving tiles, and drain tiles and pipes will be described.

THE MUSICAL BOX: HOW TO REPAIR IT.

BY A PRACTICAL HAND.

The musical box which some admire, some condemn because of the sameness. Nevertheless, a good one is delightful if not everlastingly kept going.

There is great cheating in them. A box 24 in. or 30 in. long may only have a 10 in. or 12 in. barrel, each end highly polished wood, bright levers, etc., to "do" the uninitiated. Such are astonishingly feeble for so large a concern, but "cheap" being the order of the day, they are got up for that purpose, eight or ten tunes, for the small sum of, say, £3 10s.; while a 24 in. or 30 in. box, with full-sized barrel and comb, 18 in. and 24 in., would be, say (polished rosewood, not stained), £6 and £8; £10 if extra finished.

To clean and repair one, first unscrew the four screws in outside of box, and then draw the two slides at each end inside; lift out of case entirely. Amateurs almost as a rule make this mistake, taking the fly wheel, etc., out, thereby destroying hundreds of pins on the barrel and damaging tips of teeth in comb. First see if the spring is down to the very *lowest* point, which it is almost sure not to be. For want of cleaning it will not probably be half-way, as the general public, either in case of watch, clock, or musical box, run them until they will do it no longer. Each article mentioned above would be more lasting, and give better results, if cleaned and oiled yearly.

Try the works now upon your bench. Help on the barrel, pressing from you the teeth of the wheel. Do not touch the pins. You will find it play on with this help. Keep occasionally trying slightly the reverse way to feel if fully down, and minus any force in it. Better this trouble than an expensive one by carelessness. I could mention a quicker way, but for the inexperienced it would be risky. Now with a good, strong, smooth-ended screwdriver, proceed to take out the eight or ten screws, with washers holding down the comb. Don't be afraid, but do it firmly, or you might slip, and it is sure to be at wrong side—away goes a tooth or two. Now unscrew the four screws holding the parts the barrel works in, and carefully prise each with point of screwdriver or stout blade of pocket-knife. Lift all out at once, having previously folded some soft clean paper pad-like, whereon to rest the barrel, so that no damage may be done to the pins. You can now turn over the frame, and notice underneath the three levers which change tunes, etc. Make a mark on each—1, 2, 3—so that you will not be puzzled when putting together, though you could not get wrong. Then unscrew the one screw holding fly wheel action part. Next unscrew the large drum containing mainspring, and the whole is ready to clean and repair. First examine barrel pins with your eyeglass fixed. Commence at the row of indents where the barrel always rests at end of tune. You can, of course, just slip the two brass parts into the frame with barrel without screwing, as they have holes and pins to fit, and keep in position. Now turn the barrel very slowly, and examine each row to see if any pins are bent down or to one side; if so, remember those pins take no part in the tune, and, of course, lessen the power of tone, causing what may be termed a thinness in places while playing. It is a slow and very tedious job, but when you have determined to put all into proper order, never mind the time or trouble—it will be worth your while. Have a thin-ended screwdriver, and when you see a pin bent out of position that the others are in, rest the point on the barrel, and very gently raise it to its original form. It may be a seriously damaged musical box—hundreds of pins flattened or gone: then it is a bad case; but if only a pin bent here and there, go all round the barrel and remedy, and even go over it again so as not to miss one, as it might be a particular note gone.

Now if, as I said above, it is a seriously damaged barrel, and you have abundance of patience and perseverance, procure some fine steel wire same size, to repin the barrel.

Commence by taking the pin out at the end having the small toothed steel wheel which slides on to the square end of the part passing through inside of barrel; the spiral brass spring take off, and undo the end of barrel same as lid of barrel containing mainspring in watches. Draw out other wheel with axle rod affixed. You will now see inside a composition run all over the pins to fix them. This you must melt out by holding open end over a gas jet. Replace the rod and end cap of barrel, and place in the proper position on the frame, and with a very fine though strong steel punch and light hammer proceed to drive through the broken pins. Then cut your wire about half-inch lengths, and gently tap one into each hole about half-way. When all are filled, cut them off on the outside same height as the old ones remaining in. Be sure of this. If too short, they will not lift the teeth in comb, and thus prove dummy; and if too long, will lift tooth too high. Supposing all the pins are now reinserted, take out the rod and cap end, and use the following composition. What is used by the Swiss I do not know. We use this:—Equal parts of gutta-percha and resin, say 1 oz.; half the quantity of shellac, say ½ oz.; and a quarter the quantity of pitch, say ¼ oz. for a small box, or double these quantities for a large box. It will require to be ¼ in. or so thick inside.

Next, should the spring be broken, unscrew the patent winder and remove cap of barrel. Now comes a strong job to take out so large a spring, but do not be afraid. I lay it on the bench, and press down half the coils with a punch, and draw out the first unbroken coil with good stout pliers, slipping the punch nearer outer rim until I can handle the coil with my hand; then I seize barrel with the other, and, with a sharp "wiss," out it comes. Some fix the barrel in a vice, but unless very careful the barrel is marked, which always shows a tinkering job. If outside coil is broken at the hole, or near it, do as I mentioned about watch mainspring in Vol. I., p. 633; if inner coil, same. A new one will cost from 1s. 6d. to 3s. 6d., according to size, of course; small boxes 9d. If the new spring is same width and strength, fit in as stated for watch spring. Hold firmly down while turning in each coil. Should the patent winder ratchet part be out of order, repoint smoothly and neatly the click, as it will be worn; or if click spring is broken, make one like it from a piece of good steel spring; drill hole, and rescrew it. Should a tooth or two be broken on the spring barrel, file them away, make a good dovetail as at A (Fig. 2), and with a good piece of hard brass (rotten cast trash will not do), hammer it well, and fit as described in directions for watch wheel repairs (Vol. I., p. 633).

You must unscrew B (Fig. 2) from the stop action, so that in the fixing of new spring this must be at rest upon the double tooth, C, and the mainspring must have about two turns—or even three—to carry the tune to end. In finishing this you will see, when all is complete, that

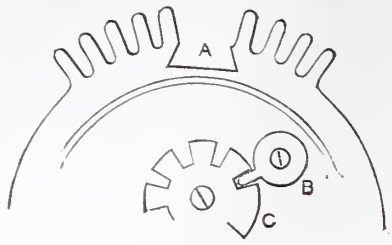


Fig. 2.—Repairs of Teeth on Spring Barrel.

it prevents you from overwinding, as in a horizontal watch.

We now turn to the comb—the most difficult job of all, for if many teeth are minus, it is no good. Should an odd tooth here and there be out—well, if you have the broken ones, solder them underside for appearance' sake only, for they will not speak again. If you have not the original ones, file imitation ones near like as possible, and solder too. I have seen it stated that speaking teeth can be affixed. Believe it not, for I tried the best professors. The sound of such teeth is a flat, dull sound.

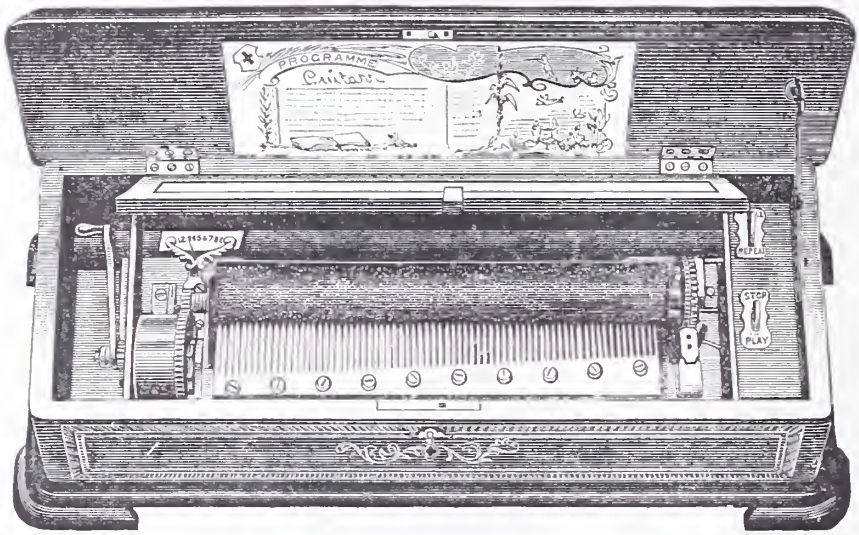


Fig. 1.—Interior of Musical Box, exhibiting Action, Comb, Barrel, etc., in position.

An odd tooth or two out, if *not* together, does not perceptibly interfere with the music, seeing that two teeth have the same, or nearly the same, tone. However, that is the best you can do, and if comb is badly damaged, it saves no end of trouble and expense to get a new one. You can give it a trial, and experience will teach. In case the action part is out of order, and the endless screw with fly attached is out of order and will not turn, see if the top end stone, A (Fig. 3) is cracked or broken; if so, the fly will not run with ease. Take it out and procure a new one. Or the endless screw may be worn. See if it is. Use your eyeglass. Try, by pushing the largest wheel,

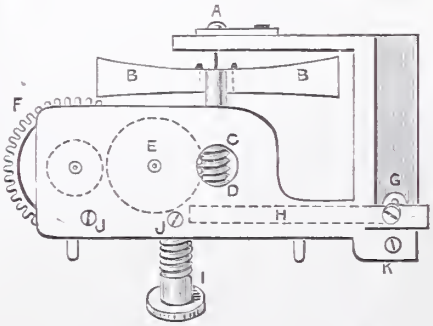


Fig. 3.—Repairs of Action of Musical Box.

F, towards the endless screw, D, and notice by holding it betwixt your eyeglass and the light, looking through the hole C. See if wheel, E, runs easily in the worm, D, or if worm is worn. See if flys, B, B, run clear, and not touch in the least (they may do, by frame having had a knock), or if any tooths in E or F are bent or injured. Now, should the worm be worn, unscrew J, J, and it will be apart; and unscrew K and let out fly. Then with a smooth thin file neatly go round the worm or screw, and after making quite smooth by burnishing it, the teeth of wheel, E, may require retouching, keeping same shape; then burnish. Now clean perfectly, frame and all, and replace. Of course you will find the wheel, E, has not the same dip into the worm, so give the screw, G, half or quarter turn to the right. Now see if near enough, but keep turning the large wheel, F, and turn screw, G, in or out, so that all works easy; if so, it is complete. Oil it, a small drop to each, and one to worm; also its top pivot. I is large screw for fixing to main frame; dotted lines show how H slides in or out by turning G; the other dotted lines wheel part inside of frames.

Now clean all well; very fine emery-paper to comb. Push towards points of teeth always, so that no mark cross-ways will show. Then slide a card betwixt every tooth, to clear out grit from the loaded teeth—under points of teeth. Be careful of small springs. Any broken replace with bent hairspring from watches, pinning in as before. (These act as dampers in a piano.) Clean barrel in frame with a brush and chalk (prepared chalk) Brush *around*, not across until it is like new. Here replace mainspring part with its four screws, then barrel and the fly action part, last the comb. Be sure to screw up *tight* for a good tone. Turn it on the side comb is on, and replace levers underneath. Having oiled the barrel, wheel, pivots, and mainspring parts, the action is already done. Now wind up a few turns, and let it play. The tone will be poor, but it is not in the case. Now see if it turns cheerfully down to last double tooth in stop action at C; if so, it is right. If not, unscrew B and turn up patent winder until sufficient power is on, then replace B, and it will be right, no doubt. Replace in the case, screw up tight with the brass washers on, and replace slide ends, having seen that the starting changing levers are acting (you will easily see this), and the part which stops it at the end of any tune. Finally wind up, and your labour will be well spent.

CARVED WOOD COVER FOR "WORK."

BY F. W. KINNEIR TARTE, M.S.A.

THE accompanying design is for a carved wood cover for WORK, preferably in oak; but the cover might be carved in any other wood suitable for carving purposes. If pine, or a white wood is selected, I would advise that the cover after being carved should be stained with walnut stain. "Jackson's

CARVED WOOD COVER FOR WORK.

DESIGNED BY

F. W. KINNEIR TARTE, M.S.A.

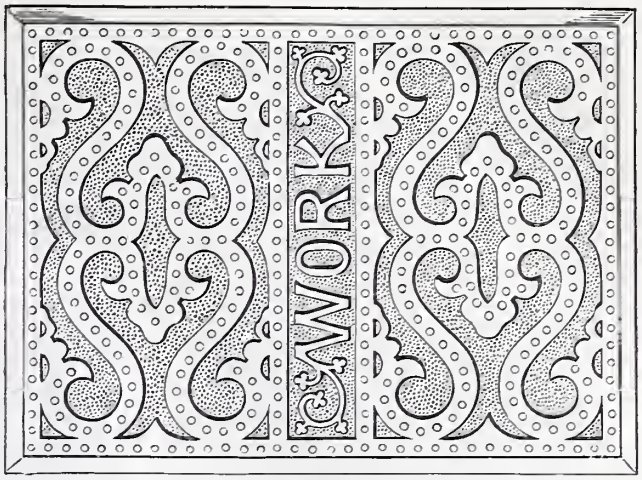


Fig. 1.—Diagram showing Entire Cover. (Scale, one-quarter full size).

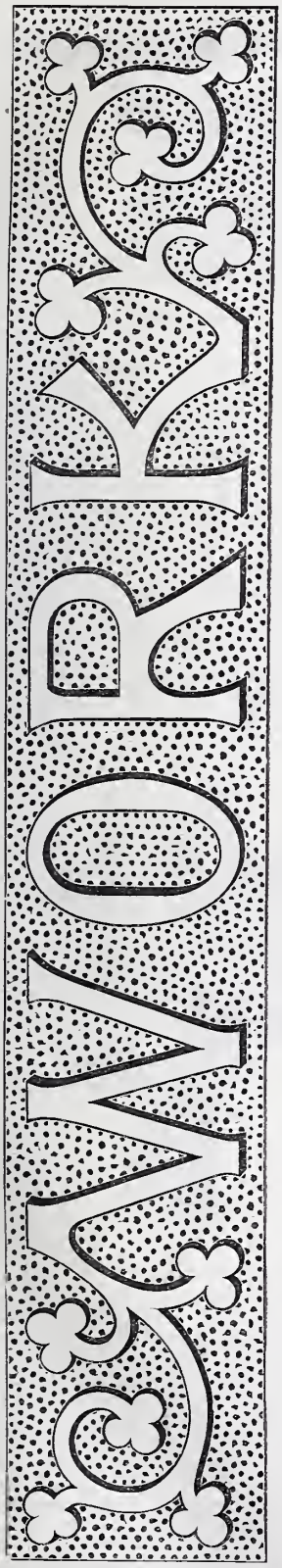


Fig. 3.—Central Portion of Cover (full size).

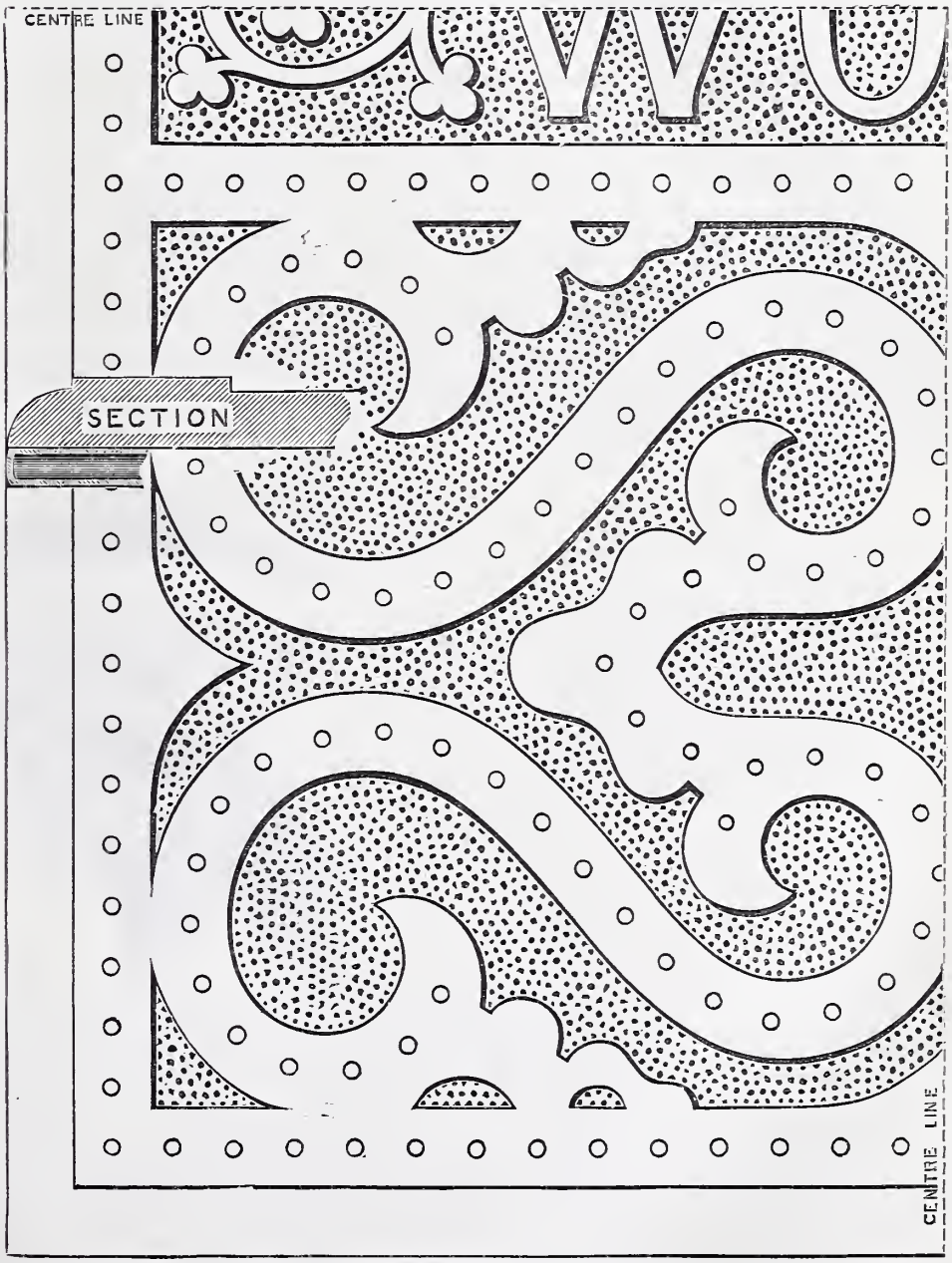


Fig. 2.—One-fourth part of Cover (full size).

Walnut Stain" is a rich brown colour, which greatly adds to the charm of white carved woods. Two coats will be found to be sufficient, but each coat should be laid on sparingly and well rubbed in with a stiff brush.

The size of the wood cover when finished should be $9\frac{3}{4}$ in. broad by 13 in. long, and the thickness $\frac{1}{2}$ in. or $\frac{3}{8}$ in. when planed up ready for carving. Fig. 1 is a quarter full-size plan. Fig. 2 is one-quarter of the cover full size, with the section showing the under cover. Fig. 3 is a full-sized detail of the lettering and sprays in the centre of the cover.

The dotted portion should be cut out about the eighth of an inch deep, leaving the lettering and design in relief. The ovolo moulding around the edges should next be worked, then the ground should be punched, and the circular punch marks on the design should be placed at fairly regular intervals.

With regard to the making up, perhaps a few hints may not be out of place. Serge makes a good undercover, and should this material be used, take a piece 13 in. by $19\frac{1}{2}$ in., fold this in two, enclosing a piece of cardboard rather smaller than the wood cover. The front edge, the top, and the bottom should now be bound with ribbon. You will then have a serge back cover the same length as the wood cover, but 1 in. wider. After stitching the edges together turn this inch up, and glue it along the under back edge of the carved wood cover. Now all that remains to complete is to have a piece of ribbon or elastic, 13 in. long, sewn on the inside back of the cover at the top and bottom, leaving the middle loose so that the paper may be removed at pleasure.

Carved wood book covers always pay for the time spent on them. They are satisfactory things to carve, for they require but little making up, and, in a great measure, keep papers tidy, and diminish their chance of being lost or damaged.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

3.—The Patent Portière, or Self-Acting Door Curtain Rod.

There must be few who will not readily acknowledge the advantage of curtains at doors and windows as a means of excluding draughts and inconvenient currents of air in wintry and windy weather, and there will be as few, doubtless, who have made use of curtains for doors, whether within the room or without the room, who will not allow that the means of lessening the inrush of air by hangings is also attended with inconvenience, caused by having to push the curtain aside both on entering the room and on quitting it. It will have occurred to many, perhaps, that it would be an advance in the right direction if, by some contrivance, the door could carry the curtain with it when opened; but to bring it about has been an insuperable puzzle. It has been solved, nevertheless, by the ingenuity of Mr. Lawton, and a portière, or self-acting curtain rod, has been made, on what is termed the Duval-Lawton patent, which provides for ingress and egress through a curtained door without the slightest trouble. A glance at Fig. 1 will show how this is brought about. There is a joint in the rod at A, and as the bracket, B, is screwed to the jamb on which the door is hinged, and the bracket, C, to the door itself, at the topmost corner of the free side, it will be understood that, as the door is opened, the rod turns on the patent joint at A, and that the opening of the door is effected without disarrangement of the curtain. When the door is closed, the parts of the rod resume their original position, and fall into the same straight line, and the curtain also is as it was before the door was opened. Each rod is fitted with a patent joint and patent bracket that absolutely guarantees the firm holding of the rod in its proper position. Being manufactured solely in wrought metal, it is of superior strength to the usual article fitted with cast brackets, and being machine made and well polished, it is turned out well finished, and in a manner which ensures easy working. The rods are made for right- and left-hand doors, and, in purchasing, care should be taken to mention how the door is hung, so that the rod supplied may be suitable for it. Rods may be had in three sizes, namely, $\frac{1}{2}$ in., $\frac{5}{8}$ in., and $\frac{3}{8}$ in. in diameter; and each is sent out complete with ends, rings, and brackets. They are manufactured by Messrs. Williams Bros. and Co., General Brass Founders and Tube Manufacturers, Pershore Street, Birmingham, who only supply through upholsterers, ironmongers, and dealers. The patent joint used in the tube may be inserted in any tube or rod where a joint is required. I do not know the prices of the rods.

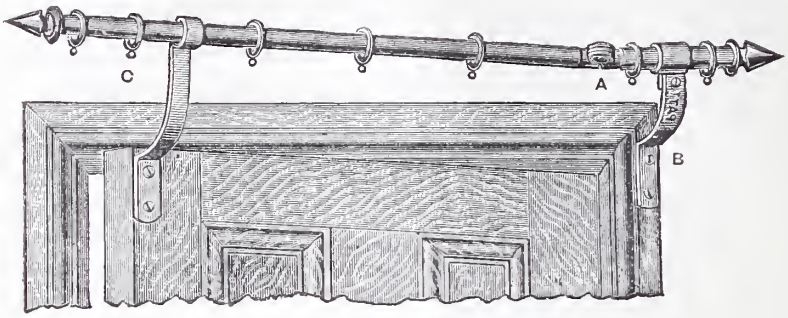


Fig. 1.—The Patent Portière, or Self-Acting Door Curtain Rod.

4.—Hodges' Mitre Shoot.

Many aids and appliances for frame-making and for making correct mitre joints have been given to the working public of late years, and the latest addition to their number has been Hodges' Mitre Shoot, which is illustrated in Fig. 2, and which is intended for planing up the joint after the wood has been cut to the proper shape by means of the saw. The patent rights are held by Mr. E. R. Sibley, Whites Hill, near Stroud, Gloucestershire, who, I am sure, will readily answer any question regarding the price at which the machine is sold, and respecting which I am utterly in the dark. I like to be in a position to mention the price of everything that I am called on to notice, for to know the cost of an article is useful to buyer, seller, reader, and myself all round, and, in many cases, saves the putting of questions on this point and the answering of the same. The nature of the machine will be seen from the illustration. First, there is a rectangular frame or bed, with raised edges or guards, which is fixed firmly to the edge of the workbench, as shown, by two screws. Attached to the frame is an adjustable bed, whose inclination forms an angle of 45° with the frame, and on this frame the moulding is placed after being cut in the mitre block, and secured by the vice, which grips it and retains it in position, the vice itself working in a small block attached to the adjustable bed. When the moulding is in position, the end may be planed up with the long plane shown in the illustration, and which is made of so great a length that it may be able to ride on the guards formed by the raised edges of the frame and the top of the bed itself. As these guards are perfectly flat and square, it follows that the end of the moulding, when planed up, must be equally flat and square. The bed, as it has been said, is adjustable, and should it deviate from the proper angle, it can be set correctly by loosening a screw at the back of the regulator, bringing it parallel with the sides of the machine, and then tightening the screw again. The regulator is at the bottom of the bed, and does not appear in the illustration. The points of utility claimed for the machine are, its capability of producing accurate work: causing no injury to mouldings; perfect adjustment by means of its rising and falling bed; the ease with which it can be worked; the possibility of reshooting the ends of a frame after two sides have been joined together; and its portability and the ease with which it is fixed. The machine takes mouldings 4 in. wide and 3 in. deep.

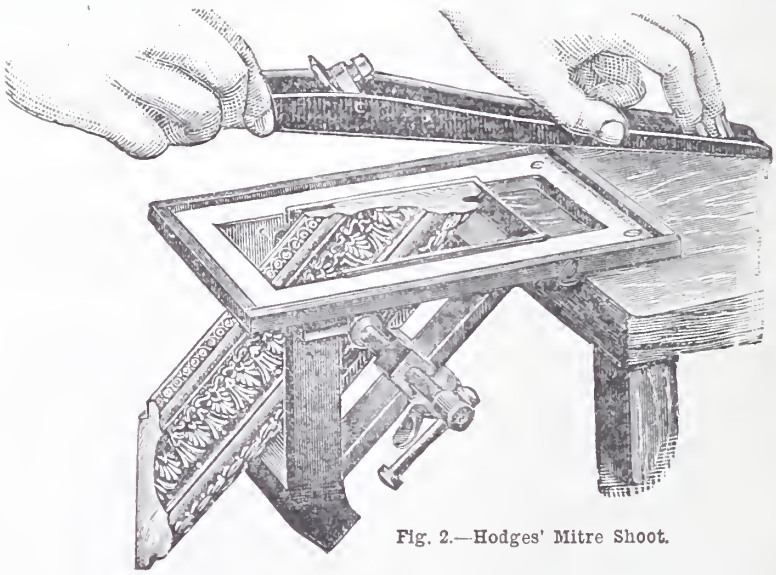


Fig. 2.—Hodges' Mitre Shoot.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

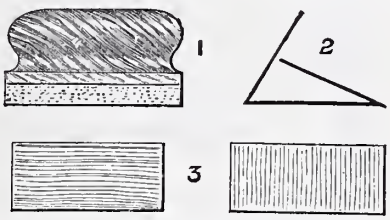
I.—Letters from Correspondents.

Misuse of Terms.—B. A. B. (*Hampstead*) writes:—"Permit me to answer H. B. (*Jarrow-on-Tyne*) (see page 779, Vol. I.). I am fully aware that H. B.'s way of holding the chisel does tend to liberate the core, and it is therefore no news to me, but I maintain that the accuracy of the mortise is more easily and surely obtained on my plan; besides, H. B. must sooner or later reverse the chisel to finish the mortise, and then his own objection to my plan applies to his procedure. He may have 'always understood that wood was bored, but that metal was drilled,' but I can assure him no competent instructor ever taught him that the distinction depends on the material operated on. He evolved the information out of his inner consciousness. Further, the term 'munting' is usually applied to the *inner* vertical parts of a piece of framing; the *outer* vertical parts are called 'styles.' 'Mullions' are the central vertical parts of windows, in which H. B.'s knowledge appears to be correct, though he wishes to be more correct than his dictionary. Here again H. B. appears to believe that the name depends on the material, and his expressed doubts as to the correctness of his dictionary spring from that idea which he has formed. I am quite willing to admit that the term is probably a workman's word, many of which spring from verbal corruptions. Mr. Adamson, I think, believes the word is a corruption of 'mounting;' it may be, or it may be a corruption of 'mountant,' especially as the 'g' is scarcely ever sounded. Be that as it may, the term is well understood, and we shall use it until a better word is found for us to use."

Gesso Work.—C. W. (*Kensington, W.*) writes:—"Will you permit me to say a few words upon gesso decoration for furniture, etc? On page 755, Vol. I., there is an article by E. C. upon this subject, in which the writer says:—'I cannot doubt that any one who can execute gesso work well would have a fine chance of doing a good business with some of the larger furnishing and decorating firms.' This is so far from being the case, that an artist, whose beautiful panels attracted considerable notice in the Exhibition of the Arts and Crafts last year, and whose proficiency can be vouched for by some of the highest in the profession, has applied to many of these firms in vain for an opportunity of showing how beautiful furniture in satin and other ornamental woods can be made by the addition of panels of gesso, much in the same way as small pieces of Chinese lacquer were formerly applied, and also how whole suites might be coloured and lacquered to suit the drapery and decorations of apartments. There is no reason why such furniture should not be as valuable and as attractive as painted satinwood or *vernis martin*; but, unhappily, our furnishing firms have not sufficient imagination to see in their 'mind's eye' the effect to be produced, or perhaps not enterprise enough to venture upon a complete novelty; thus, while copies of old furniture meet with ready sale, original work, however beautiful, is thrust aside without notice. Although much has been done by the Arts and Crafts Exhibition to introduce such works to the public, it requires a cabinet maker's or furnishing firm to take up the matter, in order to show the full value of the material, and, knowing its capabilities, I think I may say there is little fear of disappointment with the result."

Home-made Articles.—H. G. (*Bishopsgate*) writes to B. G. S. (*Dover*) (see page 779, Vol. I.):—"Bravo! Your sarcastic criticism is worth reading. According to your idea, it is impossible to do any work unless we have an elaborate set of tools. I don't think you know much about woodwork though, or else you would have been more lenient in disbelieving. The reason I sent the sketches (*not* done on tracing paper) was not to praise myself, but so as to give correspondents an idea how work can be done, and done well, with a few tools, although the work is tedious and takes a long time to do. As regards the spindles, I bought them; any person with common sense would know that to turn them you must have a lathe. If you read page 636, Vol. I., again, you will find—I refer to the dresser and perambulator being made with the keyhole saw, etc.—that at the time I made them I had no more tools in my possession: it was not from choice, but from necessity. Of course, now I have plenty of tools, and, as you don't believe I made all those things stated, I must add that I have gone in for picture-frame making and mount cutting; what do you think of that? Of course, seeing is believing, and if you or any one else wants my address, and the Editor is kind enough to give it, come and see me any night after seven, and I will show you how it's done."

Some Hints from New Zealand.—Joiner (*Taranaki, New Zealand*) writes:—"I had my attention drawn to your publication Work by a subscriber as a work that will be useful, not only to the amateur but to the tradesman. As one of the latter class, I fully endorse the opinion, and, as a subscriber now, I trust you will keep up to the standard for the sake of those who, like myself, are far away from the many advantages that a home-stayer has over the wanderer, as regards the new tools and appliances, of which we have often to be content with the notices and description only, which, however, are suggestive to the practical mind. Your various writers will please excuse me offering a suggestion as regards their methods of how the work has to be done. Don't confuse by trying to make it too plain, and above all things be workmanlike. Show how the article would be constructed by a tradesman—viz., framings mortised or dowelled, and not halved together, drawers, etc., dovetailed and not simply nailed, and so on. If it is worth making it is worth making well. My reason for mentioning this is that amateur work, as a rule, is jerry-built, and hardly a pleasure to look on. Also that he is apt to think little of a tradesman who, perforce, must construct on proper lines, whilst if the amateur learnt how to work he would appreciate good work when he saw it, and give more honour to the maker when he himself understood the accurate and nice work requisite to complete it as a whole; and to the amateur I would say don't be satisfied with rushing through a lot of things. Rather be a year making one article well, than make twelve in the same time that are neither of long service or ornamental by reason of their sloppy character. Be patient and painstaking, and the results will follow. I shall have much pleasure at times in offering suggestions, and trust they will be taken in the spirit they are offered—viz., to do an all-round good. And now for number two. In the first place, as regards the use of glass-paper, my experience has been, even with tradesmen, that few know how to hold it. In the first place, you want a proper rubber, and in practice I have found that a piece of Honduras or clean pine, 5¾ in. by 2½ in. by 1 in., with a piece of sheet cork glued on the face, and finished on the edges with a hollow, as in Fig. 1, is about the handiest form for general use. Fold the glass-paper and tear in two parts, giving you two pieces each 10 in. by 6 in. Then fold each piece twice, as in Fig. 2, and you will find there will be no slipping. The same rule can be followed in smaller pieces for using with fingers for cleaning up work where the rubber is not available. Secondly, as regards stencil cutting, I have at times been surprised, whilst reading works on decoration, that the writers advocate cutting stencils with a knife out of prepared paper, a job requiring an amount of dexterity, and also embodying the liability by one false cut to spoil the whole. My plan is to cut them out of zinc (the size or gauge used for lining export packing cases) with the fret saw, with the advantage that you can duplicate or quadruplicate if necessary. Get as many pieces of zinc as you require, lay a piece of greased paper (mutton fat is the best) between each piece, and fasten rigidly between two pieces of thin board, and, by the way, cross the grain of the wood as in Fig. 3, and you will in practice find the advantage. Paste on or transfer your pattern, drill the holes, and after cutting take apart. Clean off both sides with emery cloth, then with a sharp penknife and buhl files clean off irregularities, and you will have a set of stencils that will give every satisfaction by reason of the thinness and consequent clearness of outline. Wash clean after using, and either hang up out of harm's way, or keep in a book. I always follow this plan for fret cutting, placing the zinc for stencil between the two first pieces I cut; and fret cutters will find it save an infinity of trouble in copying or transferring patterns, with the further benefit that you can stencil on the wood, and if for polished work, polish over it before cutting. One caution only I give. Use coloured stencil inks, and never black, or you will find it trying to the eyes in following the pattern. With regard to the number of stencils to be cut at one time, that depends on the capabilities of the machine. Mine is a 'Fleetwood,' and with a No. 1 Star saw I have cut as many as four at a time out of No. 8 zinc. I wish you every success."—[I give your letter *in extenso*, as it contains many useful hints and suggestions, and is especially welcome, as it shows that Work has taken root in the Antipodes, and is valued there.—Ed.]



Diagrams illustrative of Use of Glass-paper and Stencil Cutting.

Glue for Earthenware.—M. R. (*Burnley*) sends the following recipe for a glue for earthenware, but omits to state the source of the cutting:—"Put a piece of white flint stone into the midst of a fierce fire. When it is red, or rather white, hot, take it out with a pair of tongs and suddenly drop it into a pan of cold water, which should be placed for the purpose. This will destroy the power of adhesion in the flint and precipitate the stone to a fine powder, from which the water must be carefully poured off. Now melt with white resin in an iron pot, and stir the flintstone powder in it till it becomes a thick paste. Warm the edges of the articles to be mended, and join neatly together."

II.—Questions Answered by Editor and Staff.

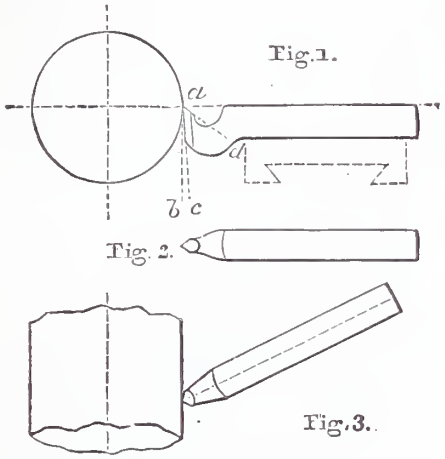
Phonograph.—E. B. W. (*Nottingham*).—It is a difficult matter for me to give you a sufficient answer to your query, you ask so little. It is not always so with querists. Some querists when asking for information do so in such a manner as to lead one to suppose that they are quite adepts in the subject at issue, and that giving them information would be like throwing water on a drowned mouse. How different is it in your case. You ask what kind of diaphragm, and what kind of wax to use in making a phonograph, and from that question and your little postcard, I have come to the conclusion that you require a great deal of information on the subject. However, I must keep to the point and answer as you have asked. The diaphragm is not always made of the same material. I used for a long time a ferrotype plate for this purpose, but now use a parchment diaphragm. The ferrotype seems to be a little too stiff, and the parchment if too thin is just the opposite. In Edison's new phonograph the diaphragm is of mica. You have the choice of these three. About the wax. The wax that is used is paraffin-wax. I do wish you had asked a little more, I would have been better able to advise you. I am going to prepare an article on the phonograph, in which I will give working drawings, which I am sure will be useful to many readers of Work, if our Editor can find a corner for the publication of it. In the meantime, if you want any further information do not be afraid to ask. I would rather see a sheet of foolscap filled with questions than a *petite* post-card.—W. D.

Re-stringing Tennis Racquet.—W. H. (*St. Leonards-on-Sea*).—It is quite impossible to re-string an old racquet satisfactorily, for the simple reason that the bow when originally strung is fully an inch in depth at the top, being fined down to three-quarters of an inch after being strung. It is still then strong enough to bear the all-round strain, but is not sufficiently strong to resist the severe pressure of the commencement of the process, without deflecting the shape. The stringing is commenced by leading the two ends of one piece of gut down through the two centre holes on the top of the bow, and through the two centre holes in the handle piece, and these strands are drawn tight by being wound over a round piece of soft wood, when they should be temporarily secured by a pin till the next strands are secured. The cross-stringing is commenced in the same manner through the two centre holes on the side of the racquet. After completion the gut requires one or two coats of varnish or French polish applied with a camel-hair brush.—C. T. S.

Electric Light for Model Eiffel Tower.—A. P. M. (*Richmond*).—This correspondent has made a model of the Eiffel Tower in fretwork, and wishes to know whether it would be possible to introduce an electric light in the lantern at the top, and feed it by means of a small dynamo concealed in the base of the model. The model and idea of lighting are most creditable, but the light should be fed with current from a small box battery, rather than from a small dynamo. Four small cells, such as those described in my article on "Model Electric Lights," which will appear shortly, will light up a 6-volt 5 c.p. electric lamp placed in the lantern. The cells may be placed on the first platform, concealed behind the legs or pillars. A lifting arrangement for the battery may be worked by means of cords and pulleys running up the interior of the model. Insulated wires, No 18 copper, cotton-covered, will connect the lamp with the battery. The whole, lamp, battery, wires, etc., will cost a little under £1. If you write to Mr. Bottone, Carsbalton, Surrey, I think he will give you full instructions, and supply you with the materials.—G. E. B.

Where to Buy an Alarm Battery.—J. A. B. (*Poplar*).—I do not know your locality, so cannot tell you where you can buy a Leclanché battery after six o'clock in the evening, or after two o'clock on Saturday. In my neighbourhood, the cells and other electric bell fittings are sold by ironmongers. Messrs. H. Dale & Co. will, doubtless, send you a battery by carrier, if you write to them. I do not think very highly of your idea for an electric alarum. There would not be power enough in the hour hand to press the springs together. Why not try the method described and illustrated by me in my article, "An Electric Time Alarum"? My own clock is fitted up in this way and gives every satisfaction. As you are a brass finisher, you could make a thorough good job of it, even better than myself. For full details respecting the switch and mode of connecting up the battery to the clock and bell, see my reply to One in Need (*Coventry*).—G. E. B.

Making Slide-Rest Tools.—BLACKSMITH (*St. Keyne*).—You ask how to make tools for iron-turning. Now it would be impossible to help you effectually without giving a number of full-size drawings of the various tools employed, and this can hardly be done in the "Shop" column. Even then a drawing of a tool point is not easy to make so plain that it shall not be misunderstood. No doubt the matter will be fully treated in WORK before long, and till that is done I advise you to get a book on the subject. Hasluck's "Metal Turner's Handbook" (Crosby Lockwood & Co.) costs only 1s. "The Complete Practical Machinist," by J. Rose (Sampson Low & Co.), 12s. 6d., is a very useful but rather expensive book. I will try to give you an idea of the principles involved in tool-making. Fig. 1 shows a bar of iron with a tool cutting at the point *a*; *a b* is a vertical line drawn straight down from *a*; *a c* is a line making an angle of 5 degrees with *a b*, and that is a suitable angle for the front of the tool, the most important angle to have correct. Fortunately it is very easy to ensure this by cutting a block to lie across the trough of the grindstone in such a way that if the shank of the tool be laid upon it while the front is ground, the front angle of any tool so held will come off ground with the proper "clearance" angle of 5 degrees. The angle, c *a d*, is the cutting angle, which for iron is 60 degrees. You can make a gauge to measure this angle by filing a notch in a bit of sheet iron with a smooth cut three-square file. Now for the shape of the point as looked at from above; that is shown at Fig. 2, where the point appears a little less than a right angle, so that the tool can be used to get into a square corner. For turning a straight shaft you would have another tool with a blunt-angled point of about 120 degrees, and in this case



Making Slide-Rest Tools.

the shank of the tool would lie across the tool-plate of the slide-rest as at Fig. 3, so that one of the front edges of the front angle will lie almost parallel with the bar being turned. The cutting point, *a*, should be at the height of the centres, and water is used to lubricate while cutting; a little soap is melted into the water, and it may drip on the work or be applied with a brush.—F. A. M.

Iron Brass Lacquer.—W. H. (*Oldham*).—Your question is rather vague. It would have been better if you had given some hint as to the class of iron articles you require to give the appearance of brass. If the iron is highly polished, and treated with two or three coats of highly-coloured lacquer, it will have a yellow but not a brass colour. Such a lacquer may be made as follows:—1 pint spirits of wine, 1½ oz. shellac, ¼ oz. gum elemi, 1 oz. gum sandarach, digest in warm place for two or three days, with constant shakings. Strain and colour to required shade with dragon's blood. Slightly heat the iron, and apply with soft brush, or, perhaps, bronzing may suit your purpose. If so, I give you an outline of the process; for although you may understand all about it, it may be useful to some other reader who does not. To 1 quart methylated spirits, add 8 oz. shellac, 1 oz. gum benzoin, digest and shake, as in last receipt, and let stand for some days. Then carefully pour off the clear liquid. Have your iron articles perfectly clean and smooth. Mix very fine bronze green with sufficient quantity of the clear lacquer to ensure an opaque varnish. The shade or colour may be modified to taste by the addition of red or yellow ochre, or darkened with lamp-black. Heat the iron articles to be bronzed slightly, and apply the varnish with a soft brush, giving as many coats as desirable. When dry, touch up the more prominent parts with some of the original lacquer, and when almost dry or tacky, apply some dry gold bronze powder with a soft brush. When thoroughly dry give a coat of any good varnish. Another recipe which may suit your requirements is shellac dissolved in methylated spirits until of rather thick consistency. Mix with this as much gold bronze powder as it will take up, and at the same time be capable of flowing from a soft brush. The iron articles should be bright and clean, and when slightly heated should have an even and rather thick coat of the gold varnish. When quite dry rub down with a wet rag dipped in finest ground pumice stone; dry and polish with a soft cloth, and finally coat with clear, mastic varnish.—OPIFEX.

Design for Chuck.—ONLY AN AMATEUR.—The oval chuck consists of two parts: the chuck with a movable slide on the face, and a boss bored and tapped to fit the nose of mandrel, and the guide ring, which is fixed by two screws against the fast headstock. Figs. 1 and 2 show the face and section of chuck. The boss is bored and tapped to fit on the nose of mandrel, and the face turned up while in position; two V-edged strips are fixed on the face by screws. These must be made perfectly straight and parallel, and fixed as shown in Fig. 2; the face of the chuck has two slots formed in it. Fig. 3 is the slide, which is faced on both sides, and the edges fitted to work in the slides; at the back two steel pins are fixed, the distance between which must be the same as the outside diameter of the ring (Fig. 5). When turned true, a taper screw is generally fixed in the centre for holding the work. The face of

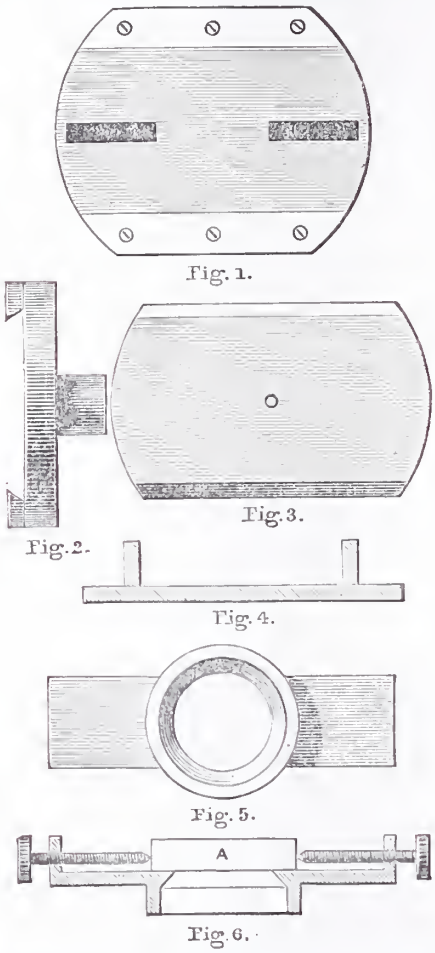
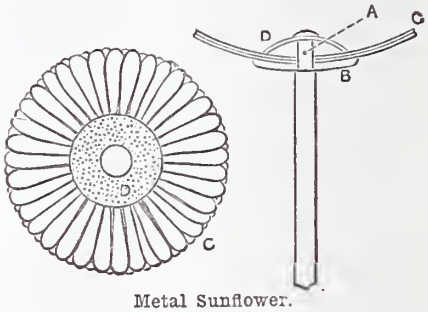


Fig. 1.—Front of Chuck. Fig. 2.—Section of Chuck. Fig. 3.—Face of Slide. Fig. 4.—Section of Slide and Pins. Fig. 5.—Guide Ring. Fig. 6.—Section of Guide Ring fixed on Headstock.

guide ring is shown in Fig. 5, and its section in Fig. 6, fixed to end of fast headstock, A. The back must be made level, and the face and edge of ring turned true. The outer ends of plate on which the ring is formed have two projections, through which screws are put to fix it to the headstock; the ends of the screws are tapered, and fit in holes at each side; these holes must be in line with centre of mandrel. The chuck is screwed on the nose of mandrel, which projects through the ring, the two pins in the slide fitting against the outer edge of ring. It will be evident that when the ring is fixed central with the mandrel, that the slide will revolve as an ordinary chuck; but when the ring is moved to either side by tightening one screw and slacking the other, the slide will at two opposite points in its revolution be that distance farther out than two other points in its revolution at right angles to them, gradually moving from the smaller to the wider points, and *vice versâ*; and if a pencil were held with its point against the slide, an oval would be described, the difference between the two diameters of which will be equal to the distance the ring has been moved from being central with the mandrel. If you construct it in metal, a few holes should be drilled in the slide, so that a wooden face can be screwed to it, on which to fix your work. Or you might make the chuck and slide of mahogany, and face the V-joints with brass plates to prevent wear, and make the boss of brass, with a flange, say, 1 in. wide and ¼ in. thick, let into a recess at the back, and fixed with screws. The ring would be a casting either iron or brass.—E.

Electric Time Alarum.—H. E. C. (*Woodford*). Fasten a pair of light springs, made of clock spring or of spring brass, to a wooden stem near the clock, as shown in my addition to your sketch. The insides of those springs, where they come in contact with each other, should be protected by pieces of platinum foil soldered on to the metal. Connect the wire from the battery to one spring, and the wire from the electric bell to the other spring. At night, when you fix the alarum on the clock, and have wound it, tie a bit of narrow silk ribbon to the alarum winder, and place the free end of it between the two springs. When the ribbon is thus placed between the springs they will be insulated from each other, and the electric bell will not ring. Pull the ribbon out, and the bell will start ringing. When the clock alarum goes off in the morning its winder will wind the ribbon around the stem, and pull it out from between the springs, and thus set the electric bell ringing. In this way the clock need not be altered at all, as the piece of wood may be fixed to a box on the mantelpiece, and placed near the clock. The springs need not be strong; in fact, should not be strong enough to hold the ribbon very tight. A bit of silk twist will do instead of ribbon, providing it keeps the springs apart.—G. E. B.

Metal Sunflower.—J. S. (*Clapham*).—You would not attempt to treat your sunflower in any but a conventional fashion, as a literal reproduction would involve very much work. A suitable method of construction is shown in the figures. Take a piece of ⅝ in. or ¾ in. copper rod, and draw down one end, A, leaving a shoulder. Get sheet copper, and cut as many circular discs as you require—one for the calyx, and say two or three for the rays, and one for the disc of the flower. Punch or drill a hole through the centre of each to pass over the



Metal Sunflower.

pin, A, which is drawn down at the top of the stem. Form a number of suitable deep serrations around the edges of the calyx, B, and of the rays, C; the latter will represent the separate florets. On the central disc, D, you should do a little repoussé work with a sharp punch, the indentations representing the florets of the disc, and on the florets of the rays punch radial grooves with a blunt chest to represent the divisions of the flowers. Then thread these separate parts over the central pin in order, the calyx first, the rays next, and the central disc last of all. Rivet the pin gently over, or tap a button-headed screw into the top of the pin to keep the parts in place. For the bud you will form one cleft disc only, riveting it first to its stem, and then closing the florets over to meet at their lips. The flower half blown should be made similarly to the one full blown, and then be partly closed over. The stems of the budding flowers will be flattened out at their lower ends, and hammered to partly embrace the main stem, to which they will be either riveted or preferably brazed. Bend all the stems to bring the faces of the flowers into the vertical direction.—J.

Small Air-Pump.—J. S. L. (*Belfast*).—You give no particulars of the purpose for which you require the air-pump. If it is for light work, as for instance microscopic preparations, you may make it in syringe form with light indiarubber valves; but if you will write particulars I will give you a dimensioned sketch from which you can make it.—F. C.

Work on Inlaying.—R. N. (*Grays*).—Messrs. Bemrose publish a book on inlaying, but it has not been of much practical use to me. Neither the "Subject Index of Modern Books" at the British Museum, nor the latest "Bookseller's Reference Catalogue," gives titles of any other. A specialist tells me that, save an old one of some thirty years ago, now rarely met with, there is no other than the above, entitled "Buhl and Marquetry."—E. B. S.

Slide Rule.—SLIDE RULE (*Manchester*).—The slide rule I never found of any use. I always found I could work more rapidly on paper than by this much-praised instrument. For that reason I am unable to answer or advise this correspondent. The use, or misuse, of this thing caused an awful blunder in H——'s office about twenty-five years since, and I have never recommended its use to any one. If a man cannot calculate without a slide rule, or book of formulæ, he is not fit to calculate at all.—F. C.

Fumigating Oak.—F. P. (*Andover*).—You are quite correct in supposing that the sapwood will not be affected by the ammonia vapour. As you want to know what to do with the sap, I should certainly say discard it. Cut it away before making up your work. This is the best hint I can give you with regard to it, but as your intention apparently is to use the sap, the only way by which you can darken it to match the fumigated oak is by staining. You will not find it altogether an easy matter to match the colours, and it is hardly a job which a novice could undertake with certainty of success. Different stains and methods are adopted for touching up the sap. I think that perhaps the best results are got with a weak gas-black polish—*i.e.*, polish darkened with a little gas-black. In work of this sort, however, no definite rule can be given, for matching up wood is an art which can only be acquired by practice and the exercise of judgment.—D. A.

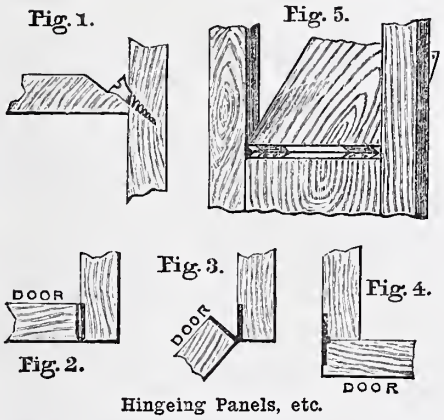
Polishing Tips.—G. D. (*Arbroath*).—I am sorry that I cannot possibly refer to your former communication to which you allude, as a letter when it is answered is done with, and I cannot pretend to remember the contents. If, as I gather, you are ROUND O, to whom an answer was given on page 508, Vol. I., which you have seen, it is surely unnecessary to tell you of a better plan of polishing oak coffins than the one you have adopted. Of course, if you want to have the colour darker you must use a stain. You will also have seen that a better filler than yours is recommended. I do not understand what you mean by using spirits of wine to "bring out all the oil." You should only use the spirit-rubber—that is, a rubber moistened with methylated spirits only—after you have bodied up your work. Whether you have done this or not I cannot understand from your letter, but you seem to be in some difficulty from marks made by the spirit. I am inclined to think that you have omitted to describe some part of your process, which, to say the least, seems a very peculiar one, and that the marks are caused by your spirit-rubber being a great deal too wet. If too much spirit is used the shellac (polish) is washed off. This you must avoid doing, otherwise you will have the trouble of going over the work again with polish.—D. A.

Staining Cycles, etc.—F. W. R. (*Harling*).—Your inquiries are within the scope of WORK, but it is quite impossible for answers to be given at once or sooner than they are. It is hardly reasonable—is it?—to ask us to take cognisance of subjects not connected with the Magazine. Your questions are answered as follows:—(1) I expect the colour of the morocco you refer to is that known as marone. It may be revived by the application of a little French polish, but unless you are very careful you will probably do more harm than good. The leather must not be saturated, but be merely wiped over with the polish. White-of-egg is sometimes used for the purpose. If the leather is much worn or abraded no treatment will avail to restore it. (2) A good mahogany stain may be made with bismark brown and vandyke brown. The former gives a very red colour, which the latter is useful to modify to any desired shade of reddish brown. Both the pigments may be dissolved with water, though a little ammonia is an advantage, especially with the brown. The stains may be kept separate or mixed together. They are more convenient in separate bottles. (3) Boiled linseed oil is used for mixing paint. I do not think raw oil is ever used in a general way. You can distinguish between the two sorts by remembering that the boiled oil is thicker than the other. (4) and (5) Parts of cycles can be obtained from most of the manufacturers, or dealers in cycle fittings and sundries. You might apply to Bown Bros., Great Eastern Street, London, E.C., who will quote prices for any parts you require. (6) To protect bright parts of machine, or any metal exposed to damp, from rusting you cannot do better than use Hartley's improved hard cold lacquer. It can be had colourless for steel, or gold colour for brass. You can get it in moderate quantities from Grew & Bridge, 42, Summer Row, Birmingham. It has a very unpleasant smell, and should therefore be applied in the open air, or in an outhouse. (7) The usual method of lining out painted work is the only practical one.—D. A.

Fire Irons.—D. W. B. S. (*Brixton*).—I hardly think that you will be able to repair your fire irons yourself, for I think it may, from your question, be inferred that you are not a metal-worker. As the threads of the screw are worn, they must be recut. It will be better for you to get this done than for you to attempt to do it yourself. If the irons are more for show than use, you might fasten the handles on sufficiently firmly with solder. A piece of lead-packing would be better than yarn or tow, but, as stated, the only permanent repair will be by recutting the threads. Gasfitting is a subject which will be treated of, but, though instructions will no doubt be of use to you in many ways, I would hardly like to promise that you will be altogether independent of plumbers. He must be a very poor professional workman who is not a long way ahead of even a more than usually skilful amateur.—D. A.

Battlesden Cart.—G. C.—The wood for building a Battlesden cart can be bought at any good timber yard, and if you have no "facilities for sawing up and planing," you might get a carpenter to do it for you; but how you propose to build a vehicle under such circumstances I do not understand. If you have room enough to carry out the work, supposing you do get the wood ready planed, etc., you surely will have sufficient space for a bench, temporary or otherwise. As I live many hundreds of miles from you, I cannot give any address in your immediate neighbourhood where timber may be purchased.—OPIFEX.

Combination Bedroom Suite.—ONE IN A FIX. (*Glasgow*).—I once heard a minister say before beginning his sermon that he was only human, and that although he was advising and correcting his flock, he was well aware that they would doubtless have to advise and correct him. I must plead the same excuse for myself, but I am afraid you have not followed my advice. If you look at my written article you will notice that I say:—"In making . . . . get it cut out and fitted together before gluing, as it can then undergo any necessary alterations, and can be glued up afterwards. Have you done this? You say that you never had courage to attempt making anything until you saw my bedroom suite. Now that puts me in mind of a man refusing, for want of courage, to jump off a bridge into the water, but finding sufficient of it to enable him to leap off a building the same height as the bridge, on to the hard pavement below; for the majority of articles represented as in wood, which appeared before my suite, require far less trouble to attempt making. Further on you say you called upon professional gentlemen, who pronounced their verdict as "the wood is lost." Firstly, are you sure their verdict was a free one? as professional gentlemen generally have an unlimited horror of their amateur brethren. Secondly, if the side door is your only trouble, and you have got all the rest together, my opinion would be that the wood is *not* lost. I am very thankful to you for pointing out my errors, and I hope you will be partial to me, for we designers have a winding road to travel in getting up something new, working out measurements, and giving the necessary instructions, and it would indeed be surprising if we did not sometimes knock against a corner or tread upon a sharp stone. There is indeed a line or two left out of Fig. 4, which should represent the thickness of the wood. Now, presuming that you have got everything right except the long door, I will do my best to set you on the right road, although it is really surprising to me that, supposing you left the door until you had got the skeleton of the job together, as I advise, you did not measure the space where the door was to go, to see if I was correct. Of course, I know I have forgotten to mention the top and bottom board of the cupboard, and I am sorry for it, but surely you might have noticed that first as last. If you have followed my measurements, your door will be 18 in. wide and 58 in. long. All that you need do, then, is to reduce it an inch; also taking an inch off the fixed panel, leaving the movable panel the same length. You should have no difficulty in doing this, if you have joined all the other parts yourself. A top and bottom board, each 17 in. by 8½ in., can be easily screwed or nailed in after the manner shown in Fig. 1, the screws being driven from the top of the top board and bottom of the bottom board. The hingeing of door will be an easy matter; Figs. 2, 3, and 4 show it. The movable panel should be hinged as in Fig. 5. If it bites too much, round off the inside of the top edge. Let me hear again from you. In conclusion, I may say that the pages of WORK are of so much value that we refrain from giving more diagrams, etc., than are absolutely necessary; some things must be left to the reader's judgment.—J. S.



Hingeing Panels, etc.

Bagatelle Table.—H. C.—It is utterly impossible within the limits of "Shop" to give such a description of the construction as would be of any service to you. If you will say on what point you wish information, I will endeavour to help you. I should like to know whether it is a bagatelle table or a bagatelle board which you wish to make. Though you say the former, I am inclined to think you intended to ask about the latter. The sundries you inquire about can be got from any good maker. You don't give your address, so I am unable to tell you of any local manufacturer. You cannot do better than go to Hennig Bros., 29, High Street, W.C., or Edwards, Kingsland Road, E. An article on the subject will be given, but I cannot say when, so I am afraid it will not help you at present.—D. A.

Plush Cover for Box.—E. C. C.—I cannot tell you what coloured plush would go best with the copper decorations of your box, that is to say, would look best to your eyes, but my own taste would lead me to choose a dark blue. This will show the copper up well, and at the same time be in accordance with the laws of harmony in colour. You must, however, remember that in decorative articles these laws cannot be rigidly carried out, and that there is an almost endless variety of tints in plush even among those of one colour. Go to some good upholsterer, and ask him to show you his plush patterns. The best way to stick the plush to the box is by means of glue. Put this on the wood thinly and evenly, and do not press the plush too hard on it. Smooth it down gently and firmly. Of course if the glue penetrates through the plush, the effect will be bad, and you must be careful to avoid this.—D. A.

Rabbit Box.—B. E. (*Hull*).—I am afraid I do not quite clearly understand your inquiry, as surely any kind of box will do to carry a rabbit in. If I wanted to make one specially for the purpose, I think it would take the form of a plain box with a sliding side or door. To afford ventilation a few holes would be necessary, and a handle on top would be a convenience. On this rough idea you may extend to any extent, and if you are in a fix how to do whatever may be necessary, let us know where the difficulty lies, and we will try to remove it. I don't reply more fully, or we shall be having inquiries taking too trivial a form for the already overburdened "Shop" columns.—D. A.

Plate Rack.—HARRY (*Manchester*).—An article describing the construction of a plate shelf, which I hope you will think "nice," is in hand, and will appear in due course.—D. A.

Lathe and Scratch.—J. H. S. (*Edgware Road*).—I fancy you would be able to see a companion lathe and fret saw at Churchill's, and I think I caught sight of one at Melhuish's a few days ago. Certainly, if you were to drop a line to the latter you would get a reply saying whether you could be shown one by calling at Fetter Lane. I really cannot tell you where you can get a piece of broken band saw. If you particularly want one it can easily be had by buying a new one, and breaking it. You surely have not taken the idea from anything in the article I wrote on the "Scratch," that the cutter cannot be made from anything but a piece of band saw. I merely mentioned this because it is something easily obtainable by most workmen in wood, and to show that what is often nothing but waste might be used. If you cannot meet with a piece it is not worth while wasting time to hunt after it, but you might ask any one who uses a band saw for a bit. Any piece of thin steel will do, and you can have no difficulty surely in getting something suitable.—D. D.

Glaze.—J. M. F. (*Silverdale*).—Glaze is a preparation used by French polishers to give the final gloss to work which has been bodied in instead of giving it by spiriting off. It is, in fact, a cheap because speedy mode of finishing French polished work. Sometimes it is useful, but on the whole it cannot be recommended. No good polisher would think of using it except on cheap work, and many of the best of them discard it altogether. A glazed surface does not stand much wear, nor does it retain its brilliancy so long as properly French polished work. It is, however, easily applied, being simply put on with a brush or soft rubber. It is made of gum benzoin and methylated spirits in about equal quantities. The gum should be powdered, and after it has all dissolved, the mixture should be strained through fine muslin. The subject will be fully gone into in one of the articles on polishing. Your question is quite definite. I wish all were equally so.—D. A.

Fuller Cells for Electric Lamps.—H. B. G. (*Maida Hill, N.*).—Assuming that each Fuller cell has an E.M.F. of 2 volts per cell, as claimed on page 429 of "Electricity in the Service of Man," and that its internal resistance is 1 ohm per cell, then it would take 8 cells to light up a 6-volt 2½ c.p. lamp, and the light would be sustained for three hours without cleaning and recharging the battery. It is not necessary to take out either the zinc plate or the porous pot when not in use.—G. E. B.

Holes in Glass.—OLIVER (*Great Yarmouth*).—Holes may be bored in glass with an ordinary drill lubricated with turpentine and camphor. The acid you refer to is probably hydrofluoric, but I certainly should not advise you to use it.—D. A.

Bottles.—T. B. (*Rochdale*).—There is no particular form of bottle used for furniture cream. It depends a good deal on the quantity you intend buying from whom you can buy them best. You might try any local dealer or the York Bottle Company, York.—D. A.

Grinding Glass.—R. J. (*London*) asks how to grind glass, how to bevel it, where to buy a lathe specially for grinding glass, how the glass is fixed on the lathe, and what tools are required. Now this is a nice little batch of questions. But will R. J. kindly say what he intends to make, as until that is made clear I do not see how any one can give any satisfactory answer. Does R. J. propose to grind a lens, a speculum, or what? The kind of lathe and tools required depend entirely on the kind of work done.—O. B.

Address.—R. S. (*Brighton*).—Messrs. Holtzapffel's addresses are—64, Charing Cross, S.W., and 127, Long Acre, W.C.

Blocks for Cell.—IGNIS FATUUS.—The blocks you mention are the Agglomerate blocks. These can only be practically constructed by the proper plant and machinery. They consist of a mixture of carbon dust and manganese, which are pressed into the shape you see them by means of pressure (generally hydraulic) of many tons. You can construct them somewhat roughly by the following method. Take equal parts of powdered carbon and manganese (these must be very finely powdered); mix these into a paste with a little molasses, press very tightly into a suitable mould, dry in a hot oven, and then apply pressure to the block by means of a screw press, and allow to remain under twenty-four hours; it will then be ready to use, but you must be very careful in using it, as it will be liable to crumble to pieces, on account of not sufficient pressure being applied by the press. Our querist had much better buy his blocks, as the construction of them is almost certain to be a failure, unless there is the proper plant at our querist's disposal; but at any rate the above process is the principle of the construction of them.—F. W. M.

Emery Wheel.—J. S. (*Leicester*).—Your most economical course will be to send the centre to a maker, who will fit a new emery wheel to it. Unless you are expert in the work you will fail in an attempt to cast one on.—F. C.

Beryl.—W. J. C. (*Jersey*) says he wishes to know where and at what cost he can procure specimens of "rough beryl." This is rather a vague question, as I do not know whether the beryl is intended for gem purposes or in the "rough;" or whether it is the common and coarse kind, as cabinet specimens. Doubtless W. J. C. is aware that beryl includes various gems, and, like quartz for example, is at the head of varieties. I have in my collection the common kind which is not at all suitable for gem purposes. I have been in communication with several mineralogists on the matter—hence the delay in answering. Mr. F. H. Butler, M.A., 148, Brompton Road, London, can supply specimens of beryl from 4d. upwards. As I have not seen the said specimens I cannot give information as to size, quality, etc., but having the name of the dealer, W. J. C. can get that for himself. If W. J. C. will communicate with me or send his address, I should be glad to compare notes with him on minerals; perhaps we could help each other. I have a pretty good collection, and should be glad to exchange if possible. Possibly the addresses of the following mineralogists may be of service in addition to the one given:—Mr. Cuttle, 30, Berners Street, London, W.; Mr. Gregory, 88, Charlotte Street, Fitzroy Square, W.; Mr. Henson, 277, Strand, W.C.; Mr. Wright, 204, Regent Street, W.—O. B.

Indiarubber Stamp Inks.—A. A. (*Castleford*).—A solution of aniline can only be kept from drying on the pad by the addition of some hygroscopic substance, such as glycerine or treacle. The following recipes for violet ink will probably be found useful. The second is the more expensive, but is the easier to make and much more satisfactory in use. (1) Aniline violet, 90 grains; boiling distilled water, 1 ounce; glycerine, 20 to 30 drops; treacle, sufficient to thicken. (2) Aniline violet (best quality), 2 drachms; methylated spirit, 25 drachms; glycerine, 20 drachms; treacle, 5 drachms; water, 10 drachms. The aniline is to be dissolved in the methylated spirit by vigorous shaking, after which the remaining ingredients are to be added and the whole well shaken together until thoroughly mixed. If the dye used be of good quality, and carefully dissolved, there will be little or no sediment; should there be any the ink may be filtered through a plug of cotton wool placed in a funnel.—QUI VIVE.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Silting up of Waterpipes.—ADALIA (*Asia Minor*) writes:—"The water of our town forms stone in the ponds and waterpipes—in fact everywhere it passes. Is there any way of clearing the waterpipes of my house without taking them off, as doing so would be impossible for me, as no men here could do it, and I should have to bring men from Smyrna, 400 miles off, to do it for me?"

Colouring Ceiling.—BOATHOOK writes:—"Will some kind friend (practical) help a lame dog over the stile? I have had a large ceiling to distemper pink—it had been coloured the same before. I washed it well off, and when dry gave it a thin coat of size to stop the suction as I thought, then mixed my whiting with thin jellied glue size, but when I came to go over it, I was fairly in a fix, for it sucked in as fast as I put it on, and although I went from one end of the plank to the other, by the time I had got down and shifted the steps for the next turn it all dried in, and the next joint showed dreadfully, and when dry it looked wretched. Well, then I got a mate to assist, but when we came to put on the next coat the stuff rolled up in a way that was a caution; and when dry this time it might have been labelled a true representation of a storm on the Red Sea. Now, will some kind brother tell me what I should do? Can I put anything in the whiting, or what must I do to the ceiling? The first coat, I may say, was thick, but still the dark plaster seemed to show through it." [Wash off your distemper and use Alabastine. See page 1 of this Volume.—ED.]

Motors for Lathes, etc.—MOTOR wishes to know if any reader has had experience of the capabilities of "The Demon Water Motors," advertised in page 750, Vol. I., of WORK. If no reply can be given respecting this particular water motor, suggestions as to the use and cost of any other efficient water motor will be thankfully received.

Boat Building.—BOATHOOK (*Manchester*) writes:—"Will some kind friend help me out of the following fix? I have built a rowing boat of the following dimensions, viz.—12 ft. over all, 3 ft. wide amidships, and about 16 in. deep; it has a wooden keel 3 in. by 1½ in., and has outriggers that extend 16 in. over side. Now, when it is put well into the water on canal it floats perfectly level, and only about 5 in. in the water, in fact it rides as light as a cork on the water. But alas! when two or three get in, it sinks down in the water considerably; but the least movement out of the centre, and it is in danger of rocking over at once. I could not build it any wider or longer on account of want of room; have I made it too shallow, or what? Any real practical advice will be thankfully received. My own idea was to put on an extra wooden keel, or would lead do better? or to place outside at the water level two boards about 6 in. wide, and cover the under side with cork—a sort of wings, to prevent rocking over—but it certainly would look ugly."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Exhaust Fan.—T. D. G. writes in reply to D. B. S. (*Ferns*) (see page 750, Vol. I.):—"The most suitable apparatus for D. B. S. (*Ferns*) is a good air-propeller. I can let him know something about one that is used in carpet-beating machines, chaff-cutting rooms, and other places where there is a lot of dust to contend with."

Exhaust Fan or Ventilator.—In reply to D. B. S. (*Ferns*) (see page 750, Vol. I.), G. & Co. (*Glasgow*) write to say they have an exhaust ventilator which is effectual in drawing off light dust, hot and foul air, etc., in mills, warehouses, schools, workshops, etc.

To Make Boots Watertight.—WORKER BEE writes in reply to RUTHENPHARL (*Saltburn-by-the-Sea*) (see page 750, Vol. I.):—"Melt together 6½ parts beeswax (get it genuine, from a beekeeper), 26½ parts of mutton fat, 6½ parts thick turpentine, 6½ parts olive oil, 13 parts lard; well heat 5 parts of lamp-black and stir it into the melted mass. The mass is then poured into little wooden boxes and allowed to cool. Apply with the fingers before a warm fire. It will soften hard boots as well as make them perfectly watertight—provided, of course, they are sound."

Exhaust Fan and Ventilator.—W. M. D. (*Kelso*) writes in reply to D. B. S. (*Ferns*) (see page 750, Vol. I.):—"I have had considerable experience with exhaust fans, as used in flour milling processes, and I think the system which is best for keeping a flour mill practically free from dust will probably be suitable for D. B. S. I would advise him to fix, say a 30 in. fan, driven about 700 or 800, on the floor of his loft, with the mouth of it directed upwards through roof, taking care to have no sharp bends in it; he should then have an air trunk, about 10 in. square, fixed below the floor of his loft, extending the whole length of shop, or as far as to reach his machines; then this trunk should be connected to his fan by two spouts, one to each side of fan; he may then connect each machine to main air trunk by smaller ones, about 4 in. square. This will only work well if he can partially enclose his machines so as to have not more than a quarter of their circumference open for grinder to work at."

Fret Machine.—A. A. (*Coventry*) writes:—"If FAIR PLAY (see page 763, Vol. I.) will refer to my saw, he will see it is fixed on my lathe bed, and works by the same crank and fly wheel. I should like to see the saw he has made, that works so well, from the design by W. R. S., for, in spite of explanations, I am still doubtful."

Photo Zinc Etching.—S. C. R. (*Derby*) writes in answer to O. G. B. I. (see page 763, Vol. I.):—"I would ask him what class of negatives he is using; the negatives which are used for this class of work must either be in line, dots, or stipple. The whole of the designs must show as clear glass, whilst the other parts must be nearly opaque. Now, as regards the film of bitumen, it must be as thin as ever you can get it, and show on the zinc merely as a thin golden stain. I should recommend O. G. B. I. to first master the albumen process, and then take up the one in bitumen."

Exhaust Fan.—THE BLACKMAN VENTILATING COMPANY, LIM., write in reply to D. B. S.'s (*Ferns*) query as to exhaust fan or ventilator (see page 750, Vol. I.):—"If he will write us, we shall be pleased to give him, free of charge, the benefit of our experience in dealing with scores of similar places."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—E. M. A. (*Salisbury*); F. T. (*Hants*); C. H. T.; B. B. (*London, E.*); E. H. (*Stockport*); E. C. M. (*Ipswich*); W. D. (*Newcastle-on-Tyne*); W. W. (*Whitehaven*); G. E. S.; I. S. (*Dorchester*); W. C. T. (*Glasgow*); J. M. (*Bournemouth*); G. T. (*Oswestry*), MUS. CO.; INQUIRER; C. W. J. (*Clapham Common*); W. L. C. (*Aberdeen*); G. P. (*Sussex*); C. H. G. (*Loughborough*); CLAUDE; ANXIOUS TO KNOW; H. B. (*Birmingham*); DISAPPOINTED; R. J. E. M. (*Athlone*); PAINTER; APPRENTICE; T. P. H. (*Liverpool*); ANXIOUS; A MONTHLY READER OF "WORK"; A. W. H. (*Halifax*); J. W. B. (*Oldham*); A. G. P. (*Hastings*); A. G. R. (*Gravesend*); PHIL; FRITZ COMBE; G. R. (*Sunderland*); E. S. (*Manchester*); E. H. M. (*Thackley*); BEESWAX; WATCHMAKER; H. G. N. (*Islington*); W. C. (*Hornsey, N.*); DYNAMO; B. F. (*Battersea*); LEDGER; FAIRY BELLS; A. B. C. D. (*Tooting*); W. C. (*Newcastle-on-Tyne*); R. P. (*Carnarvon*); BOTCH; LEO; H. S. (*Birmingham*); F. C. B. (*Battle*); P. J. A. (*Chorley*); D. A. C. (*Aberdeen*); J. K. (*Oldham*); W. S. (*Holloway*); A. W. A. (*Belston*); H. H. (*Southgate*); A WOOD CARVER.

Trade Notes and Memoranda.

ANOTHER bridge is in contemplation across the Niagara. It is to be near the International Bridge, and it is to be for the exclusive use of the Canadian Pacific Railway Company. The new bridge is, of course, this company's scheme, and the reason for it is the substantial one, as given out by Mr. Van Horne, the chairman, that the Canadian Pacific Company finds it inconvenient to have to depend upon a right of way not absolutely under its own control.

THE following method of polishing wood with charcoal is much used by French cabinet-makers. It is only applicable to things made of carefully-selected woods, of a close and compact grain. They are first covered with a coat of camphor, dissolved in water, and almost immediately afterwards with another coat, composed chiefly of sulphate of iron and nutgall. The two compositions, in blending, penetrate the wood and give it an indelible tinge, and render it impervious to the attacks of insects. When these two coats are dry, they rub the surface of the wood at first with a very hard brush of couch grass (*Chien dent.*) and then with charcoal of substances as light and friable as possible, because if a single hard grain remained in the charcoal, this alone would scratch the surface, which they wish to render perfectly smooth. The flat parts are rubbed with natural stick charcoal, and the indented portions and crevices with charcoal powder. Alternately with the charcoal, the workman also rubs his piece of furniture with flannel soaked in linseed oil and the essence of turpentine. These pouncings repeated several times cause the charcoal powder and the oil to penetrate the wood, giving the article of furniture a beautiful colour and a perfect polish which has none of the flaws of ordinary varnish.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SITUATION WANTED.

Young Man wants situation as sawyer, accustomed to circular saw; good references.—JOHN SMART, Sawmills, Dufftown, Banffshire. [1 s

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [34 R

Complete Fount of Rubber Type.—Two alphabets, to form any word or name, box, pad, ink, and holder, post free, 1s. 6d.; extra alphabets, 6d. per set; figures, 3d. Business, address, and pocket stamps equally cheap.—W. C. PRESTRIDGE, Manufacturer, Cumberland Street, Bristol. Established 1870. [20 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Heckley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [27 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [31 R

"Roll Call" Pipes.—Healthful, Luxurious, THIRSTLESS Anti-nicotines. Briars. Post free, 1s. 8d.—ALLEN DEWSNAP, 65, Pikes Lane, Glossop. [32 R

Twenty Fretwork Patterns, free, 6d.; Swiss Saws, 1s. 1d. per gross, free. Fretwork instructions, Tool and Pattern Lists, with specimen design, gratis.—W. ELLICOTT, Launceston. [33 R

Materials for Violin Making from BRIGGS and TARR, Violin, Violoncello, and Double Bass Makers, Commercial Street, Leeds. [28 R

Lindon, Patent Agent, 2, S. John St., Liverpool. [29 R

Microscope Slides.—Thousands gorgeous polarising, brilliant opaque, and entertaining slides, 5s. dozen. Microscopes, mounting apparatus, etc. Catalogue free.—HENRY EBBAGE, 344, Caledonian Road, London. [2 s

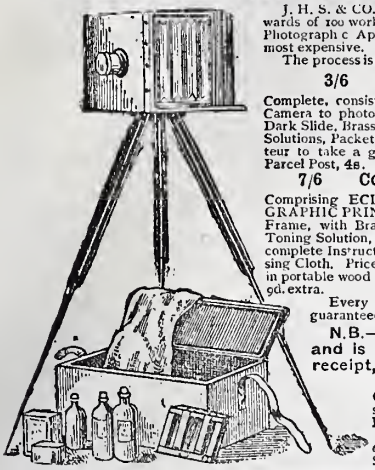
The Demon Water Motors, half man power, for driving lathes, dynamos, etc., from house supply; feed pipe $\frac{3}{16}$ inside, hardened turned shaft, improved long cast bearings, brass inside parts, price 8s. 6d. Also one man, 12s. 6d.; ⅛ horse power, 18s. Seen appointment.—Stamp, P. PITMAN & Co., Aubrey Road, Withington, Manchester. [3 s

Picture Moulds.—9 ft., 2½-in. gilt, 9d.; others equally cheap. Special trade terms.—DENTS, Importers, Tamworth. [4 s

J. H. SKINNER & CO., EAST DEREHAM, NORFOLK,

MANUFACTURERS AND IMPORTERS OF

PHOTOGRAPHIC APPARATUS AND FRETWORK MATERIALS.



J. H. S. & CO. have now a large Factory with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description, from the cheapest to the most expensive.

The process is simplicity itself. Full Instructions supplied with each set.

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

Every Set is carefully examined before being sent out, and guaranteed to be in working order.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase money.

Better Sets, 10s. 6d., 21s., 42s., 100s., and upwards. Complete Catalogue of Photographic Apparatus, one stamp. **J. H. SKINNER & CO., EAST DEREHAM, NORFOLK.**

Wholesale Agent for London—J. MOTHERSILL, 60, Holloway Road, N., and 6, Southampton Row, where Samples may be seen.

Timber Yards, Sawing and Planing Mills covering about Two Acres near Railway Station.

J. H. S. & CO. keep regularly in stock about **120,000 FEET OF FRETWOOD,** solid and 3-ply, veneers, &c., besides a very large quantity of Logs, Planks, and Boards, Carving and Turning Wood, &c., and **200,000 FULL-SIZE DESIGNS for Fretwork, Wood Carving, &c.,** besides an immense Stock of Joiners' Tool Chests, Fretwork Outfits, Drills, Saw Frames, Hand and Treadle Machines, Saw Blades, &c. &c.

Specialities for 1888 & 1889.—Books of New Designs. FRETWORK No. 1, containing 12 Large Sheets, price 1s. No. 2, containing 20 Sheets of larger and more elaborate Patterns, 2s. 6d. Book of Wood Carving Designs, containing 14 Patterns, price 1s.; these are all New Patterns, not sold in any other form, and would, if sold separately, cost three or four times the amount charged. Fretworker's Handbook and Workshop Guide, price 1s. New Designs. All Patterns greatly reduced in price.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, 48 Saws, Awl, File, 4 Designs (with sufficient planed Wood, gratis), and 1s. Handbook on Fretwork, price 3s. 6d., carriage paid. 12 feet Assorted Planed Fretwood, 3s. 6d.

☞ Special Fretwork Design, in commemoration of Her Majesty's Jubilee, size, 36 in. by 26 in., price 2s. 6d.

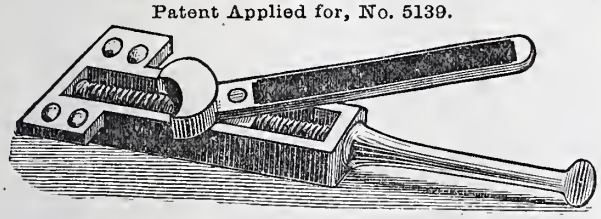
JUST PUBLISHED, NEW CATALOGUE of Machines, Saws, Designs, Wood, &c., 56 pages, 600 Illustrations, with Instructions, 4d., post free. Good Fret Saws, 1s. 4d. per gross; best ditto, 1s. 9d. per gross.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

NURSE'S REGULATOR.

Patent Applied for, No. 5139.



For adjusting the Irons of all English Pattern Bench Planes. Can be easily fitted to any Smooth, Jack, or Try Plane, without alteration of Irons already in use. Price 2s. each; post free, 2s. 3d.

Price Lists free by post on application to Sole Makers,

CHARLES NURSE and CO.,

PLANE MAKERS AND TOOL MERCHANTS,

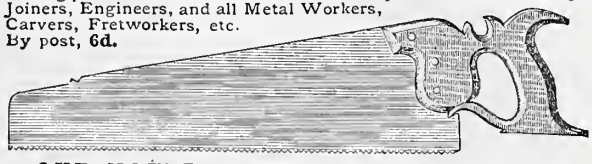
182, Walworth Road, London, S.E.

(Established 1841.)

TOOLS.

Buy from the MAKERS, the Oldest Established and the Best House in London.

NOTE.—Our New Illustrated 200-Page Catalogue is now ready, containing 700 Illustrations of all the Latest Improved Tools for Carpenters, Joiners, Engineers, and all Metal Workers, Carvers, Fretworkers, etc. By post, **6d.**



OUR NOTED CAST-STEEL HAND-SAWS.

18 in.	20 in.	24 in.	26 in.	28 in.	Rip or Half Rip.
3/9	4/-	4/9	5/-	6/3	CARRIAGE PAID.

NOTE THE ADDRESS:— **MOSELEY & SON, 323, High Holborn, W.C.**

FRETWORK PATTERNS.

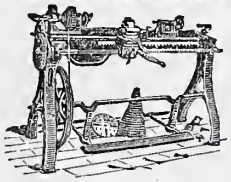
FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,

TOOL MAKERS,

DUBLIN.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING,

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

MASON'S WINE ESSENCES.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER.

These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of Mason's Extract of Herbs makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a Bottle of each for 15 stamps.

NEWBALL & MASON, Nottingham.

Agents Wanted.

WATERPROOF FLUID GLUE.

(Patent.)

By post, 1s. 3d. *and* 8d.

WATERPROOF GLUE CO.,

62, Dale Street,

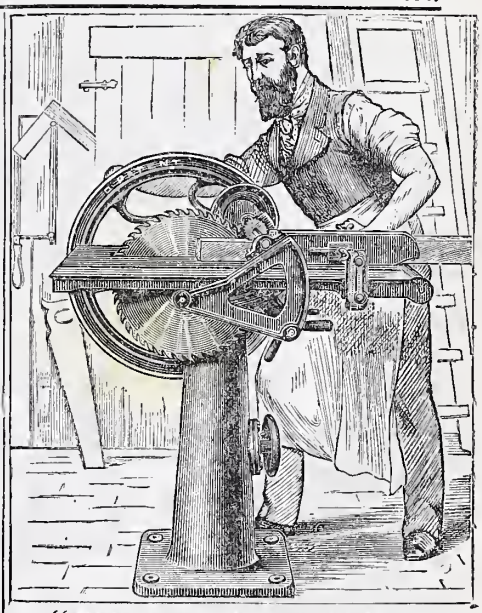
LIVERPOOL.

40th Thousand, 1s.; post free, 1s. 3d.

CASSELL'S Shilling Cookery.

364 pages, crown 8vo, bound in limp cloth.

CASSELL & COMPANY, Limited, *Ludgate Hill, London.*



"THE LEYTON"

New Patent Circular Saw Bench for Hand Power.

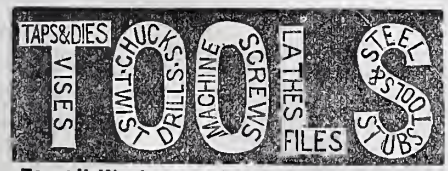
Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

RD. MELHUISH & SONS,

FETTER LANE, LONDON, E.C.

Gold Medal for Excellence of



For all Workers in Metals, also Joiners, Wood Carvers, etc.

WE HOLD THE MOST COMPLETE STOCK IN THIS COUNTRY.

And all Orders have Immediate Dispatch.

Orders for Hardware and Tools over 10s. in Value, Carriage Free.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.

37, CHANCERY LANE, LONDON, E.C.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

Post Free on Application

Cassell's Classified Catalogue.

ASPINALL'S ENAMEL.

COLOURS—EXQUISITE. SURFACE—LIKE PORCELAIN.

Testimonials from the Queen of Sweden, the Marchioness of Salisbury, &c.

FOR ALL SURFACES OF WICKER WOOD, METAL, GLASS, EARTHENWARE, CHINA, &c.

"Simply Perfection."—*The Queen.*

Made in over 100 Colours. Sold in Tins, 4½d., 1s. 3d., and 2s. 6d. For Baths (to resist Hot Water), 1s. 6d. and 3s. Post free, 7d., 1s. 6d., 3s.; 9d., 1s. 9d., and 3s. 6d.

READY FOR USE. A CHILD CAN APPLY IT.

SOLD EVERYWHERE.

ASPINALL'S ENAMEL WORKS, LONDON, S.E.

Telegrams—EDWARD ASPINALL, LONDON. COLOUR CARDS FREE.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic WEAKNESS speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be Healthy and Strong permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place).

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

FRETWORK AND CARVING.

Highest Award—Gold Medal for Tools and Patterns.

Machines, Designs, Tools, Wood, Mirrors, Hinges and Fittings, Varnish, etc.

T. N. writes:—"I got a First Prize from one of your Designs."

R. W. A.:—"Received your Catalogue today, and consider it the best I have seen."

R. B. M.:—"Machine to hand, am highly pleased with it."

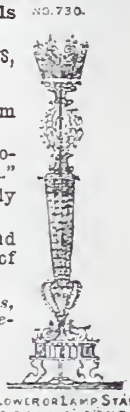
J. A. S.:—"I have taken Eight First and One Second Prize with various patterns of yours."

Illustrated Catalogue of all Tools, Wood, etc., and 500 Miniature Designs, free for Six Stamps.

Harger Brothers,

SETTLE, YORKS.

OCCASIONAL TABLE, SIZE 26½ X 15 INS.



FLOWER OR LAMP STAND, SIZE 44 X 12 INS.

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6d. OR FOR 7 STAMPS BIRMINGHAM. [33

GRATEFUL—COMFORTING.

EPPS'S COCOA

BOILING WATER OR MILK.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 55.] SATURDAY, APRIL 5, 1890. [PRICE ONE PENNY.

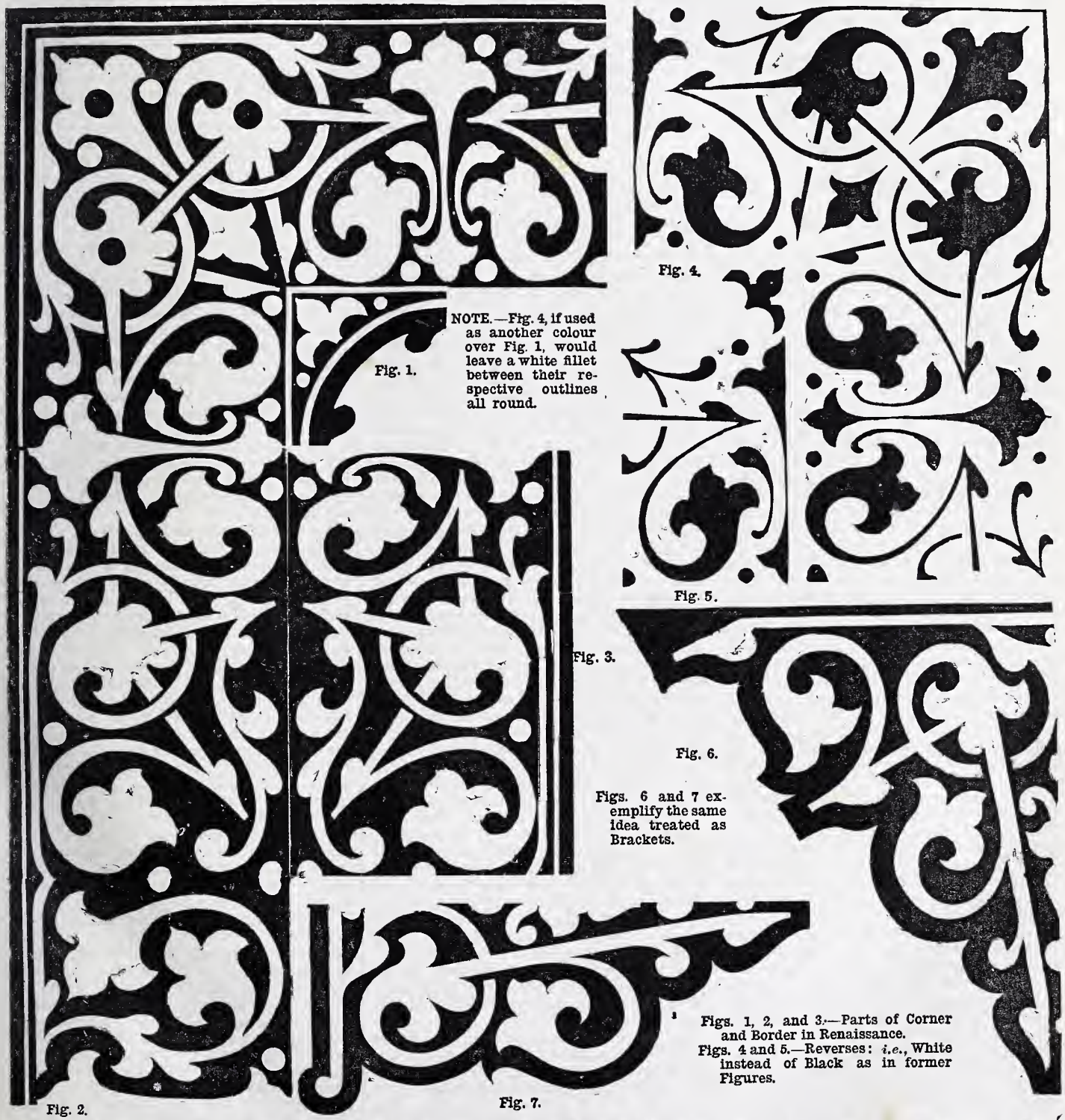


Fig. 1.

NOTE.—Fig. 4, if used as another colour over Fig. 1, would leave a white fillet between their respective outlines all round.

Fig. 4.

Fig. 5.

Fig. 3.

Fig. 6.

Figs. 6 and 7 exemplify the same idea treated as Brackets.

Figs. 1, 2, and 3.—Parts of Corner and Border in Renaissance.
Figs. 4 and 5.—Reverses: *i.e.*, White instead of Black as in former Figures.

Fig. 2.

Fig. 7.

Corners and Borders given in Illustration of "Examples in Designing for Work and How to Go about It;" being Hints on Art Work for Workmen.

DESIGNING FOR WORK: HOW TO GO ABOUT IT.

BY JOHN W. HARLAND.

There is really nothing so difficult as designing, in the true sense of the word. It is not that suitable ideas will not come into the mind just when you want them so much as *how* to express the ideas you have in such a form as that the workman or the amateur can carry them out readily without any superabundant labour that this difficulty most frequently presents itself. In other words, any ingenious mind can think of some form, or arrangement of form, that will please the eye; but something more than this is required—that the design shall also be what we call practical or practicable—*i.e.*, that it shall be capable of being applied to the purpose intended, and that there shall be no violation of the law of the fitness of things. For instance, a stiff, although elegant, combination of geometrical curves and figures would be out of place in the flat, such as a panel; yet, owing to the folds in which all drapery falls, would be very suitable if carried out in curtains, table covers, or tapestry hangings, where the severity of outline would be tempered and blended, and could never be seen entirely at one view. Further, to design for any given purpose, the designer can never succeed to the full if technically ignorant of the after-process by means of which his design is to be carried out. An artist who attempted to design a chair or buffet, let us say, without understanding how the construction ought to be made to combine strength with lightness, would certainly fall into some mistake which would betray his want of knowledge, and entail a large amount of very unnecessary work upon whomsoever had to carry out the execution of it. We think there is a vast amount of good inventive design thrown away for want of some theoretical knowledge of the after-processes, and one of the functions of Work is to supply in its columns an insight into the principles of construction, as well as to teach the actual worker how best to do his work, that the designer may curb his imagination and modify his creation by studying the means and methods afterwards used to perfect and embody his designs. And the actual worker ought to know something at least of the principles on which all designing is based. The sooner we can explode the theory that "the cobbler should stick to his last," "the gunner to his linstock," etc., the better. A workman will be better for any knowledge, however extensive or varied, however theoretical or practical, concerning his tools, the materials in which he works, their properties and relations, and of the forms he is required by his copy or design to give to such materials. To illustrate this, suppose a circular form occurred in the construction of any piece of work, and the workman did not know how to reproduce with compasses a true circle, he would never get it absolutely perfect by any other means, and he would absorb endless time in approximating to it. Of course, this instance is purposely chosen to show how ridiculous it would be, but there are other curves than the circle that *some* designers and many workmen could not reproduce in a mathematically true manner, for want of theoretical knowledge. Work in time will no doubt give the requisite knowledge, both theoretical and practical, and what I want to urge is that any one in reading Work may benefit himself much more than at first sight appears by carefully studying articles that do not seemingly apply to his craft or business at all, and that he fancies do not concern him in the least.

The cleverest imagination, if untrained, is intractable and wild, just as the strength of a giant who knows not how to apply it is valueless and purposeless. Flights of fancy leave no impression on the air, unless undertaken systematically and with a clearly defined aim or object to confer the quality of usefulness upon them, in addition to mere beauty. It is all very well to sneer at utilitarianism, but it is the great factor that may make imaginative work productive and profitable. What is the use of the carrier pigeon soaring into the upper air and flying a thousand miles without the missive, carrying news to others, beneath its wing? Its flight is no less wonderful, the bird no less beautiful, the curves it performs in mid air none the less graceful, but it is, after all, its practical utility that is the chief cause of its being appreciated, and these other attributes which might have passed almost unnoticed are brought to notice and admired. From this let us deduce our first law of design.

(1) *Utility enhances the value of beauty.*—If this law be always remembered, imagination will be, to some extent, fettered at first by not having a free vent for expressing itself, but this curbing will, in the end, act as an incentive to it to widen the channel; and since it has no other escape, it will be much more easily utilised and turned to good account, instead of wasting itself on idle fancies and useless dreaming. We leave to the moralist to point out how such a gift as the imagination, left untrained and idle, runs riot and induces sin; we content ourselves by saying that, for the purposes of Work, it is *waste* not to cultivate and train it to a useful career. One of the most curious and intricate, as well as subtle, powers of imagination is the building upon realities and facts by association of ideas a claim to sympathy and appreciation in others and by others. All beauty has a power over the human soul, and if the form and colour are beautiful in any design, a certain charm makes itself felt in the beholder; but if this sentiment is enhanced and deepened by association in his mind with other beautiful things, by recollections of tender passages in history or his own life, how much more is the beauty of the design made to penetrate and move him! This is one form of utility, for the object, or one of the objects, of the designer is achieved: his work has expressed a sentiment, a feeling; it has touched some chord. Such a design lives—nay, outlives—its designer: it is not the result of chance or accident, but of thought. Our second law of design is almost an axiom, since it is contained in the meaning of the word.

(2) *To design, one must think.*—One must think of every surrounding circumstance, every concurrent idea—think of days gone by, of all possible memories of form and colour—and think how these thoughts can be utilised and made subservient to the purpose in view, selecting such as are harmonious, reserving others that are not so for a future season, that no incongruity may mar the work. The more thought is expended, the purer, nobler, and higher, the more powerfully sympathetic, will the result be.

All human and mundane things are limited—time, space, power, and so on; our mode of expression more, perhaps, than all. Our power of expressing the brightest glory of light is reduced to mere white, the deepest darkness can only be rendered by black; between these range pigments that do not express one-thousandth part of the colours visible in Nature. To keep, as it were, to scale, colours must be used co-relatively—we must be content with our limited capacity for reproducing them *in petto*, in degree, in miniature, as to force as well as to size. Again, motion is inexpressible, as it involves an idea of three or more positions of a body following one another at three or more different consecutive times. We are limited in art to reproduce one position only at a time; we can only select such a position as will give an idea, firstly, that it has been arrived at only and solely by motion from a previous position; and secondly, that it is transitional only to some other future position. In short, we must express the condition or attribute of *unrest*. We can only arrive at such expressions as these by the aid of thought: first by analysing Nature, which is the consummate art of God; and secondly, by our imperfect art endeavouring to express its sentiment, rigorously and conscientiously abstaining from the temptation to attempt more than a confessed inferiority on the one hand, and on the other to a mere servile imitation. These remarks apply more particularly to the highest forms of human art, but are necessary here as generalities having a bearing on the thought necessary in the almost trivial design of every-day work. For it is most true that a careless, thoughtless spirit is evil and non-productive, and Nature carries out into the most insignificant detail the most wonderful and loving beauty of thought far mightier and grander and more exhaustive than is possible to the human mind. The more the imagination is enchained to dwell on such trains of thought as we have, faintly only, indicated, the more negative it will become, and the more surely will it veer nearer and nearly towards the direction of its guiding Pole-star, even in the most simple and apparently insignificant work of the day's business.

To illustrate this and show more clearly the intended bearing of the foregoing remarks, let us suppose a border is required to separate a dado around a room from the papering above. The idea of a border of this kind is self-evident; our every-day mention of it would be expressed thus: "A border running round, etc." This abstract ideal must be the governing motive; the form we select should be chosen entirely for its attribute of running. Now, as we cannot draw or paint anything in more than one position, and can only select an emblem of running, let us turn to the book of Nature. Plants give us delicate and beautiful colours, and as they grow and move imperceptibly to us, give us the best facility for emblematic motion. Further, many plants propagate by what are called "runners," like the garden strawberry, which throws out long tendrils or shoots, which run along the ground and strike root here and there, eventually to form other plants.

Here, then, is one motive, available for a design for a running border. Further search would reveal thousands of plants that would fulfil the conditions. Suppose again that, instead of a border round a room—*i.e.*, a horizontal one—we require a border round a panel, we should look for a creeping plant as a motive; but with this fact staring us in the face, that creeping plants cannot creep in the air without support of some sort, which would compel us to think again for the ideal support required. Back again to the inexhaustible book of

Nature, inquiring, in a spirit of reverence, for truth. What supports the ivy? Oftentimes the oak. Oak branches twist themselves into various forms, and shoot out at all manner of angles, and bend into endless curves; the ivy follows for the sake of its strong support. Here is a motive: one out of thousands that Nature holds out to us. "But we don't want a mere copy of Nature," it may be said; anybody can do that sort of design. I reply that I also do not mean to adhere to Nature servilely and strictly, but I believe this, that there is no truer, purer, or more logical basis of design than Nature, and if one only thinks out a natural synonym or emblem, as it were, pre-existing in Nature, that the functions of any design, however conventional, even geometric, its treatment may be, must of necessity bear the impress of their origin. I would add that if you quote from Nature, let your quotation be correct, and thus acknowledge its source, no matter how your fancy may lead you to carry it out in the way of treatment. There is nothing new, or even original, in this. The art of the Egyptians and the Greeks was thus based; well-known instances are the lotus of the one and the acanthus of the Corinthian capitals. These remarks bring me to "style," as it is termed, which only means carrying out in design a motive in the sort of way commonly done by others, either at any particular epoch, or in different countries, or in harmony with architectural ornamentation. The designer, when selecting a style of treatment, should therefore have read something of the history of, and be somewhat familiar with what is known of, the epoch, or people, or architectural ornament which that particular style expresses or represents. As the style very frequently is not a matter of choice with him, but depends upon the style of other portions of the decoration, it follows that he should study until he is fairly conversant with all styles. He should be able to analyse ideals, refer them to their own place, classify them as to style, period, or country, and to reproduce by special treatment other motives in the same style as they would have been treated at the time or epoch by those who produced the models of style he is called upon to follow. I point this out to the readers of WORK in order to enforce the truth that nothing of any value can result without labour and knowledge, which is its highest result, and without the constant exercise of thought, which is the nearest approach possible to the mind of man to the "Divinity that shapes our ends, rough-hew them how we may."

As it would be almost an impossibility for any one mind to amass such a wide knowledge of facts, and, at the same time, to undergo such drudgery as would train eye and hand to the mechanical dexterity known as the "technique" of his profession, as well as a knowledge of the after-processes of all trades in carrying out his design, so that it should be practical, as before pointed out, it is well to select one only of the almost infinite classes of design, and become thorough master of that, rather than study superficially the whole range—design, say, for textile fabrics, for furniture, for carving, for modelling, for casting in metal, for repoussé work, leather work, for engraving, etc.: for any one of these, not attempting all or even many of them. *Ars longa, vita brevis est.* Art is long, life is short—too short, alas! to succeed even in one thing sometimes: to succeed in everything far too short, and to attempt it would prevent success in anything.

Perhaps I have been led somewhat deeper into the ethics of my subject than was my first intention, but I hope, on some other occasion, to write more on the practical portion of it. The illustrations are examples of design and treatment which apparently have but little reference to the present article, but I give them in the hope they may prove useful as ideas for others to think out, as bases for other designs, or for adaptation to other purposes—in fact, as suggestions. For instance, for fretwork border round a panel one has only to leave the necessary stops to keep the white or solid parts together, and then saw out the black parts, or even, *vice versâ*, to utilise these designs at once. Again, for stencilling in colour upon a flatting ground in house decoration, Figs. 1 to 5 would answer very well; or, again, as the basis for a carved frame, with very little modification in treatment, they could readily be adapted.

CLEANING AND LACQUERING OPTICAL BRASSWORK.

BY CHAS. A. PARKER.

PREPARATION OF NEW AND OLD WORK—HOOKS AND HOLDERS FOR HANDLING AFTER DIPPING OR POLISHING—CHAMFERING WORK—BUFFS—LACQUER BRUSH.

IT must be understood that a lacquer is applied to the surface of brasswork for the purpose of improving its appearance and preserving a polish that has already been obtained, and is not intended to impart a brilliant lustre to old and tarnished brass, as some may imagine; the lacquer simply being a form of varnish which prevents the freshly polished surface of the metal from becoming tarnished by exposure to the atmosphere, hence the necessity of always lacquering work which should retain a good appearance. In point of fact, the operation of lacquering newly polished work detracts slightly from its appearance, but as it would soon rust and turn black if exposed to the air, it becomes necessary to protect the surface by a coat of lacquer, which, if good, will retain its colour and resist the action of the atmosphere for a number of years. The process of lacquering is rather difficult to execute properly, especially on large surfaces, when the beginner will find the lacquer continually getting a smeary look; but after a little practice, it will be possible to lay on an even coat of lacquer free from streaks, the great difficulty being to know the exact degree of heat best suited to the particular lacquer in use, and the effect to be produced, this kind of knowledge being such as can only be obtained by personal experience.

Preparation of the Work.—In all cases where the work consists of a number of parts fitted together, including camera fittings which are attached to the woodwork, it will be necessary to unscrew or separate their component portions and arrange them in such a manner that each screw, etc., shall be returned to its respective place; in fact, in order to prevent mistakes, it will be found advisable to number each piece of brasswork on the under side. The polish on brasswork may be produced by several different methods, as may be imagined from the great number of workers in this metal, each of whom pursues his own particular course in order to obtain the same result—a highly polished surface; different processes being gone through in each workshop according to the custom of the trade.

For finishing off coarse or common class new work, such as rough castings, which it is wished to protect from tarnishing or oxidising by a coat of lacquer, it will be necessary in the first place to prepare the brass to receive the coating by washing it thoroughly in very hot water with plenty of washing soda, using a stiff brush in order to entirely free it from all traces of grease, and after giving it a good rinse in cold water, the articles are dipped in a pickle, composed of equal parts of nitric acid and water, until covered with a white coating of the appearance of curdled milk, when they are quickly removed and rinsed in a large vessel of clean water, being afterwards dried in hot boxwood sawdust. The sawdust should be kept in a tin biscuit box, which can be placed over the kitchen oven to warm, and when the brass is dropped in among the sawdust, the box should be well shaken, in order that the article may be quickly dried. On being removed the metal will be found to have acquired a splendid lustrous appearance, and may be lacquered forthwith; or, if desired, the more prominent portions of the work can be smoothed by means of a flat file, which is held as nearly horizontal as possible, going over the surface first with a second cut, and then with a dead smooth, if not in possession of a smooth file to come in between the last named; the work being finally brought up to an even grain by means of Oakey's emery paper, in the following degrees of fineness: Nos. F, F F, and O.

In order to preserve the colour of the brass up to the moment of lacquering it will be advisable to dip it in a little commercial nitric acid to which a small quantity of cream of tartar has been added, the article being immediately afterwards rinsed in clean water to remove all traces of the acid, and then dried in hot sawdust, the dust being afterwards brushed off with a dry soft brush, and the article lacquered as quickly as possible.

In the case of old work which has been previously lacquered, such as a microscope or photographic lens, it will be necessary to first unscrew the lens cells and separate the inner tubes from the outer jackets, being particular to note the position of the various parts; and when thus separated, boil off the old lacquer in a lye made by mixing ½ lb. of potash with a gallon of water, the work being allowed to remain in this lye for about twenty minutes, when it should be taken out and immediately plunged into clean cold water, which will have the effect of removing the whole of the old lacquer; it is then taken out and brushed with a clean brush, and if considerably tarnished, it should be dipped in a pickle as before described, which will eat away all the outer coating of corrosion and leave the surface of clean brass. When quite bright and clean it is removed from the pickle and thoroughly rinsed in clean water. If running water is to hand, so much the better; if not, it will be found necessary to have several vessels of clean water handy, so that the work may have a good rinse in all of them, and on being removed from the last water, it is transferred to the sawdust box, from which it is taken in hand to be polished according to the instructions herein contained, and the degree of finish required.

It is advisable to conduct the operation of dipping out in the open air, or in a well ventilated apartment, as the fumes given off by the nitric acid are very baneful to health; but where ordinary care is exercised, there need be no fear of danger. Those who

object to the fumes of the nitric acid may use the following pickle, which has no unpleasant smell: Make a saturated solution of bichromate of potash with boiling water, and (when cold) add 1 oz. of sulphuric acid slowly to every ½ pint of solution. Never add the water to the acid or pour the latter into the hot solution, as it might be attended by serious consequences.

If an article has to be handled after dipping or polishing, it should be held in rag in the hand, or suspended on a piece of wire bent in the form of a hook, or it may be held between a pair of tweezers, a strip of wood slit longitudinally being a capital substitute for the latter. A brass or copper wire of about No. 10 B.W.G. may be bent into the form of a hook similar to Fig. 1, and used for the purpose of hanging the articles on while dipping, flat brass plates being placed on a wire holder similar to Fig. 2. As stated above, it is necessary to avoid handling the work during the operation of dipping, etc., as the slightest trace of grease from the fingers will spoil the after process of lacquering.

In preparing new microscope fittings for lacquering—or in fact, any work for which a superior finish is required—it will be necessary to first scrape up the curved edges of the various parts, holding them in the hand, or clamping them in the jaws of a vice between two pieces of sheet lead or leather. The tool employed for this purpose will be a scraper, which is simply an ordinary triangular file, the sides of which have been ground up smooth and sharp on a grindstone, the edges being set on an oilstone until they are sufficiently sharp to take off clean bright shavings. All the flat surfaces and straight edges of the work must be smoothed by means of a dead smooth file, which will obliterate all traces of the previous file-marks. When this has been done, take a piece of emery paper (not cloth) and use this to get rid of the file marks, wrapping it round an old smooth flat file or a thin strip of wood, having previously cut the paper to a size about an inch less in length and about three times the width of the file or wood, in order that it may be wrapped round it and held in position by the forefinger of the right hand whilst in use, being particular to rub in one direction only, and continue the process until all traces of the file marks have disappeared, when a finer emery paper may be substituted, until the finest (or flour) emery is finally used to obliterate the marks made by the previous paper. If a drop of oil is now smeared over the surface of the brass the grain may be brought up to a smooth and even semi-polish. It will be necessary to carefully clear away all traces of emery dust before commencing to use a finer paper, otherwise ugly scratches will continually appear on the surface of the work, only to be eradicated by going back a step and commencing *de novo*. After the finest paper the finish will be very good, but it can be further improved by rubbing with a piece of water-of-Ayr stone, which must be moistened with water from time to time.

Never substitute emery cloth for the paper, as the latter lasts much longer and works smoother than the former, very frequently working down to a glossy surface before giving way, and, moreover, the flatness and sharp edges of the work are better preserved by the paper than by the cloth. If the article is now held in a clean rag in the hand, and is then brushed with a soft brush (or a stick covered with one or two thicknesses of woollen cloth) and a little whiting, being afterwards wiped dry on a clean linen rag, it will then be ready for lacquering; or, if desired, the final polish may be imparted by means of a buff stick and a little crocus powder, or any of the numerous polishing pastes and powders. Of the latter, the writer has personally used "Davis's Metal Polish," ½d. per packet, and the "Universal Metal Polishing Pomade," 1d. per tin. The latter, which is a German preparation, has gained four prize medals, including a gold medal at Kensington in 1884, and it is certainly the most useful article for instantly imparting a brilliant polish to metal work that the writer has ever had the pleasure of using. Mr. H. Seeger, 21, Mincing Lane, London, E.C., is the sole agent for Great Britain, but it can be obtained from oilmen and some cyclist emporiums.

The following will be found the best method of using the preparation: Anoint a

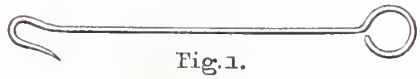


Fig. 1.

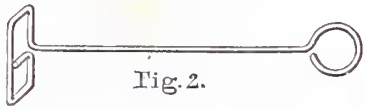


Fig. 2.

Fig. 3.

Fig. 4.

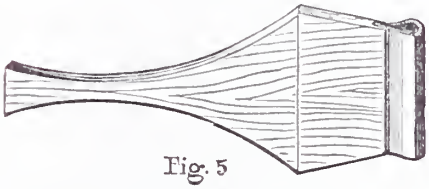


Fig. 5

Fig. 1.—Wire Hook for Handling Articles after Dipping or Polishing. Fig. 2.—Wire Holder for Dipping. Fig. 3.—Mode of Chamfering End of Stone. Fig. 4.—Mode of Making Buff. Fig. 5.—Best form of Brush for Lacquering Broad Surfaces.

polishing buff with a little—not much—and then rub briskly, and with considerable pressure, upon the surface to be polished, remembering that it is always usual to take the strokes off lengthwise of the work, which should be the same way as the grain left by the emery papering. This will speedily bring up the surface to a lustrous polish, providing that the article has previously been papered up smooth, and care has been taken to eradicate all the file marks. When the superfluous pomade has been cleared off by means of a piece of soft rag, the surface will present a polish very slightly inferior to a burnish in point of brilliancy. The screw holes will require cleaning out with a piece of pointed wood cut to the requisite size. This is a necessary precaution, otherwise the grease will melt out of the holes when the article is heated and overrun the surface, thus spoiling the lacquering. Small nuts and screws may be polished by means of a chamois leather which has been dipped in the pomade, and is held between the thumb and first finger of the right hand, being quickly rotated over the part to be polished, the superfluous pomade being cleaned off by another portion of the leather as soon as the polish appears. Screws will seldom require emery-papering first, unless they are very old and tarnished, as they are generally left tolerably bright from the lathe; but should they need it, the paper may be used in the same manner as the leather.

Although the process just described, in which the file-marks are eradicated by means of emery paper, is very rapid, it is apt, in inexperienced hands, to have a knack of taking off the sharp edges of the work, giving it a slovenly appearance; it is, therefore, usual with the best work to secure a superior style of finish by means of stone-polishing, using grey-stone, blue-stone, and water-of-Ayr stone. This process, although more tedious than the one previously described, imparts that neat and square appearance to the work which, in the eye of a connoisseur, is a sure indication of good workmanship. In order to secure this superior class of finish, instead of using the emery paper to remove the file-marks the three qualities of stone mentioned above are employed for the same purpose in the order given. The grey-stone, which is used first, must be wetted with water, and then worked rapidly across the surface of the metal, also in circles, until all traces of the file have disappeared, care being taken to prevent it from slipping over the sides or ends of the work so as to damage the sharp edges. This stone is afterwards followed by the blue-stone, which is used in the same manner until it has removed all traces of the coarser stone, the article being finally finished by going over the surface carefully with the water-of-Ayr stone, which is taken straight across the work from side to side, in order to lay the grain, the article being afterwards dried by wiping it on a clean rag; after which the final polish is imparted by means of the pomade before described, or, if desired, tripoli and oil may be used instead. A great many workmen file their stones to the form of a chamfer, as shown in Fig. 3, and rub the chamfered portion on the surface of the brass; a greater pressure is thus brought to bear upon the work, and the task of obliterating the file marks thereby hastened. It will be necessary to wipe the work each time that the stone is changed, and the polisher should be careful not to get any grit on the surface during the latter stages of polishing. When it is wished to finish off the brass in the highest state of perfection cleanliness is the first consideration, and unless all the materials employed are kept distinct from each other and quite free from dust, it will be useless to attempt to get good results. The work should be lacquered as soon as possible after being polished, as it will soon lose its brilliancy. To prevent the rapid tarnishing as much as possible, it is usual to wrap the articles in a clean linen cloth until ready for lacquering. The stones above mentioned can be obtained from any dealer in watchmakers' materials; for instance, Mr. Cohen, 132, Kirkgate, Leeds. They are sold in slips from 6 in. in length and about an inch square. Round or flat buffs will cost about 2d. each, or they may be readily made by gluing a thin strip of leather on to a narrow piece of wood, as shown in Fig. 4.

Referring to the appliance shown in Fig. 5, representing the best form of brush that can be used for lacquering broad surfaces, I shall reserve its description until I am able to deal with the methods of lacquering, which space compels me to reserve for another paper.

THE ÆOLIAN HARP: HOW TO MAKE IT.

BY C. P. WEBB.

THIS interesting instrument is somewhat incorrectly named; its more proper appellation would be Æolus's harp, as it derives its title from Æolus, who, in the heathen mythology, held the place of "God of the Winds;" but modern usage and euphony have corrupted it into the name it now bears. In a practical journal like WORK it may be incongruous to dilate upon its scientific principles; suffice it to say that it consists merely of a wooden box or shell, across the top of which are stretched some strings, which are acted upon when placed in a current of wind, producing a succession of harmonious sounds. The weirdlike, yet melodious, sounds proceeding from it have inspired the thoughts of many poets, but none more so than Thomson, who, in his "Castle of Indolence," thus feelingly alludes to it:—

"From which with airy fingers light
Beyond each mortal touch the most refined,
The god of winds draws sounds of sweet delight.

* * * *

Ah me! What hands can touch the string so fine?
Who up the lofty diapason roll
Such sweet, such sad, such solemn airs divine,
Then let them down into the soul?"

The name of its inventor, and also the date of its invention, are apparently shrouded in mystery. We have an allusion to it in the works of Kircher, a celebrated philosopher, born in 1602; but it does not appear to have been introduced into England until the year 1750, when it was described as a new invention.

The principle of its construction is so simple that it is quite within the capabilities of the veriest tyro in the art of woodwork; although, naturally, the greater the care bestowed upon the workmanship the more satisfactory will be the result.

We will first consider the construction of the body of the instrument. For this we shall require a piece of sound deal, $\frac{1}{2}$ in. thick, 8 ft. long, and $4\frac{1}{2}$ in. wide; this must be nicely planed, and have the edges truly squared. Cut this up into two pieces of 3 ft. 6 in. long, and two of 6 in. long; carefully dovetail the ends of all these pieces, that they may fit together and form the sides and ends of a box measuring 3 ft. 6 in. by 6 in. For the top and bottom take a very sound clean piece of $\frac{1}{4}$ in. or $\frac{3}{8}$ in. deal, planed up and glass-papered, 7 ft. long by 6 in. wide; cut this into two equal pieces of 3 ft. 6 in. long each; in one of them, which is to form the top or soundboard of the instrument, at a foot from each end, and in the centre longitudinally, cut a hole about 2 in. in diameter (E, Fig. 2), with a fretsaw or sharp penknife. We next require two blocks to strengthen this board for the reception of the pins and screws which the strings are attached to. For these, take two pieces of beech or other hard wood 1 in. thick, 5 in. by 4 in. Finish these nice and smooth, and attach them to the soundboard, on what will be the under side, at $\frac{1}{2}$ in. from each end and side, as shown at B in the sketches; they may be fastened on by glue and screws from underneath. This board may now be laid on to the framework; the blocks, if properly fitted, will just drop in, and in order to withstand the strain to which they will be subjected may be further strengthened by two small screws on either side passing through the sides of the box into them (see Fig. 3). The top itself is fastened on the sides and ends by means of glue and small screws round the edges. The other piece of thin board is now to be fastened to the bottom of the box in a similar manner, and the body of the instrument is complete.

We shall now require seven iron pegs, the same as are used for holding the strings in a piano, and a like number of violin pegs. Bore seven holes in each end of the soundboard into the blocks in the position shown

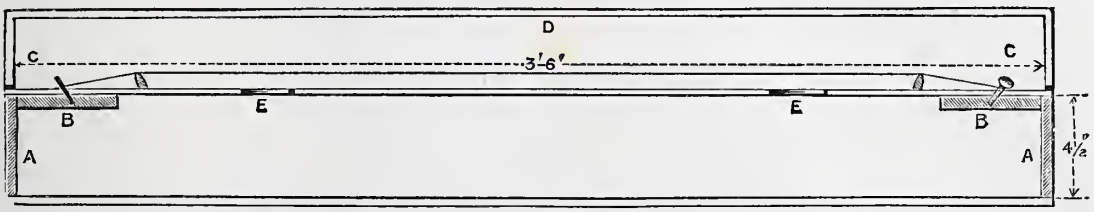


Fig. 1.—Æolian Harp: vertical section. (Scale, $1\frac{1}{2}$ in. to 1 ft.)

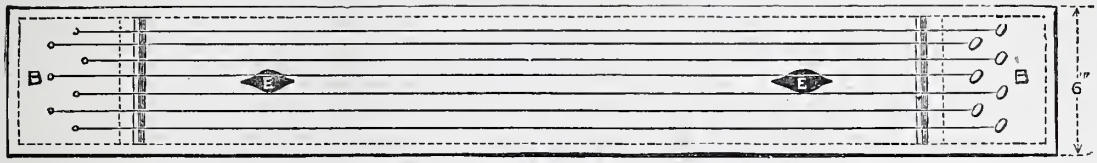


Fig. 2.—Æolian Harp: plan. (Scale, $1\frac{1}{2}$ in. to 1 ft.)

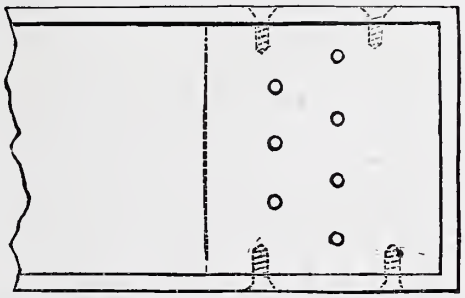


Fig. 3.—Mode of fixing Side to Block. (Not to scale.)

at B B, Fig. 2; these should be bored in a diagonal direction: as indicated at C C, Fig. 1, see that the pegs fit tightly in the holes, the iron ones at one end, the wooden ones at the other. Now cut two pieces of beech $5\frac{1}{2}$ in. long by $\frac{1}{2}$ in. by $\frac{3}{8}$ in., and shave off two edges of each to form triangular pieces on a $\frac{1}{2}$ in. base: these must be glued firmly across the face of the soundboard at about 5 in. from either end, and a slight notch made in the top edge opposite to each peg. These will form bridges across which the strings are to be strained.

Now procure some catgut (violin strings), pass one end through the holes in the iron pegs, carry it over the notches in the bridges, along the face of the soundboard, and attach the other end to the wooden pegs, which turn tightly in their holes until the strings are thoroughly strained. The strings must now be tuned in unison—that is, they must *all* be of *exactly* the same sound. This is done by turning the pegs until the desired effect is obtained.

As the effect is much enhanced by directing the current of wind over the strings, we must now take two pieces of $\frac{1}{2}$ in. deal, 6 in. by 3 in., and a piece of board similar in size to that used for the bottom of the instrument; glue one of the small pieces across the edge at each end of the board; this will stand over the face of the instrument as shown in the unshaded portion in Fig. 1. Now place the whole on the window-ledge and close the window down on to the top of it at D, Fig. 1, and with a moderate breeze blowing we shall be rewarded by hearing the plaintive tones peculiar to the Æolian harp.

THE WATCH BALANCE-SPRING.

BY A. P. B.

THE balance- or hair-spring of a watch is a fine spring attached to the balance, to control the movement of that part when set in motion by the power of the mainspring, communicated through the train of wheels and escapement. The time-keeping qualities of a watch, therefore, depend to a great extent on the balance-spring and its proper adjustment. So that a watch of otherwise good construction and design would be of comparatively little value as a time-keeper if supplied with a badly-adjusted balance-spring; while a watch of inferior description might be rendered less inaccurate by giving closer attention to this particular part than is usual with watches of the cheaper class.

The strength of the balance-spring is mainly dependent on the weight and size of the balance itself, and must be of such strength as will give the requisite number of vibrations to the balance in a given time. The number of vibrations per minute in any watch may be readily found by multiplying the number of teeth in the escape wheel by as many times as the number of leaves in the escape pinion is contained in the number of teeth in the fourth wheel; this will give the number of double vibrations the balance should make per minute.

Too strong a spring causes the balance to travel too quickly, and the watch gains; but with one that is too weak, it will not move sufficiently fast, and the watch will lose.

The most advantageous length for a balance-spring is not so readily determined, as in certain forms of escapement somewhat long springs are required, while in others the best results are obtained by shorter springs. It is, however, usually found best in practice to give about ten turns of spring to a horizontal, and twelve or fourteen turns to a lever, escapement.

To fix a new balance-spring: take the balance, remove the small brass collet from the staff, and unpin the old spring; then, having selected a spring of the requisite number of turns, place the outer or last coil between the curb-pins of the regulator, and see that the balance pivot-hole will come

exactly opposite the centre of the spring when the balance shall be in place; then lay the spring on a flat surface, and notice if there is sufficient room in the eye of the spring for the collet. If, as is usually the case, there is not, then a portion must be removed, so that the space in the eye of the spring is of somewhat larger diameter than that of the collet. To ascertain if the spring selected is of the proper strength, take the balance and pass the staff through the eye of the spring, then place a minute portion of beeswax on the point of the pivot to keep the spring from coming off. Now pick up the spring by taking hold of the outer coil at a distance of about $\frac{3}{16}$ths of an inch from the end—the balance will be raised with it, being supported by the small piece of beeswax; give the balance a slight turn, and it will continue to move to and fro for some half-minute or more. Count the number of vibrations it makes in half a minute (it is easier to count each alternate vibration), and if this exceed the proper number that it should make in the time, then the spring is too strong; if, on the contrary, the vibrations are too few, then the spring is too weak for the balance, and in either case other springs must be tried until one is obtained which will give the correct number of vibrations in the time as near as can be calculated by the eye.

The spring has now to be pinned to the collet. To do this, first examine the small lateral hole in the collet, to see that it is quite free and clear; now take the spring at the eye, and bend the end to a distance of about $\frac{1}{16}$th of an inch to a right angle; pass this bent portion into the hole in the side of the collet, and pin it carefully in. The spring should now be quite true and flat with the collet, which should be exactly in the centre, and the spring leave the collet with a nice curve, care being taken to see that it does not touch at any other part, and that the small pin does not project from the hole and touch against the spring; otherwise its action will be impaired.

The spring has now to be attached to the balance-staff by the collet, the outer coil placed beween the regulator pins, and the end pinned into the stud, the collet being so adjusted that the watch will be in beat (in horizontal watches the dot on the balance-rim should be opposite the stud). The spring should be pinned into the stud in such a way that the outer coil will occupy the middle of the space between the two curb-pins of the regulator, so that when the balance is moved to and fro, it will strike both pins evenly. The regulator should be placed at the slow position, and the spring examined to see that it acts correctly; if so, the regulator should be gradually moved round, and the spring altered where necessary, till it is found to strike both pins evenly in any position at which the index may be put. The second coil of the spring should be observed, to see that it does not strike against curb-pin or stud. The watch may then be regulated in the usual way.

THE ART OF GRAINING.

PRACTICAL PAPERS ON PAINTED IMITATIONS OF WOODS.

BY A LONDON DECORATOR.

INTRODUCTORY AND ILLUSTRATIVE — PREPARING WORK — "GROUNDS" AND "GRAINING COLOURS."

THE utility and art morality of painted imitations, although not a subject of the first importance to the student of graining and marbling, is, nevertheless, sufficiently a question of practical interest to the community at large to warrant its introduction in these pages. Notwithstanding this distinctive branch of house embellishment has been successfully practised and honoured, to the direct knowledge of the trade, for fully one hundred years past in our own country, no subject of a like nature has caused such disputation and outspoken criticism amongst eminent decorative authorities of recent years as the practice and study of such imitations.

Half a century ago, and even still later, the art of graining was in the zenith of its popularity. The successful imitator was looked up to by the operative house painter, and, in fact, by the patrons of his craft as an art-worker—of the lesser order, maybe—but of a branch of decorative painting of a very remunerative nature, and such as even Royalty was pleased to patronise. As evidence of this, there is the still existing marbled imitations which, under the personal direction of the late Prince Consort, were executed upon the walls of the Grand Entrance, or "Marble Hall," the "Grand Staircase," leading from thence to the Throne Room, the State Ball-room, and other minor positions at Buckingham Palace, about forty years ago, and at which period the present front of the palace was built. Another notable example of painted imitations comes to my mind—the grand staircase of the aristocratic Carlton Club, Pall Mall: a splendid example of painted marbling, which Messrs. Gillow blotted out with "ivory white" paint and Dutch-metal gilding only some three years ago. What a radical change has transpired between then and now! To-day we have WORK offering to the would-be grainer for a few pence the foundation of that craft which a generation ago could only be obtained by heavy premiums or apprenticeship, and the execution of which was jealously guarded from the inquisitive gaze.

John Ruskin's much-quoted dictum, that "there is no meaner occupation for the human mind than the imitation of the stains and striæ of wood and marble," has, unfortunately, been a potent force in lowering graining and marbling from the exalted position it had obtained at the period mentioned. Until these uncompromising words went forth to the "community of refinement and art-culture" who hold him as the exponent and high priest of all that is true and beautiful in art, no very weighty opinion denouncing such imitations is recorded. From the earliest known times of its introduction and use, the value of this branch of house painting, which can combine so admirably utility with embellishment, had, indeed, been fully acknowledged and established; and had this sweeping condemnation been penned by a writer of less eminent ability and fearless individuality as an art critic than Mr. Ruskin, there is little doubt but that its proper sphere of decorative popularity would not have been in the least affected thereby. Coming as it did, however, from one whose judgment on most art matters is one to "conjure" with, the results were soon made evident, inasmuch that it became *fashionable* to decry that which was previously applauded, and the skilled and clever imitators of the metropolis especially found their occupation almost gone. "Old things have passed away!" became the cry of the unthinking following of this master mind. Even, as in some instances, where the architect or decorator was not averse to its introduction in a building, it rarely happened that the client—if a person of advanced knowledge and "art-culture"—would, himself, countenance so flagrant an exhibition of "artistic ignorance." Herefrom, then, to a great extent arose the disfavour accorded this imitative art, and which has continued, although to a less extent, down to the present day.

The authoritative decorators who uphold graining and marbling number amongst themselves, however, men of eminence, not only as writers upon art, but far more so as practical workers, than even Mr. Ruskin. For instance, we have the valuable opinions of both the late Sir Digby Wyatt and Owen Jones—of "Grammar of Ornament" fame—that such imitations are permissible and commendable, provided they are introduced in situations consistent with utility and common sense: that is to say, where the genuine article could properly be used. That this is but a rational view of the matter no unbiassed person of intelligence will deny, since, if the use of graining and marbling be objected to—notwithstanding fitness or merit of execution—solely upon the principles of being imitations or "shams," the argument will carry one into most absurd extremes. No staining of simple deal or pine to imitate a more costly or pleasing wood! No cast plaster imitations of carved stone-work! No putty composition or papier-mâché enrichments to the surface of apartment or furniture: not even to embellish a mirror-frame—lest some poor creature may be deceived into thinking it is genuine carved work! The amount of pleasure that may be derived from the beauty of the ornament is not worthy of consideration in such work: so, at least, appears to be the creed of the "anti-sham" party. Gilding a picture-frame or similar ornament must also come under condemnation, since where lies the difference between so imitating a carved surface of metal and covering a wall with an imitation veneer of marble?

An extract from the *Architect*, published some years back during one of those periodical occasions at which this question comes to the front, offers so suitable a closing judgment upon the controversy herein considered, that I am tempted to quote it—with the promise, however, that quotations shall not hereafter be substituted for that personal knowledge and experience of my theme which, I am aware, readers of WORK expect and look for. "Graining and marbling, of course, are quite an inferior art to veneering, and, to speak plainly, are more directly a make-believe. A slab-slate table, for instance, enamelled to imitate Aberdeen granite, has been known to deceive for more than a moment the expert eye of an Aberdeen stone polisher; and it is quite a common thing for a sufficiently subdued imitation of satin-wood or mahogany to be mistaken for veneer, or an unpretentious panel of griotte or malachite for the real marble. So cleverly, indeed, do grainers accomplish their work—when they permit themselves to operate with due reserve—that vast surfaces of wall, as in Buckingham Palace and Stafford House, are found panelled out in the likeness of costly materials with such excessive liberality and faithful resemblance as to create in the mind of a modest stranger the feeling that he is being made a fool of. Nevertheless, for common woodwork in a common house—setting aside for the moment the fashion of green paint and other sad colours which

happen to be in vogue—what can be more satisfactory than well and discreetly executed wainscot graining? Let us bear in mind one thing that seems to be quite overlooked at present. Why is a woman's cotton dress printed with a pattern? Not for the sake of the decoration—a plain colour would often be far more preferable—but for the simple purpose that it shall not 'show the dirt.' The object of graining a door is, in like manner, that it shall not be too readily soiled and stained. Our popular colour decorators know only too well how far this vulgar consideration applies to the melancholy tints of painted woodwork which it is their function just now to make supreme. Perhaps we may put the case of graining and marbling thus:—When the imitation is too pretentious for possibility, it is no better than the too majestic mimicry of the stage, where the jewels are glass and the gold tinsel; but so long as it is kept within the limits of common sense, for the mere purpose of producing a decorative finish by confessed imitation, the better that imitation is the more graceful is the effort of workmanship, and the more to be encouraged as a thing that ought not to become a lost or even a degraded art. As for the varnished dealwork now so common (in every sense), although it would be quite an error to disparage it in principle, one may safely ask whether, in order to make it really presentable to a fastidious age, it does not require much better workmanship than is customary, and better material than it would pay to use."

The Stafford House imitations of marble, I may here mention, are not of the ordinary painted nature, as the above able writer appears to class them, but consist of a kind of imitation *veneer*, known as the *scagliola* process. This noble building, the town residence of the Duke of Sutherland, is noted for possessing a grand hall and suite of State apartments which compare favourably with any building in London, those of Buckingham Palace in some respects not excepted. The hall and staircase to which the writer evidently refers is a magnificent piece of work. Some idea of its imposing aspect may be gathered from the fact that it occupies, on a rectangular base, the whole of the centre of this mansion. Its height from floor to roof is about seventy feet, and it is computed that a thousand foot soldiers can be placed upon the ground floor. Its connection with my paper will be fully justified when I explain that the greater portion of the wall surfaces and the massive Corinthian columns of this staircase are all decorated with the "scag," marble imitation. Thousands of square yards there must be; and a grand effect it gives, being moulded and panelled out, and with immense oil paintings in the centre of the wall flanks. I believe it is without a rival of its kind in the kingdom; and as a noble example of imitative work its existence is one of the best answers to John Ruskin's tirade that the student of such work can find comfort and encouragement in.

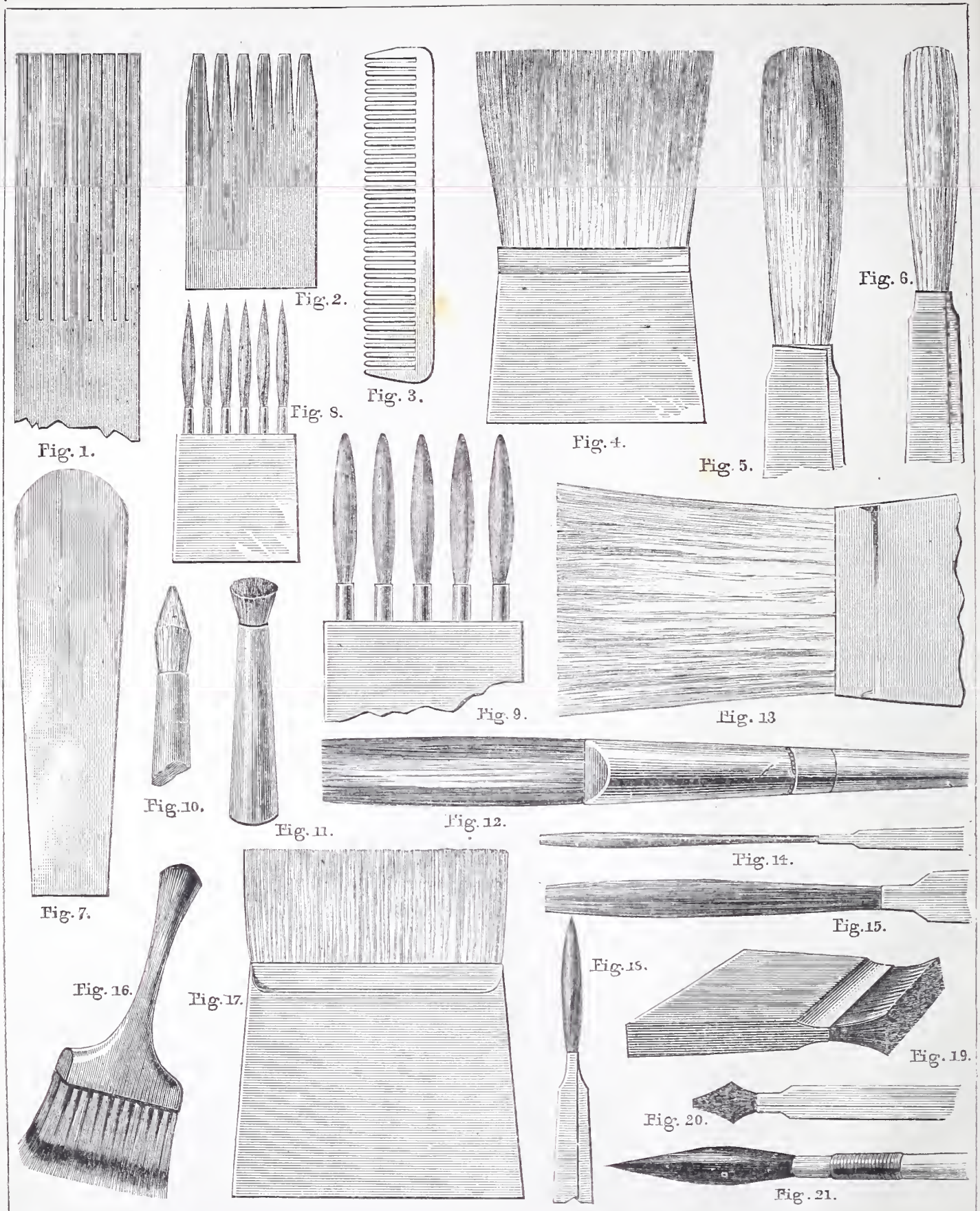
The papers on house painting which appeared in Vol. I. of WORK have made the earnest reader who accompanied us through that series familiar with most of the materials required for graining and marbling, as well as with the practical elementary stages of "brush work," as the plain painting is termed. Although no effort will be spared to make this set of technical papers complete in itself, it must be understood that the contents of the former series are invaluable to the student of graining and marbling, and that in compiling these lessons on "the art of graining" I have assumed, necessarily, that the primary knowledge above mentioned is common to both writer and student.

Grounds for Graining and Graining Colour are terms denoting two very important factors in connection with the imitation of woods, the meaning and practical working of which the student must thoroughly master before he endeavours to produce the features and markings characteristic of any specie of wood. The "ground" is a technical term involving two distinct ideas: namely, *surface* and *colour*. A properly prepared and painted *surface* should be free from grittiness, coarse brush-markings, dents, or excrescences, and should present a smooth and hard appearance. The amount of *gloss*—dependent upon the proportions of linseed oil and turpentine used in mixing the grounding paint—is scarcely a matter of strict rule, but rather a consideration of circumstance and the personal preferment of the grainer. Some skilled workers advocate about three parts linseed oil to one of turpentine, whilst others fully practised in the work use equal proportions, or even the reverse of those first mentioned. The student may with advantage bear these points in mind: where oil-graining with steel combs is used, the first-named, "hard-gloss," is the best. A dull gloss is more pleasant to work upon in graining by water or distemper process; the water-colour has more affinity thereto, and does not "cess" or run off. For the best class of this distemper graining I, personally, prefer a dull gloss, in which imitations, however, two coats of varnish are necessary for a good finish. On the other hand, there is a distinct advantage in using a hard oily ground for water-graining, since the oil has a considerable binding nature upon the pigment (when the water has evaporated from the work), and, consequently, one coat of varnish will "bear out" much better upon this latter than upon work executed on a dull paint. In no case can a good "ground" be obtained with dead or "flatting" paint; for there must always be sufficient oil in the colour to allow the paint to be thoroughly spread and lightly "laid off," and hence ensure the above quality of freedom from coarse brush-markings. As to the *colour* of the ground employed, this, of course, is principally defined by the wood we are about to imitate, whether oak, mahogany, or maple, and so forth. Beyond this leading fact, however, there is a wide range of knowledge to be acquired, by careful observation and experience, ere the student can correctly judge the combined effect of the two distinct factors, *ground colour* and *graining colour*, when manipulated together in the likeness of a wood.

Properly prepared Graining Colour should be characterised by two distinct qualities. Firstly, that of *working freely* and cleanly, not only from the brush, whilst being spread, but during the subsequent manipulation. Secondly, that correct and *particular colour* combined with the transparency of the pigment, which, when superimposed upon the "ground," shall imitate the colour of the genuine polished article. This matter of combined colour effect must be thoroughly grasped by the mind of the would-be grainer, since it is the chief working principle upon which the imitation of the wood is based. It is no uncommon occurrence for a writer upon such kindred subjects as painting and graining to be asked for directions to make "graining paint": that is to say, an opaque "body" mixture which shall give the appearance, without the two distinct "grounding" and "graining" processes, of oak wood. A little study of the above will show that this is impossible. So soon as *white lead* is mixed with the pigments from which the graining colour is made, the transparency and richness of the latter are practically nullified; whilst the graining colour alone, being only of the nature of a *stain*, lacks the preservative and protective qualities of a white lead or other "body" preparation.

The Preparation of Woodwork for Graining is a matter here calling for our attention. Although the imitation of oak is very often adopted for woodwork that is very rough and imperfectly "got up" by the joiner—as much on account of the figure "taking the eye off" this defect as for the serviceability of the graining—a smooth surface and ground are a desideratum. The "filling up," that is, making level, of such poor woodwork is a matter that must be relegated to a future series of papers; but, given a fairly good door, the following processes will ensure for us a satisfactory ground for working upon. The door should first be lightly papered, unless the joiner has done it for us, with No. 1½ glass-paper, and then thoroughly brushed down with the dusting brush (shown in illustration of painters' brushes, Vol I., page 820). The knots in the wood are then coated thinly once or twice, according to the nature of the knot, with "patent knotting" composition, the most transparent of which is the best. This dries in a few minutes, when the work is coated with priming made from three parts white to one part red lead, one-tenth in weight or bulk of paste or liquid driers added, and the whole diluted to a thin paint with three parts linseed oil to one part, or less, of turpentine. When dry and hard, the second coat is made of an oily nature also—say one-third of turpentine to two of oil. This should be used "rounder," or thicker, and be made from white lead and driers, but stained a few shades darker than the desired ground, and which latter we obtain by the third coat. It should always be borne in mind that any coloured paint will cover far better upon a previous coat a *few shades darker* than if the reverse is tried. Suppose we are desirous to imitate light oak—that is, new oak without any artificial darkening—our second coating may advantageously be used of the depth of colour given by the real oak wood. The ground colour—in this case the third coat, and which is the least number we can prepare new work with—will then be decidedly lighter than the second coat, and will cover much better than upon white paint. It may be advisable to mention that any nail holes should be "puttied up" after the priming, when it is advisable to let the work stand a day before painting again. Paint should always be strained before using, and the work lightly papered down and dusted previous to each coating. The pigments required for staining the white lead paint to the required ground colour is a matter governed by the colour of the wood we are imitating.

Samples of the Genuine Woods are equally as necessary to the study and practical proficiency in the imitative arts for copying from as are alphabets for the practice of sign-writing. The graining of figured oak is very analogous to hand writing: so much so, indeed, that if an employer has several good grainers working for him he is easily able, if himself a practical man, to say which of them has executed a piece of work; just



TOOLS USED IN GRAINING. Fig. 1.—Steel Comb. Fig. 2.—Leather Comb. Fig. 3.—Comb for Overgrainer. Fig. 4.—Mottler. Fig. 5.—Side View of Thick Mottler. Fig. 6.—Medium Mottler. Fig. 7.—Thumb-Piece. Fig. 8.—Sable Overgrainer in Tubes. Fig. 9.—Hog-Hair ditto. Fig. 10.—Maple-Eye Shader. Fig. 11.—Dotter. Fig. 12.—Veining Fitch. Fig. 13.—Thin Oak Overgrainer. Fig. 14.—Ditto, side view. Fig. 15.—Medium Overgrainer, side view. Fig. 16.—Badger Softener. Fig. 17.—Hog-Hair Mottler. Fig. 18.—Ditto, side view. Fig. 19.—Camel-Hair Mottler. Fig. 20.—Side View Burnt Edge ditto. Fig. 21.—Goose Sable Pencil.

as an accountant can distinguish between the handwriting of his half-dozen clerks, all writing a good hand. For the correct reproduction of oak figure especially, the necessity is a very imperative one. The student of graining cannot do better than invest in a *picked* sample of veneer of such woods as mahogany, satin-wood, maple, and walnut. Although other papers in WORK will furnish instructions for veneering them on to boards or "panels" of yellow pine, I should not advise a novice to risk injuring expensive samples by making his first "essay" with them. As they will be of life-long value, rather have them mounted by an expert hand—although there is no reason why the student should not *polish* his panels, and at the same time *well study the characteristics of each wood.* Respecting the oak pattern, it is the better plan to purchase a solid piece of good figured English oak: for this reason, that after mastering the growth and nature of the "lights" or cross-markings of one sample, we can get a friend to take a thin shaving off the surface, and thereby obtain for us another aspect of the natural growth to imitate. It is one of the peculiar charms of figured oak that with every planing of a panel some variation in the figure is apparent: a fact which the student should take advantage of.

The accompanying Illustration of Grainers' Tools represents a collection required for the ordinary imitative processes, to be hereinafter explained. Their cost and particular use will be briefly indicated in the next paper, and will be further fully considered as each tool is brought into its proper use. In my next article the graining of figured oak by the ordinary oil process will be described; and, following this, all varieties of oak graining, walnut, mahogany, maple, and other decorative woods, will be carefully and practically treated. The "present day" and artistic value of graining will be duly considered; and useful papers, interspersed amongst the above, will be given on graining furniture, plain staining and varnishing, inlaying, and decorating with woods generally. The paper on house-painters' brushes, which appeared in Vol. I., page 820, should be studied in conjunction with the subjoined illustration of grainers' tools.

NOTES ON SCALES AND SCALE-DRAWING.

BY A WHITWORTH SCHOLAR.

To the vast number of the readers of WORK, who are engaged in any of the various branches of constructive industry, an acquaintance with the subject of scale-drawing cannot fail to be of interest and value. I propose, therefore, to indicate briefly the principle involved, and to illustrate my remarks by the aid of practical examples.

In the first place we may note that it is only in exceptional cases that we are enabled to make drawings equal in size to the objects they are intended to represent. For example, in plans of buildings, maps, surveys, and in fact the great majority of the instances in which drawings are employed, it becomes as necessary to reduce the representation of the object as in cases of minute mechanism (as a chronometer) it is desirable to increase them.

It is to be distinctly borne in mind, however, that to whatever extent the representation of the object is diminished or increased, the relative proportion of every part of the drawing to the corresponding part of the object remains uniform throughout. It is evident, therefore, that in constructing a drawing to scale we must provide ourselves with an artificial standard of measurement which shall bear the same relationship to the real standard of length as our drawing is to bear to the real object.

For example, in the case of a map or plan, this artificial standard or "scale," as it is called, may have an actual length of, say, 5 in., and at the same time represent a distance of 10 miles in the drawing. In this instance the scale would be divided into ten equal parts, each indicating miles, while by subdividing one of these divisions into eight equal parts, furlongs may be represented.

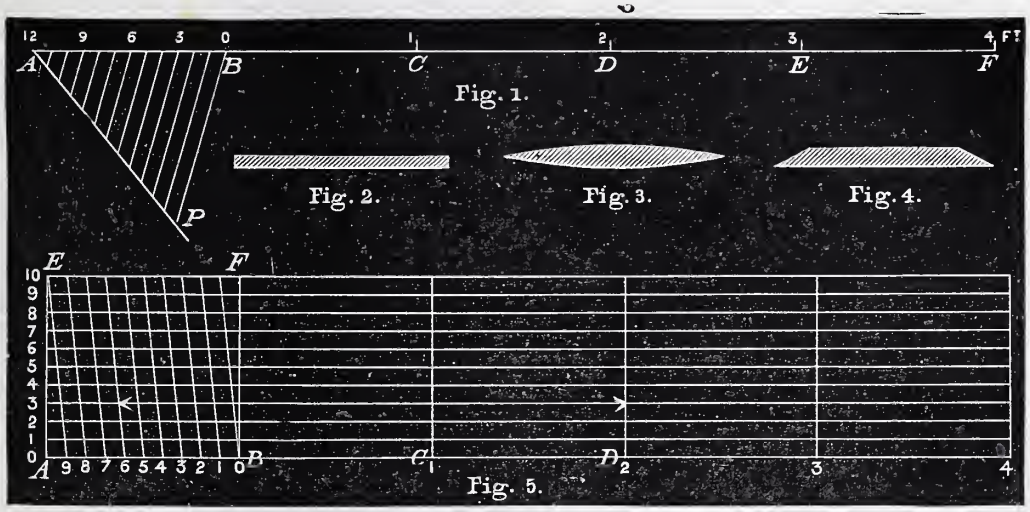


Fig. 1.—Mode of Setting out Scale in proportion of 1 in. to 1 ft. Figs. 2, 3, and 4.—Sections of Ivory and Boxwood Scales. Fig. 5.—Example of Diagonal Scale.

Here, then, we have an actual length of half an inch, which is understood to represent one mile, and the map or plan would be described as been drawn to a scale of half an inch to the mile. There is, however, another way in which this fact may be stated. The number of half-inches in a mile is $1760 \times 3 \times 12 \times 2 = 126{,}720$; and as this number of half-inches is represented by one half-inch, it is evident that our drawing is only $\frac{1}{126720}$ of the real object it is intended to depict. This expression $\frac{1}{126720}$ is known as the "representative fraction" of the scale, and is sometimes used to define any particular scale in place of the equivalent expression previously explained.

In order to illustrate our remarks, we will proceed to construct a scale for a drawing, in which one foot may be conveniently represented by one inch, and of which the representative fraction is therefore $\frac{1}{12}$.

We commence by setting out upon a straight line, A F (Fig. 1), successive lengths A B, B C, C D, etc., each 1 in. in length. As these divisions represent feet in the drawing, by subdividing one of them into twelve equal parts we shall be enabled to denote inches upon our scale.

To divide each of the larger divisions into inches would be both tedious and unnecessary, for, as will presently be seen, the first division only requires to be so divided.

To satisfactorily fulfil their purpose, scales must be constructed with the greatest possible care in order to ensure accuracy. It therefore becomes necessary to explain how the first division, A B, may be accurately divided into the required number of parts. To do this from the point A, a straight line, A P, is drawn, making any convenient angle with the line to be divided. Commencing at A, we step along this line twelve equal divisions of a convenient length, as shown. From P, the end of the last division, a straight line is drawn to the point B. Then lines drawn parallel to P B through each of the divisions of A P will divide A B as desired. If due care is exercised, very accurate results may be obtained by this method. Practically, however, an expert draughtsman would directly divide the line into the required number of parts without any difficulty.

If now we examine the scale, we shall notice that the end of the first division representing feet is figured 0, and that the remainder of these large divisions are numbered 1, 2, 3, etc., in the direction from left to right. But in the case of the smaller divisions we commence at the same zero point, and figure the successive divisions so as to read from right to left. The advantage of this arrangement will be made evident by an example of the use of the scale. Suppose, for instance, that we wish to indicate upon our drawing a length of, say, 3 ft. 9 in. Placing one foot of the dividers on the division marked 3 ft. and opening the instrument until the other foot rests upon the point marked 9 in the inch divisions, we have evidently obtained the required length, which may then be transferred to the drawing.

Ivory or boxwood scales may be purchased at any mathematical instrument maker's. They are usually supplied in the form of strips rather more than 1 ft. in length by about 1 in. in width, and of various sections, some of which are shown in Figs. 2, 3, and 4. A strip containing eight different scales will be found very useful for general purposes.

These separate scales are undoubtedly very convenient. It is well to bear in mind, however, that drawing-paper expands and contracts, according as the humidity of the atmosphere varies, so that when the drawing is on a very small scale, and the measurement requires to be very accurately determined, a scale constructed, as previously explained, upon the margin of the drawing-paper will be found most serviceable. With this arrangement, both the drawing

and scale are equally affected by atmospheric changes, and the accuracy of the drawing is not impaired. Separate paper scales may be obtained, but as the various kinds of paper are not equally affected, it follows that the error arising from this cause is only partially rectified by their use.

There is another and ingenious form of scale known as the "diagonal" scale. By means of this device, very minute measurements, impossible to define in a plain scale, may be accurately and readily obtained. The principle of its construction is shown in Fig. 5, a diagonal scale showing inches, tenths, and hundredths of an inch.

In this case the divisions A B, B C, C D, etc., are each 1 in. in length, the zero point being at B, and the first division, B A, being divided into ten equal parts. The vertical height of the scale, which, in this instance, is much greater than in ordinary scales, is also divided into ten equal parts, through which divisions horizontal lines are drawn. The upper horizontal line, E F, is also divided into ten equal parts, and oblique lines drawn from the points in A B to those in E F, the point B being joined to the first point in F E, and the remaining lines drawn parallel, as shown.

Suppose now that we wish to obtain a length of 2 in. $\frac{6}{10}$ths and $\frac{3}{100}$ths of an inch; or, as it would be generally expressed, 2·63 in. To obtain this length we place one foot of the dividers upon the point where the vertical line, D, and the horizontal line, 3, intersect, and the other foot on the point where this horizontal line cuts the oblique line figured 6; the distance so obtained will be 2·63 in. as required. That this is so may be seen from the following considerations:—The distance between F and the first oblique line is, by construction, $\frac{1}{10}$th of an inch, and this distance uniformly decreases until at the point B it vanishes completely. It is evident that as we descend from F to B, at each of the horizontal lines this distance becomes $\frac{1}{10}$th less than at the previous one; and therefore at the horizontal line, 3, we have remaining $\frac{3}{10}$ths of $\frac{1}{10}$th $= \frac{3}{100}$ths of an inch. The distance D6 taken along the base line gives 2·6 in., and by measuring on the third horizontal line we add the $\frac{3}{100}$ths just referred to, and obtain the required length, 2·63 in. Diagonal scales may be used for a variety of purposes, and, when carefully constructed, give very accurate results.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

5.—Moseley's "Compactum" Tool Cabinet.

Since the amateur workman went into action in downright earnest, and aspired to turn out specimens of handicraft in wood that would compare favourably in point of construction, finish, and utility with articles made by his professional brethren, tool-makers and dealers have certainly done their best and utmost to provide him, not only with good-looking and well-contrived tools, but with handy bits of furniture—for so the tool cabinets of the present day really are—to serve not only as fitting repositories of his tools, but also to be utilised as a work-bench, and to spare him the necessity of cumbering his "den" with an ordinary work-bench if the exigencies of space and conditions of life are such as compel him either to indulge in his liking for manual work in his own special room or to leave it alone altogether.

The latest in the field is the "Compactum" Tool Cabinet, invented, manufactured, and supplied by Messrs. Moseley and Son, 323, High Holborn, London, W.C., of which an illustration when closed is given in Fig. 1, and another, showing it open, in Fig. 2. When shut up, it presents the appearance of a handsome-looking tool cabinet, 3 ft. 6 in. long, 3 ft. high, and 1 ft. 5 in. deep, with a carpenter's bench at top of the length just named, but slightly wider. The bench is fitted with a thoroughly good parallel bench vice and a bench stop, as shown in Fig. 1. If kept in a room that is used for other purposes than joinery and cabinet-making, a cloth can be thrown over the bench and the general purpose of the cabinet kept out of sight, or, at all events, in the background. One of the chief claims of the cabinet lies in the admirable way in which every inch of space within its bounds is utilised. Immediately below the bench is a long narrow drawer, with compartments for nails, screws, etc., and, as shown in Fig. 1, there are other drawers on the left-hand side of the cabinet, about half its width and length, forming a useful place of deposit for carving tools, etc. These drawers occupy an intermediate space between the cupboard in front of the cabinet, which is closed with two doors, and is fitted up with tools arranged on the back of the cupboard and within the doors, as shown in Fig. 2, and a rising and sinking tool rack. This rack, when raised up, forms a back for the cabinet, and is fitted up with tools, as shown. When it is lowered it gives width to the bench and makes a flush top, affording a sufficient surface for fitting and planing up wide work. The compartment on the right of the cabinet between the front cupboard and the space occupied by the tool rack is utilised for the reception of an extension piece for the work-bench, a leg for its support, and large planes and other tools for which room cannot be conveniently found in the cupboard in front or the rack behind. It will be seen in Fig. 2 how this extension piece is utilised. On the inside edge are two dowels, which enter holes in the edge of fixed part of the bench. Under this piece is fixed a leg, which supports the extension piece and imparts to it a necessary firmness and rigidity. It will be noticed that there are two holes in the front edge of the bench, which enable the extension piece to be fitted on in front as well as to the end, forming a convenient addition for wood carving, etc., the workman being able to sit at work of this kind on a stool provided for the purpose. The three special points claimed for this bench over any other that is in the market are (1) The sinking tool rack, which makes a flush top to the bench, and thus does away with the necessity of having a raised back to the cabinet; (2) the extension piece, which, when fitted to end of bench, makes its entire length 5 ft.; and (3) the fitting of the extension piece to the front of the bench, forming a compact and handy carver's table, so that when the operator is at work all the necessary tools can be arranged for use nicely within his reach. The price of the cabinet, with tools, is £16 16s.; without tools, £9.

The Editor.

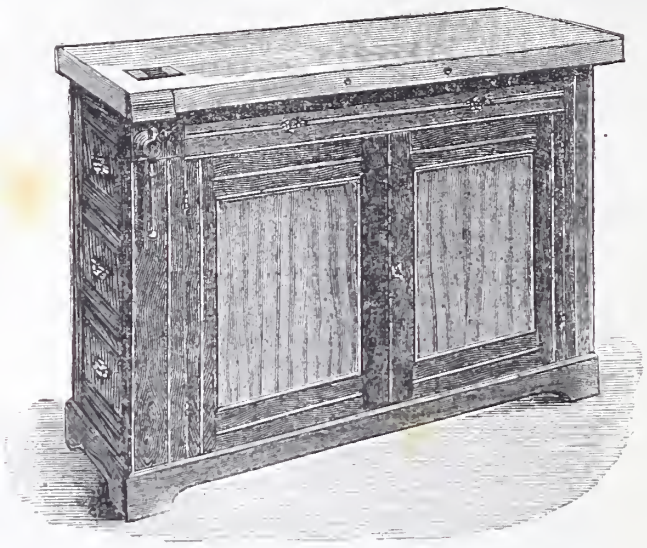


Fig. 1.—Moseley's "Compactum" Tool Cabinet, closed.

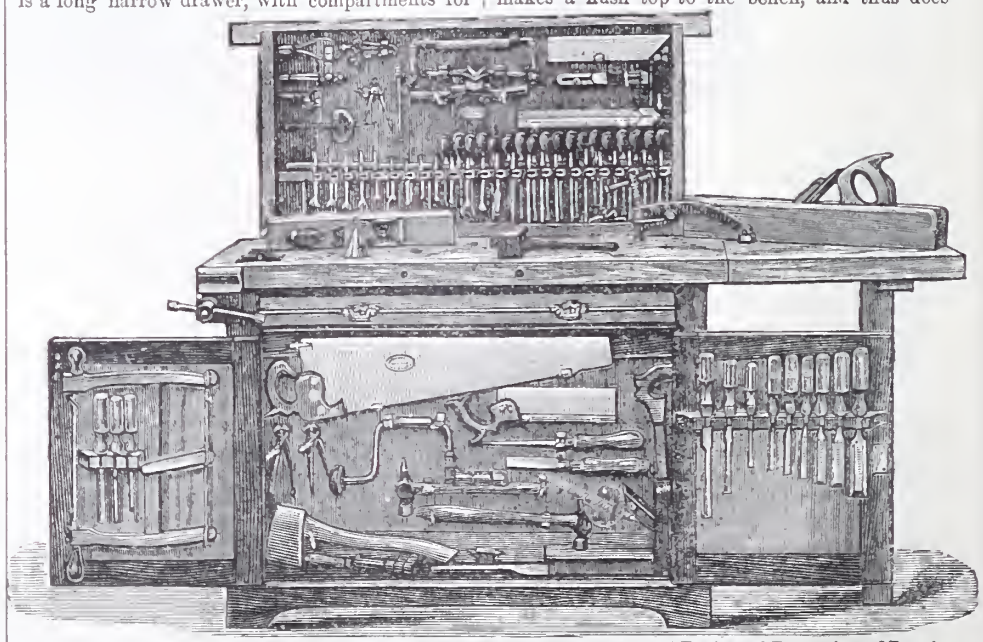


Fig. 2.—Moseley's "Compactum" Tool Cabinet open, showing Storage of Tools and Extension of Bench.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Timber Measuring.—A. R. (*Scorrier Saw Mills*) writes:—"The following simple rules may be of benefit to many amateur readers of Work:—To bring scantling to 1 in. board measure, multiply the breadth by its thickness, and by its length, and divide by 12. Suppose a piece to be 4 in. by 5 in, and 12 ft. long, example—

```
      5
      4
     --
     20
     12
    ---
  12)240(20 ft. super.
     24
    ---
      0
```

Again, to find the number of square feet in a board or plank of any length or breadth, multiply its length by its breadth and divide by 12. Example, a plank is 14 in. broad by 20 ft. long—

```
      20
      14
     ---
  12)280(23⅓ ft.
     24
    ---
      40
      36
     ---
       4
```

To find the contents of round timber, multiply ¼ girt by ¼ girt and by length of log and divide by 144; for instance, a log 52 in. around the centre, ¼ would be 13 in. or ¼ girt; suppose the log to be 24 ft. long the following will be the contents—

```
      13
      13
     ---
      39
     13
    ----
     169
      24
    ----
     676
    338
   -----
144)4056(28⅓ ft.
    288
   -----
    1176
    1152
   -----
      24
```

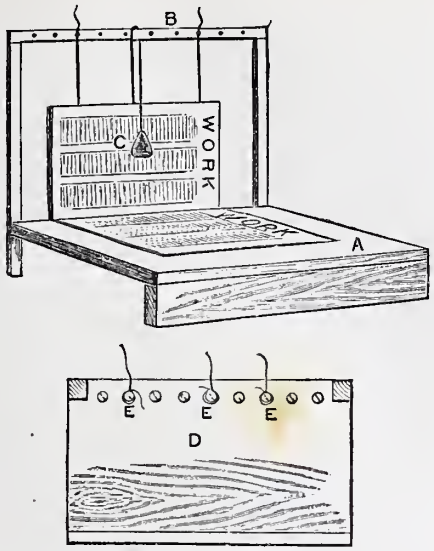
The above remarks may appear very simple to many professionals who read the pages of Work, but many an amateur may be enlightened by them."

Slide Valve.—Erratum.—T. R. B. (*Newcastle-on-Tyne*) writes:—"For steam-post (see page 810, Vol. I.) please read steam port."

Mitre Cramps.—Kilburn writes:—"The Kildonan (see page 636, Vol. I.) Combined Mitre Block and Cramp is the best design I have seen yet. It is far before H. J. L. J. M. (*Ealing*) (see page 766, Vol. I.). I can't see how he is going to nail his frame. He speaks of inserting thin wedges. I understand a wedge as having a thin and a thick end which won't answer in that kind of work I think. I should like enlightening on the triangular piece of Kildonan's cramp—whether it is first made in one whole piece and then cut, or is it made in two small triangles as represented in design?"

An Easily-Made Fret Machine.—F. R. C. B. (*Camberwell*) writes:—"I have seen W. R. S.'s fret machine (see page 332, Vol. I.) and I consider it the best of any I have seen. For an amateur who intends to make his own machine there is no better than this. It is cheap, simple, and last, but not least, it has a vertical cut. If there is any one who does not quite understand what W. R. S. means, he has only to communicate with him, and I have no doubt he will be as glad to let him see the machine for himself as he was me."

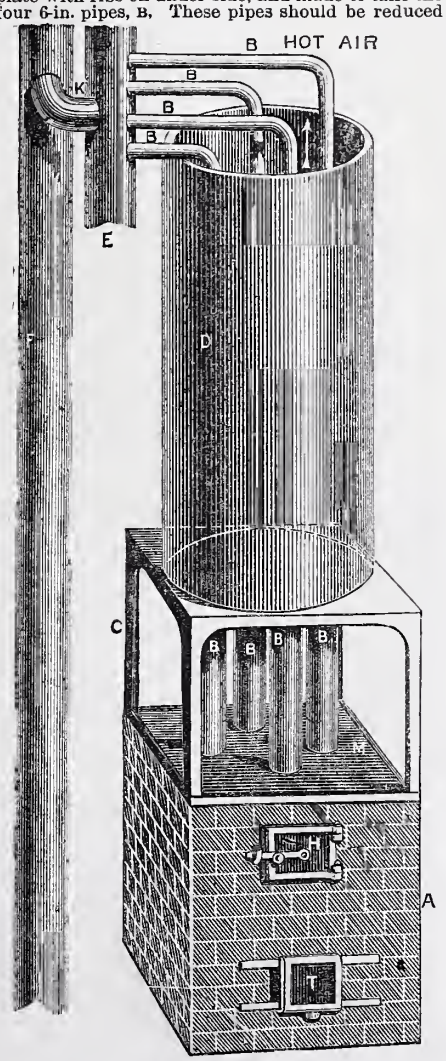
Bookbinding, etc.—J. S. A. (*Manchester*) writes:—"I am pleased to see this subject is being treated (see page 716, Vol. I.), as I have taken in Work from its commencement, and should like to bind it myself. I have made a frame for stitching books, a rough drawing of which I send, as it may be helpful to some of the readers of this valuable paper. The following are the parts of the little appliance":—



Bookbinding Frame.

A, Table for hook to rest on.
B, Top rail with holes bored through for receiving string.
C, Piece of lead tied to the top to hold half of the leaves up while stitching.
D, Table turned over to show how strings are fastened underneath the table by means of a row of screws marked E, to correspond with the holes on top. The frame is all wood, and is easily made and very cheap.

Hot Air Fitting.—Artist in Wood writes:—"I forward you a sketch showing how best a top room may be filled with hot air from a furnace in the basement of building. A, furnace of fire-brick or grate wanted; size for very large one 2 ft. square, 3 ft. deep inside. H, door to put the coke in; T, door to admit air, and take out ash; M, cast-iron plate with ribs on under side, and made to take the four 6-in. pipes, B. These pipes should be reduced to 2-in. where they enter the soot box, E. F, chimney; K, 6-in. pipe from soot box to chimney; C, cast-iron frame, open spaces 17 in. deep all round to admit air; D, drain pipe 26-in. to enclose the pipes, B. There should be a good thickness of fire-brick at bottom of furnace. Make the furnace top so that it can expand with heat. Do not let the other casting rest upon it, but on brickwork fix a thick fire-tile to the doors. If the fire burn too fast, open door H, and close door T. May be made any height from 12 ft. length of stove pipe. A large volume of air will blow very quickly up the shaft. D, made of drain pipe. This is the cheapest and most effective of all heating operations that the world has ever seen."



Hot Air Fittings.

How to lay out Saw Mill Machinery.—A. R. (*Scorrier*) writes:—"Many and varied are the opinions of engineers and others as to the best way to lay out the above, and it is a question that requires a deal of study before a commencement should be made to fix the machinery; if not properly fixed, much power may be taken that otherwise might be saved. Although I do not class myself an engineer, I take great interest in such work, and have studied it a great deal. As this paper is open to criticism, should I make a wrong statement I shall expect to hear of it. In going through a saw mills I always take notice how and where each machine is fixed, and in three cases out of four I consider a deal of power is wasted, which means cost, and lost cost, unless the machinery is refixed, which is an expensive affair. Whenever machinery of any kind is to be fixed, there should be forethought; if put in by random, when it is too late, it is said, if I knew or thought of it I would have had my machinery laid out different. I have seen fixed, and helped to fix, more than one machine, for saw mill work, and will try to show what I consider the best and easiest way to drive such machinery. In the first place, you should know what machines you are going to fix, and about the average power it will take to drive each machine, then the size and length of shafting, and number and size of pulleys to be keyed on the shafting, allowing for each ton weight 1 H.P.; this will give an idea what power engine will be required. The kind of engine I prefer for saw mills generally is a semi-portable. I will give my reasons. First, it takes little room; 2nd, it is easily fixed; (3), steam is soon got up; (4) it is very steady, the boiler being over the workings, and resting on the frame of engine; (5) it takes but little time in cleansing the boiler; (6) it runs at a good speed, which is an important point, as the main shaft should run at a speed of from 220 to 250 revolutions per minute. If the engine runs very slow, a large wheel is required on it, and a small one on the main shaft to get up the speed, therefore the main belt has to be at a great tension, which means waste of power and a short life to the belt. Again, as a rule the main belt is driven from the fly wheel. I consider this a great mistake, as it is a check on the engine, and the engine often gets centred, when there is a difficulty in starting again. The better way is to have a belt wheel on the opposite end of crank shaft smaller than the fly wheel, and a much tighter rim than the rim of fly wheel, the fly wheel being larger and the rim heavier; when it gets up to a certain velocity there will be a force in it which will greatly help the engine, and do more work and with greater ease than if the belt was on the fly wheel. Again, if possible (I use the word possible, because there are exceptions), it is not at all times that the ground room can be had to do as we should wish; therefore I say, if possible, fix the engine so as to drive the main shaft from the centre, as it will drive with less power than if driven from the end; and on either side of drum or pulley, over which the main belt runs, there should be a bearing to take the pull of belt, and to keep the shaft from vibrating; this should be the case wherever there is any great strain by belt. I would also recommend a friction clutch as made by Bagshaw & Co., Yorkshire, one on either side of bearings taking pull of main belt, so that at any time should there only be work for a part of the machinery, the clutch can be thrown out of gear, and that part of the shafting and machinery thrown idle. Again, if you have several machines to drive, key the pulleys that are to drive the heaviest machines one on either side of main belt pulley, then the next to the heaviest on either side of them, and so on, so that the lighter machines may be farthest from the centre of shaft; this will regulate the load, and the engine will do her work with less steam, which means a saving of fuel. Again, counter shafting should be avoided as much as possible, but if it cannot be avoided drive off from as near the centre as possible, not forgetting to reserve the lightest machines for the counter shafting, and if convenient run the shafting from underneath, as the bearings can be fixed more firm, and shaft will not vibrate as if driven overhead; vibration is injurious to all saw mill machinery, and causes the brasses of bearings to cut quickly; again, much power is wasted by having too small a pulley, and too narrow. This is a very important point. If belts are run over good size pulleys they need less tension, and do not give so much trouble by frequent slipping, and will last much longer. In a future issue, with Editor's permission, I hope to write briefly on the slipping of belts. In a back number a correspondent writes in reference to jaw-cracking words, and condemns such; I feel sure if any one looks for such in this letter he will be deceived. I think the most illiterate may understand the above, and I hope it will benefit many of the readers of Work."

II.—Questions Answered by Editor and Staff.

Colour Mixing.—£ s. D. (*Navan*).—You will understand by the date at which your answer is given, how utterly impossible it is to reply to technical questions in "Shop" without a long interval transpiring. The two pieces of wall paper you enclose are in colours that are usually called "light sage" green or "lettuce" green — terms usually adopted to give the unprofessional worker a notion of what particular hue of green is meant. Olive green would hardly be a correct term: this word is usually associated with a much darker and more blue kind of green. Should your woodwork still be waiting, as a professional worker of varied experience, I should advise painting the panels about the colour of trimmed edge sent, and the remainder of woodwork, skirting, etc., a much deeper shade, more approaching a russet brown. The panel mouldings might then be picked out with either a dark rich marone, burnt umber, or sott coral colour. Either would be harmonious—the coral would be the prettiest, and the umber the most sober. You should then varnish all of it with inside oak varnish. There is but a very slight difference between the two shades you send and have marked; that on the flower is slightly lighter and more yellow. To mix the paints recommended, you will require for the light about 3 lb., made from about 1½ lb. of white lead, ¼ lb. patent driers, mixed well, with equal parts raw linseed oil and turpentine, to working consistency. To get the desired colour, stain with yellow ochre and a little green or blue pigment, purchased ready ground in oil; should your colour appear too bright, tone it down with a very little umber. This would be, as you desire, a paint composed of the least harmful pigments, and such as nearly all inside work is done with. For the styles, etc., if you prefer merely a darker shade of same colour, more yellow, green, or blue and umber will give it you; but if desiring the brown, this would require but little white or green—principally ochre and umber. For mouldings, burnt umber and a little ochre mixed in turps and varnish; if marone, use deep Indian red: purchase twopennyworth, dry, and this with white will make coral. The turps and varnish will dry the latter, but, of course, the style colour will require some patent driers—about one-eighth part. Strain all your colours before using through fine muslin.—F. P.

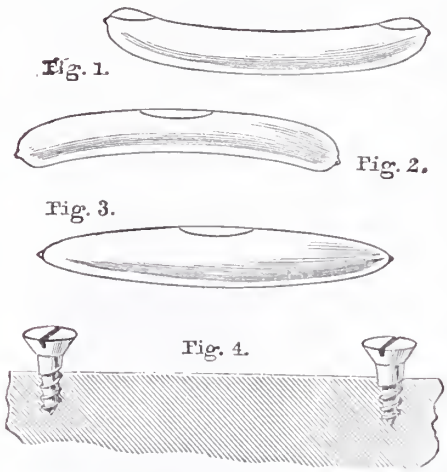
Silvering Glass.—A Subscriber asks:—"Will you inform me what are the ingredients used and the routine for using of same in silvering plate glass?"—I have already, within the last few weeks, replied to similar questions. If A Subscriber thinks of silvering plate glass of any considerable size, my advice is the same as *Punch*, under other circumstances, has given—"Don't." It requires skill such as is only to be got by much practice; besides, to do it on a limited scale would be more expensive than to purchase the glass silvered. I have succeeded in doing small pieces fairly well, but should never attempt a considerable plate of glass. The work must be done on a perfectly level table, marble by preference, with a gutter around it to save the mercury. Spread a sheet, or sheets, of tinfoil, which must be larger than the glass. Lay tho foil perfectly smooth without creases. On this pour pure mercury, and carefully spread it over the foil with a haresfoot. See that the glass is perfectly clean and free from all grease. On the amalgam place a sheet of smooth paper, and on the paper lay the glass. Now by a steady pull draw away the paper; by so doing any dirt on the surface of the mercury will be removed, also the film of air. Place a weight on the plate and leave for some hours, then tilt it on its edge for the mercury to drain. There is also a chemical method, but from A Subscriber's letter, I presume the above is the one desired; if not, write again. The tinfoil can be procured at any mathematical instrument maker's; sometimes druggists keep it.—O. B.

Graph Composition.—Amor Scribendi (*Castlejohn*).—Soak two ounces of best thin Russian glue in four ounces of cold water for twelve hours, then put over a gentle fire, and when melted, add eight ounces of common glycerine and five drops of carbolic acid as a preservative. Paris whiting must now be added until the mixture is of the consistency of thickish cream. Thoroughly mix and set in a shallow tin tray to set. This preparation must not be allowed to boil when on the fire. I have other formulas, but this is the most simple and the cheapest. For ink, purchase a bottle of aniline ink from any rubber stamp maker, or, for home-made article, dissolve a penny packet of Judson's purple dye in two tablespoonfuls of hot water.—H. L. B.

Magazines for Decorators.—M. T. C. C. (*Belfast*).—"The Journal of Decorative Art," price 7d. monthly (postage 4d.), is *the* decorator's paper, and full of useful designs and information. The publishers brought out a Christmas number, price 1s. 6d., post free, which shows how to decorate a drawing-room from start to finish, and for which purpose it contained a coloured plate and eighteen full-sized stencil designs ready for cutting. The publishing offices are at 15, St. Ann Street, Manchester. Order through any newsagent.—H. L. B.

Cleaning Silver-Plated Goods. — Waiter (*Ganton*). — Get some carbonate of ammonia or some hartshorn shavings, and dissolve in the water used for washing the silver-plated articles. This will remove newly-formed black stains. To remove those old black marks mentioned in your letter, powder up a little of the carbonate of ammonia, and mix with some plate powder; make the whole into a paste, and rub it on the stain until it has been removed. You might try a little of Brooke's Monkey Brand Soap, it is an excellent thing to remove stains from metal articles.—G. E. B.

Spirit-Level Tubes.—D. J. (*Oldham*). — The knowledge of how to choose and fix a spirit-level tube may be useful to others besides the querist. These tubes are of glass, and are made by drawing out when hot in the glass-blower's blowpipe flame glass tubes of a suitable size; a tube becomes smaller and smaller as drawn out, but with care, does not cease to be a tube, though when twisted hot, or broken cold, and placed for a moment in the flame, the small tube existing at the thin point is easily sealed up. These tubes are not straight, though their crookedness is so little as hardly to be seen; the most crooked of them form the tubes known to workmen as quick, because the bubble quickly comes to the highest portion of the tube; if, therefore, quickness of movement is desired, let D. J. (*Oldham*) get a crooked tube. Now, if he considers for a moment, he will see that in fixing the rounding side must be uppermost, as in Fig. 2. A tube like Fig. 1 would be quite useless, as the bubble would divide into two portions, as shown, and no indication be possible; but let the tube be turned over in its receptacle, and be placed as in Fig. 2, the bubble comes to the centre with great promptitude. These sketches, which are exaggerated in order to appeal more strongly to the eye, will give some idea of how to choose a tube, reminding ourselves, however, that for the sake of accuracy, a tube nearest straight is best; further, a tube which is quite straight for a portion of its length, and curves off towards one end, is very undesirable; of course, if the tubes could be uniformly larger in the centre, as if formed on a turned model, no care would be necessary in mounting, as in Fig. 3.



Spirit-Level Tubes. Fig. 1.—Glass Tube wrongly set, curvature exaggerated. Fig. 2.—Glass Tube rightly set, curvature exaggerated. Fig. 3.—Tube that might be placed any portion upwards. Fig. 4.—Screws in Bench to adjust Level; need not be level at first, can be brought level by trial and reversal of level.

However placed in the body of the level, the highest point of the tube must almost inevitably be in or near the middle of the top interior surface; but this condition never obtains, and to attain it would cause needless expense. It is also desirable that a tube, when set in its place, should give similar indications when reversed, as in Fig. 3, although the surface is not level; this cannot be unless the curvature of the tube is uniform, and is uniformly set in its socket. The bought levels are set on a tin foil film, which makes the bubble more easily seen; if D. J. and others cannot mount so, obtain some plaster of Paris and a little powdered blue; mix dry, or else mix plaster with water and blue ink; quickly set convex side upwards, so that the bubble reverses equally at a slight inclination. This adjustable inclination is easily obtained by inserting in the bench two wood screws for a portion of their length, as in Fig. 4. By this means, trying and reversing the bubble ought to occupy similar positions as regards distance from the centre; then adjusting the screws until the bubble rests in the same place when reversed the centre can be marked. I need scarcely remind D. J., or any other reader, that long before this has been accomplished the plaster will have set; but it does not matter, a sharp trying plane will adjust it by planing the under side better than any fingers could adjust the tube; and if the tube has been deeply bedded, as it should be, the block containing it can be made parallel after the under surface is adjusted. Finally, I find it useful to have a level 12 or 18 in. long, because it is easy to estimate if you know the length of your level and the length of the work—say, a 12-in. level sideboard for instance, 8 ft. long: level requires to bring the bubble to its centre ⅛ in. under one end, it is obvious that 1 in. under one end of the sideboard will be required to level it.—B. A. B.

Bookbinding Articles.—P. B. (*Westmoreland*).—All the articles necessary for bookbinding, whether amateur or professional, may be purchased from Messrs. George Royle & Son, 6, Lovell's Court, Paternoster Row, London, E.C. I should advise P. B. to write to them for their list and make a selection. But as he is only an amateur, I may give him an idea of what articles he really requires: a sewing press or "bench," as it is called in the workshop, costing about 10s.; half a dozen keys, costing 2s.; needles and thread; a lying press, with runners on one side for cutting, a plough and knife, a press pin, costing from 40s. to 50s.; pressing boards, cutting boards, and backing boards, assorted sizes—not less than 20s. worth will be required; a hammer, 5s.; a knife for cutting and paring, 6d.; a knocking-down iron, about 3s. 6d.; a marbling trough, 5s., with marbling combs costing from 7s. 6d. each; marbling colours from 3s. 6d. per lb. There will also be required burnishers, a tooth agate, a flat agate, a blood-stone or iron-stone, cost about 20s.; a glue pot and brush, 4s. 6d.; gold-knife and cushion, with drawer, costing 10s.; a gas-stove, costing about 40s. or 50s. Then the finishing tools: sets of handle letters, ranging from 10s. to 50s., according to size and style; ornaments of all kinds: sprigs, corners, centres, lines, rolls, pallets, tail-pieces—the cheapest piece being about 3s. 6d., while some will run as high as 25s. Besides these things, bodkins, folders, compasses, scissors, and quite a host of other things, that can only be added as the necessity for them presents itself. There is, after all these things have been procured, the material to be provided, such as leather, cloth, paper, strawboard and millboard, glue, gold, etc., in the selection of which I shall be most happy to assist in whatever way I can. In the meantime, if P. B. writes to the address given for the list, he will find it a great help. Many of the articles he could easily make for himself, if he is handy with carpenters' tools. If he should think of making any of them, I will be happy to give him sketches and instructions to guide him.—G. C.

Dulcimer Articles.—Dulcimer (*London, W.*).—Before this meets your eye, you will have noticed that these papers *are* continued. It is impossible, having regard to the requirements of very many thousands of readers, to continue any one subject in consecutive weekly numbers of Work. Each subscriber wants his or her subject brought forward.—Ed.

Leather Lace Machines.—G. L. (*Gainsboro'*).—I am not acquainted with, nor can I learn about, any machine which would be likely to be more useful for your purpose than the one you name. You do not say what the laces are for, nor the quantity you want to produce, so that I am not able to advise you as fully as I might otherwise. The most suitable tool I can suggest is a knife.—D. A.

Staining.—E. J. (*Leith*).—Your first letter was replied to in due course, and long ere this appears you will have seen the answer to it. I am sorry to hear you are at a standstill because you have not seen your former inquiry replied to, but it is really quite impossible for answers to letters to be published directly, even though they may be written at once. You will easily understand that the magazine must be printed some time in advance, and I am sure after this hint you will not think you have been neglected.—D. A.

Gas Burners and Electric Lamps.—Chromos (*Brixton Hill*).—(1) I cannot give you the candle powers of Bray's gas burners, from No. 1 to No. 6 respectively. Perhaps some one of our correspondents can furnish Chromos with the desired information. I should think, however, that no definite reply could be given, unless one knows the pressure and quality of gas to be consumed in the respective burners. (2) Your second question also will not command an exact reply, since the battery power needed to light up an incandescent lamp will depend upon the resistance of the carbon filament, and the necessary voltage to overcome that resistance. A 12-volt 5 c.p. Swan lamp will require a battery of 6 quart Bunsen cells, arranged in series. This would be the best kind of lamp to use with this battery. (3) As you want to light up six of these lamps with quart Bunsens, you will have to use 36 cells, arranged in series, the lamps also being in series. If the lamps are arranged in parallel, less cells will be required; but in this case the battery will soon run down, because it will have to furnish a larger volume of current.—G. E. B.

Storage Battery.—Cottingham (*Hull*).—If the red lead paste has been pressed well into the perforations of the plates, it is just probable that the cause of peeling off is due to a too rapid charge or discharge of the battery. The plates should be gradually "formed" by repeated and increasing charges and discharges, not too rapid at first. Four cells of any size above six square inches of plate surface will light up a 2½ c.p. lamp, ranging in voltage from 5 to 8 volts, but not those having a voltage of over 8 volts. You must choose the voltage of the lamp to suit the battery. An 8-volt lamp is most suitable to a 4-celled storage battery. Your battery, when fully charged, should light up an 8-volt 5 c.p. lamp for six hours.—G. E. B.

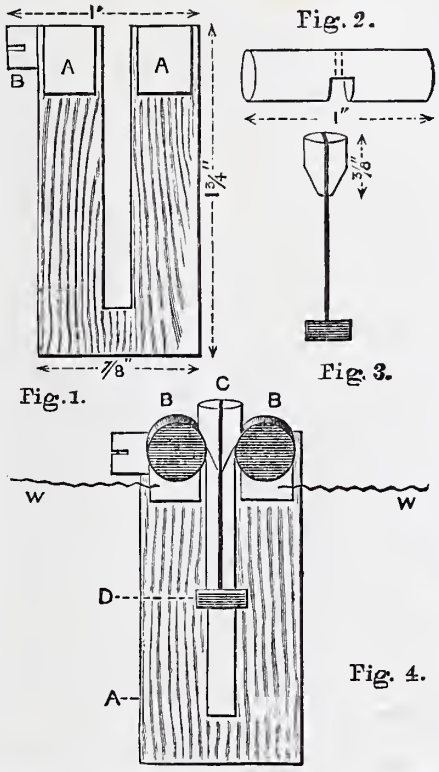
Decorative Process.—J. S. (*Bristol*).—I am not aware who the agent for the process to which you refer is. It seems to have disappeared altogether. An attempt was made to float a company to work it, but, I believe, without success, as shareholders' money, I am informed, was returned.—D. D.

Piano Small Work.—ASPIRANT (*Glasgow*).—The butts are made in lengths, and worked complete, then they are cut with a small circular saw to the size required, and the holes drilled afterwards. Of course, to do this, you would require a small lathe fitted up to saw and bore with; you would also require a hammer rail for the butts to fit in; the metal of the rail is cut with a wheel, with a cutting edge. The cloth used for bushing the butts is of a special kind, being silky on one side. For bushing, it is cut into strips the size of the hole, and the ends are cut pointed; then put a little glue on your finger and thumb, and roll the ends to a fine point, and leave to dry. When dry it is threaded through the butt, and a touch of glue or shoemaker's paste is put on the part that is to remain in the butt, and the cloth is cut off level with the sides. Then the holes are broached to fit the centre wire. The cut for the vellum to fit in the levers is made with a circular saw, but if you will examine a lever, you will see that there is a small cut across it; this gives freedom for the cut where the vellum goes to open. The levers are made in lengths of wood, worked with planes to the size required, and the vellum is sized with thin glue, and hung up to dry, then cut in strips, and put into the saw-cuts of the levers. Then the wood is made damp with a sponge and clear water, and narrow plates of iron, made warm, are placed on over the hinge, with pressure from small band-screws; this sends steam through the pores of the wood, and softens the glue on the vellum. I do not know where you get your smallwork in London. Try V. A. Hallpike, 213, Mare Street, Hackney, London, E., for cheap and good smallwork, then consider whether it is worth your while making your own. Small goods, such as vellum, bushing cloth, or leather, he would send by post.—T. E.

Repairs to Piano.—G. R. (*Manchester*).—It is very gratifying to all concerned in the production of WORK to read such praise as yours, as it stimulates us to further endeavour to meet the wishes of our numerous subscribers. Thanks for introducing it to your friends. You will find on examining the bent sides of your piano that the glue has given way, and pulled the bolts in the manner described by you. To remedy this you will need to slacken the strings with a tuning hammer where they are attached to the bent sides, and if necessary take off the pins. Now you will have to take out the bolts, and try to make a good gluing with hot glue to the bracings of your bent sides. It will probably come away altogether on the removal of the bolts, as I expect these are all that hold it. If you can get some pressure with cramps or hand-screws all the better; if not, when nicely fitted into its original place, put your bolts in temporarily to hold it in position and bore some holes, say a dozen, along both edges of your bent side into the bracings for 4-in. No. 18 screws; and having fitted it to your satisfaction, you can make it warm and glue it down, putting your screws and bolts in as quickly as possible; also glue blocks in behind the bent side to attach to the bracings. Before pulling your strings tight leave a day or two to dry in a warm room. The cause of the soundboard bulging is because the bent side, as it pulled away, pressed it against the wrest plank. If you take out the back of your piano you will find that the soundboard has been forced away (where it is bulged) from the vertical bars crossing the soundboard. You had better run some thin glue in between the bar and soundboard, and put some 1-in. screws in from the front.—T. E.

Piano Alterations.—W. H. S. (*Crieff*).—It is our wish to be courteous at all times, and shall always deem it a pleasure to answer any question submitted to us by our subscribers. Thanks for the pamphlet you sent, and your good wishes for the success of WORK. Your square piano must be a very old one, judging, from the early mechanism of the action, by the sections you sent. It was probably made in the eighteenth century. It would be no advantage to extend the soundboard, but you may fill the cracks up with some dry pine wood and keep it in position by gluing some strips of linen underneath, gluing the cracks at the same time; also put a screw or two through the bridge into the soundboard and try to run thin glue in the opening and draw close. I should think the cause of absence of tone is that the soundboard has sunk, and that the strings have no bearing on the bridge of the soundboard. You can ascertain whether this is the case by laying a string clear of the pins of the bridge, and see if it rests on the bridge when tight; if it does not do so, then your soundboard has sunk. This is a very common occurrence in old square pianos, the bars on the under side of the soundboard not being strong enough to resist the downward pressure, and often they have been strung with heavier wire than the original to try and increase the tone. But heavier stringing would have the reverse effect, pressing the soundboard down. You say you are ingenious, and so, I take it, you have plenty of patience, and don't mind a little trouble. The only way to improve it would be to take the soundboard out, and put a couple of stouter bars on the under side, making them a little round in their length, to throw the soundboard up.—T. E.

Telephone Transmitter.—AMATEUR ELECTRICIAN.—It is a very difficult matter to advise AMATEUR ELECTRICIAN as to the best transmitter, and how to construct it, for the reason that transmitters and receivers are the subjects of so many patents; and although one may make and use a patented article for experimental purposes, it becomes rather risky when made for "actual and continual use." When I wrote the article on the telephone I had this fact before me, and purposely abstained from going into the subject further than the experimental stage. If the receivers which you have made are of the pattern described in the article referred to, you must be careful how you use them, as they are substantially the same as the instrument used by the United Telephone Company, who are the proprietors of the Bell patents. One of the best transmitters, the "Blake," is also owned by this company, and they are very jealous of their rights. So it will be best to give a description of a transmitter which does not trespass on forbidden ground. As all transmitters are simply modifications of Professor Hughes' "Microphone" already described, if you have caught the principle of that instrument I do not think it would be a very difficult matter for you to devise a transmitter which would then be your very own. I have experimented a good deal in this way, and find that almost anything will transmit speech provided of course you have a battery to produce the necessary current and a shaky connection close to the speaker. However, I will give directions for making an excellent transmitter, which may be used without fear of



Telephone Transmitter, section — A, Wooden Piece; B B, Carbon Rods; C, Carbon Cone; D, Head-weight; W W, Wires.

any trouble with the telephone companies. Two instruments of course will be required, and the description of one applies to the other. A little box 4 in. square by 1½ in. deep, and without a lid, is made. The four sides are made of ¼ in. stuff. The bottom, or, as I should say, front, as it becomes the front when the instrument is complete, is made of very thin pine about $\frac{1}{16}$ in. thick. This should be well made, and the sides nicely polished. A small piece of wood ¼ in. thick, shaped like Fig. 1, with a cut down the centre, and of the sizes given in the figures, is also required. The centre cut divides it into two pieces, joined at the bottom, over the tops, and coming down the sides about ⅜ in.; fix with screw or pins two little pieces of sheet brass, shown in Fig. 3, for the purpose of soldering the connecting wires to; two little pieces of ¼ in. carbon rod with a hollow filed in the centre of each to fit tightly over the brass-covered ends of the wood piece; a hole is also drilled in the centre of each carbon to pass a screw or pin through for fastening up to the wood. The shape and size of the carbons are shown at Fig. 2. I prefer to make these carbons from the rough carbon of the gas-works by breaking off pieces and patiently filing them to the required size and shape. Other two small pieces, each provided with a little lead weight, are necessary, and when these are made the instrument is complete. These two pieces are made as small as possible, and cone-shaped like Fig. 3; in each make a cut right round in which to imbed a small fine wire for the purpose of attaching a small piece of lead to serve as a weight so as to ensure a connection between the cones and the carbon rods. Fig. 4 shows the complete instrument in section. The cones rest on the carbon rods, and it is attached to the box by a single screw passing through the front into the small projection shown at B in Fig. 1. After all is complete a piece of paste-board with a small hole in the centre about 1 in. in diameter should be glued over the front to damp the vibrations, as the thin pine vibrates too much, and the sound of the speaker's voice would thus be heard in the receiver a little confused. I hope that with these directions A. E. may be able to make his instrument complete and capable of doing the work he requires. I presume he understands that he will also require call-bells to complete his system, and that all should be mounted on a switch-board. Other information for the necessary connections has been given in "Shop." If anything else is wanted I will be pleased to help. I am glad that you like my article, and that it has been a help to you.—W. D.

Connecting Time Alarum.—L. T. (*Glasgow*).—Following the idea presented in your sketch, and calling the battery A, the bell B, the switch S, and the clock C, connect a wire to the carbon of A, and lead to one of the binding screws on B; from the other screw lead a wire to one of the stops on S; from the pivot of S, lead a wire to the works of the clock, C; from the alarum hand on C, lead a wire back to battery and connect to the zinc element. This will complete the circuit when the switch is on, and the hand of the clock makes contact with the alarum hand. See also replies to ONE IN NEED (*Coventry*) (see page 813, Vol. I.) and IRON TURNER (*Bolton*) (see page 829, Vol. I.).—G. E. B.

Sealing Gassner Cells.—R. L. (*Plymouth*).—The composition appears to be marine glue, but pitch will do equally well for the purpose. Shoemakers' wax will also serve as a substitute, or a mixture of resin and beeswax melted and poured on the top of the cell.—G. E. B.

Electric Light Installation.—NIMO (*Ireland*). This correspondent wishes to light up his house with electric light, employing from 8 to 10 incandescent lights, of 16 c.p. each, fed with current from accumulators, charged by day with current from a dynamo driven by 1½ h.p. engine. As his requirements are probably a type representative of others, I answer the questions in detail. (1) The requirements for current are ten 16 c.p. lamps. Supposing these to be 48-volt lamps, taking 0·8 ampères of current each lamp, 0·8 ampères × 10 lamps = 8 ampères, and 8 ampères × 48 volts = 364 watts of current. As 746 watts of electric current equal 1 h.p. of energy, we shall get ample power out of the engine, even if we allow 50 per cent. loss for power consumed in conversion, resistance of wires, friction, etc. This power would be most economically employed if used direct, without the intervention of accumulators. (2) As accumulators cannot be expected to yield more than 80 per cent. of the power employed in charging them, you would have to charge them for nine hours to get six hours' work out of them in return. (3) As we are about to use 48-volt lamps, we shall need a pressure of at least 50 volts, and this can be supplied by 25 cells, arranged in series, since each cell has an E.M.F. of 2 volts. As these cells will have to yield 8 ampères of current for six hours (equal to 48 ampère hours of current), and 1 square foot of positive plate will only yield 6 ampères of current, we shall need positive plates exposing at least 9 square feet of surface, since the plates will be injured if fully discharged each time. The cost of each cell (D. and G. type) will be about 18s. per cell, or a total of £22 10s. for accumulators. (4) Any good type of ring dynamo, such as the Gramme, Simplex, or Manchester, will serve your purpose. It must yield 8 ampères of current, at a pressure of at least 62·5 volts, if the accumulator cells are to be charged in series, since the charging current must always have a surplus voltage over that of the combined E.M.F. of the accumulator cells, to prevent injurious reversal of current. The dynamo would have to be driven at a speed of from 1,500 to 1,800 revolutions per minute. Mr. S. R. Bottone, electrical engineer, Carshalton, Surrey, will supply you with such a machine for about £15. (5) I cannot exactly tell you what wires you will need. This can only be determined by personally inspecting the premises, engine, etc. The size of main conducting cable will depend upon the distance of the dynamo from the accumulators, and of these from the house. Anything under fifty yards will be served with a cable of seven stranded No. 20 B.W.G. copper wire. Branch wires may be of No. 20 double cotton-covered copper wire. In addition to the wires you will need 1 main switch-board between the dynamo and accumulators (this will cost about £1); 10 small switches, at 1s. each; 10 lamp-holders, at 1s. each; 10 brackets, or pendants, costing from 7s. 6d. each, or upwards, according to style and finish; and a few lengths of safety fuse wire, at about 2s. per lb. Lamps will cost 48s. per dozen. (6) The above-named gentleman can supply all that is necessary, if required.—G. E. B.

Model Telegraph.—C. J. G. C. (*Brighton*).—This subject may be treated a little time hence.—G. E. B.

"Lathes and Turning."—C. J. G. C. (*Brighton*).—If you will kindly refer again to the notice of this book on page 443, Vol. I., you will see that it is not published by the London Lathe and Tool Company, but by Messrs. E. & F. Spon, 125, Strand, W.C. The company publish the little pamphlet mentioned in the same notice.—G. E. B.

Elastic Wheel.—J. S. (*Bristol*).—I am very sorry to say I can afford you no assistance with this. If it is still made, perhaps some of our readers can oblige with name and address of maker, but I think it very likely if you were to inquire of some of the travellers who call on you, you might elicit the desired information.—D. D.

Canada Balsam Cement.—E. H. N. (*Highbury*).—The bottles mentioned on page 503, Vol. I., of

WORK can be procured from any of the leading opticians in London or the provinces, and it would therefore be invidious to mention any one in particular. In reply to the second part of your question, I have tried many cements for the purpose of resisting the action of glycerine and spirit, and find that for glycerine, gold size, or a solution of pure india-rubber in wood naphtha, is the best. For spirit the latter is about the only safe cement, and even that is not very reliable. I find it is best to use spirit as little as possible, on the principle that prevention is better than cure.—A. T. S.

Smoky Chimney.—F. W. B. (*Lancashire*).—If it were possible for me to tell you how to cure the above, I should at once confer a blessing on hundreds of people. There are so many things to be considered, for instance:—1st. Was the chimney properly cored or swept when built? 2nd. Is the opening between the grate and fireplace, or the throat, or that portion of flue directly above the grate, too large, and therefore admitting more fresh air than is warmed? 3rd. Does the flue communicate with another flue? 4th. Is the fire properly supplied with fresh air? 5th. Is the chimney surrounded by high buildings, hills, cliffs, etc., or built against a gable end or other wall higher than the chimney itself? 6th. Can you see the sky when you look up the chimney? I will now give you some methods that I have seen adopted, which have to a great extent had the desired result. I think the simplest way of doing so will be to consider all the above questions apply to your case. 1st. Have the chimney properly swept with the view of removing any obstruction, and not only soot. 2nd. Put a board or a piece of zinc across the fireplace, so as to reduce the opening. Of course this may be as ornamental as you wish. In one slight case, I remember, a deep valance to the mantelboard got over the difficulty, and in another instance (as in yours), where the fire was only occasionally lit, a large sheet of newspaper lighted and thrust up the chimney before lighting the fire to warm the accumulated cold air met the case. 3rd. Close the opening of the other fireplace if not in use. 4th. A small hole through the wall at the level of or under the floor, opening out just above the hearth, and admitting fresh air from outside, behind, or at the side of the grate, would give this; but both the internal and external openings should be covered with a grating. Another but very unpleasant remedy is to leave the room door slightly ajar. A brick cut out of the chimney above the roof in the most sheltered position will sometimes quicken the draught. 5th. This is generally the cause of what we call a blow-down, and the only reliable way I know of is to fix a tall-boy or blow-down cowl in place of chimney pot. I have used R. Boyle and Son's cowls with success in several cases of this description. 6th. A simple zinc or galvanised iron pot with two elbows, just sufficiently bent to prevent you seeing the sky when you look up the flue (the area of the inside of the pot should not on any account be larger than that of the flue), might get over this trouble. I must also state that I have known cases where most of the above methods have failed. There are more elaborate ways of endeavouring to get over this problem, but as you ask for something you can do yourself I hope they will meet your views.—E. D.

Veneer Purchasing.—NOVICE (*Cardiff*).—Write to the following firms, who will quote you for all kinds of veneers:—J. Wright, 51, Great Eastern Street, E.C.; A. Farmer, 49, Austin Street, Shoreditch; W. and J. R. Hunter, New Bethnal Green Road, E.; Maple & Co., Tottenham Court Road, W.; or A. J. Hall, Barrington Road, Brixton, S.W. Have you tried Messrs. Sessions & Sons, timber merchants, Cardiff?—A. J. H.

Turned Articles.—S. S. (*Walmer*).—You can easily obtain the turned parts for any piece of furniture you may wish to make from any cabinet maker. It will not cost you more than if you went to a wholesale house, and you will be able to get exactly what you want. It seems almost a pity, though, not to get a lathe of your own, or to club with other amateurs in your neighbourhood to purchase one for general use. The best wood for turned parts depends entirely on circumstances.—D. A.

Overmantel.—F. D. (*Salisbury*).—Several designs for these have already been given, but though none of them seem exactly what you want, you ought to experience no insuperable difficulty in getting up one to suit yourself if you will carefully study the hints and instructions which have appeared. As some idea of the mode of procedure the following remarks will be of assistance to you. First make your back framing. To this from behind screw the side shelves, which should either be supported on brackets or turned columns at the front corners. Glad to hear you found the construction of your table so interesting, and your success ought to be an encouragement to other amateurs.—D. A.

China and Glass Riveting.—CAROLUS (*York*).—An article on the above subject appeared in No. 53 of WORK. You would probably be able to get the necessary tools, etc., through any good tool shop in your city. If not, write to Melhuish & Son, Fetter Lane, London, E.C., who will no doubt be able to supply you.—D. A.

Polishing.—F. P. (*London*).—If you will kindly refer to the "Shop" columns in our back numbers, you will find that most of your questions have been anticipated by other readers and duly answered. Without knowing something about your mode of working it is impossible to assign the correct reason for your work going dull. If you will let me know precisely how you have polished anything which has not kept its brilliancy I may be able to help you. I do not understand your inquiry about "glazing of the polish." By "glazing" you may intend the technical expression, but from the rest of your letter I am inclined to think you mean rather to ask how to get the brilliant gloss seen on a well French polished surface. This is got by using the spirit rubber. "Glaze" is simply rubbed or varnished on. No doubt the articles on polishing will be of more assistance than any of the already published handbooks, none of which we care to recommend.—D. A.

Glass-Burning Kiln.—VITRÉ.—The kiln I had for burning glass was one of Thompson's patent gas kilns. It consisted of a fire-brick chamber open at one end, but shut in with iron doors, and a small trolley was run into this chamber, upon which the glass was laid; a series of Bunsen gas jets on the two sides of the kiln played over the under side of the top of the brick chamber, and made the bricks red hot, and the heat was then deflected on to the glass, and soon turned it to a bright red heat. Two peep-holes were placed in the iron doors, so that you could watch the glass, and know when to turn off the gas. These kilns are rather expensive, the smallest one costing, I believe, about £30. Small terra-cotta muffles, capable of turning a small quantity of glass at a time, can be bought of Lechertier, Barbe and Co., Regent Street. These are heated with coke, and are comparatively inexpensive. If only a small quantity of glass is required to be burnt at a time, it would be both a saving of trouble and expense to send it to a professional kiln man. The charge is only between 4d. and 6d. a foot for firing.—F. M.

Glass Kiln.—J. J. D. (*Bournemouth*).—A kiln could be constructed of brick with flues, heated from below, and the iron box to contain the glass would be placed in the brick oven but with space at sides, top, and back to allow the flames to play around the box. The front of the muffle (as the iron box is termed) would consist of a movable iron door with a peep-hole in it to watch how the glass is getting on. It would depend upon how much of the work you could do yourself in the way of laying bricks and setting the muffle as to its cost, but by inquiring of a kilnman, such as Tames, 78, High Street, Camden Town, some idea of total cost could be ascertained. Doulton's sell terra-cotta muffles which are better for firing delicate work in than iron and can be fired to a much higher temperature, and these would require setting in brick work as above. Lechertier, Barbe & Co., Regent Street, sell small portable terra-cotta muffles which do not require setting in brick work, but these do not hold very much at a time. If much work has to be fired it would be cheaper to build a kiln. Thompson's gas kilns are very admirable for firing glass. (See answer to VITRÉ above.)—F. M.

Elementary Tool Book.—A GROWING ENTHUSIAST.—The book you should buy is "Cutting Tools Worked by Hand and Machine," by R. H. Smith (3s. 6d.), published by Cassell & Company.—F. J. C.

Future Subjects.—H. R. (*Manchester*).—The subject you mention will be fully treated in WORK as soon as some of the present papers are completed. From time to time further supplements will be given.—ED.

Carpentering.—E. C. S. (*Stoke Bishop, near Bristol*).—Papers on dovetailing (*i.e.*, jointing wood) are in preparation, as well as some on sash-making, for this volume.—ED.

Photographic Appliances.—CONSTANT READER (*Somerset*) will be able to procure all he requires from most apparatus manufacturers, or from Henry Park, 1, Orchard Buildings, Acton Street, Kingsland Road, London, E., who advertises to supply any parts of photographic apparatus.—E. D.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Flux for Solder.—H. J. (*Bristol*) writes:—"If BLOWPIPE (see page 732, Vol. I.) finds he cannot succeed in making a flux for soldering by the use of borax, the simplest and best way of getting out of the difficulty is to purchase a bottle of soldering fluid prepared especially for silversmiths, which he can obtain of H. Isaac, 32, Trinity Street, Leeds, at 6d. per bottle."

Varnish for Pipes.—C. W. B. (*Plymouth*) asks:—"Will any one kindly inform me of the most approved varnish for meerschaum-washed clay pipes—also for 'torrified'—and the method of procedure?"

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. W. F. (*Mansfield*); W. S. (*Appleby*); C. H. L. (*Lancashire*); J. M. H. (*Wallsend-on-Tyne*); T. F. F. (*Bower Park*); A. R. (*Haslingden*); A. G. C. (*Tottenham, N.*); A. F. (*Stockbridge*); ONE OF YOUR REGULAR SUBSCRIBERS TO "WORK"; WOOD WORKER; J. S. (*Sheffield*); C. S. (*Glasgow*); E. J. B. (*Burton-on-Trent*); H. N. C. (*South Norwood*); ONE IN A FIX; L. W. H. (*Liverpool*); C. E. T. (*Liverpool*); A. D. (*South Hackney*); X. E. A. (*Sheffield*); W. S. M. (*Leeds*); E. W. (*Peckham, S.E.*); L. J. P. (*Wellingborough*); PLUMBER; A. M. (*Hull*); A. K. (*Glasgow*); A. P. (*Girvan*); E. R. B.; J. F. (*Elgin*); J. D. T. (*Leeds*); F. H. A. (*India*); G. E. A. (*Newport*); W. A. (*Shildon*); JOE (*Liverpool*); A. B. (*Battersea Rise*); H. B. (*Chatham*); W. E. (*Launceston*); W. H. S. (*Salford*); VILLAGER; J. J. M. (*Ebbw Vale*); R. W. (*Pontefract*); N. H. (*Rainhill*); THEO; W. D. (*Newcastle-on-Tyne*); J. L. (*Carlisle*); C. (*North Shields*); LLEWELLYN (*Camelon*); ONE WHO IS NOT A SMOKER; WORKER BEE; H. C. (*Notting Hill*); ENGRAVER; J. F. (*Elgin*); AN ADMIRER OF "WORK"; W. P. (*London, E.C.*); W. H. C. (*Tipton*); J. R. C. (*Bacup*); T. D. P. (*Dalston*); ALPHA; PARK AVENUE; W. P. (*Southport*).

Trade Notes and Memoranda.

IN the exhaustive Chinese report referred to in WORK, page 750, Vol. I., we have summaries of the numbers of members belonging to the unions, the contributions per head, the percentage of members on unemployed, sick, and superannuation benefits, and the amount per head of membership paid for these several benefits. Then follow detailed tables of particulars of the different societies' reports, which occupy the bulk of the book; also tables showing the causes of death with average ages, and the kinds of accidents and diseases for which benefits are paid by certain unions. An appendix of extracts from the latest annual statements of certain unions completes a bulky and by no means dry volume of 262 pages full of interesting facts for working people. What a contrast this government report affords to the time when combinations of artisans were illegal and punishable with imprisonment!

A SENSIBLE decrease of the natural gas issuing from the earth in the region of Pittsburg, U.S., has lately been spoken of. But it must be insignificant, since there are figures published to show that, in Pittsburg alone, there are 500 miles of main for conveying the natural gas. These supply 37 glass-houses, 40 iron factories, 83 foundries, 450 other establishments, and 4,268 private houses. The annual amount of gas consumed is represented as being equivalent to 7,000,000 tons of coal.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [6 R

Complete Fount of Rubber Type.—Two alphabets, to form any word or name, box, pad, ink, and holder, post free, 1s. 6d.; extra alphabets, 6d. per set; figures, 3d. Business, address, and pocket stamps equally cheap.—W. C. PRESTRIDGE, Manufacturer, Cumberland Street, Bristol. Established 1870. [2 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [3 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

"Roll Call" Pipes.—Healthful, Luxurious, THIRSTLESS Anti-nicotines. Briars. Post free, 1s. 8d.—ALLEN DEWSNAP, 65, Pikes Lane, Glossop. [5 R

Materials for Violin Making from BRIGGS and TARR, Violin, Violoncello, and Double Bass Makers, Commercial Street, Leeds. [7 R

Bead Planes, all sizes to ⅝ in., 2s.; ¾ in., 2s. 2d.; ⅞ in., 2s. 4d.; 1 in., 2s. 6d. Carriage paid.—CLARKE, Tool Maker, Exeter. [2 S

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields, etc. Each packet, 1s. 100 Decorator's Stencils, 2s. 6d. All post free. Lists free.—F. COULTHARD, East Cliff Terrace, Bournemouth. [3 S

Model Work.—Castings, parts, models, screws. Catalogue, 95 illustrations, 4d.—BUTLER BROS., Bentham Road, South Hackney, London. [4 S

The "Postable" Floral Tripod (see WORK, Jan. 25th), post free, 1s. 6d.; pair, 2s. 9d. Bamboos supplied.—S. J. EATON & Co., 3, New Inn Yard, Tottenham Court Road, W. Agencies granted. [1 S

Notice.—We take in Exchange Lathes and various tools for better. Catalogue, 6 stamps. List of Second-hand, 2d.—Britannia Co., Colchester.

Largest Stock of Engineers' and Mechanics' Lathes, Shapers, etc. Stocks and Dies. Forges, etc.—Britannia Co., 100, Houndsditch, London.

Call and select from our stock at 100, Houndsditch; but all letters addressed Britannia Tool Factory, Colchester.

Britannia Co. supply Gas or Steam Engines, and fit up workshops complete. Terms, Cash or easy terms. [8 R

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

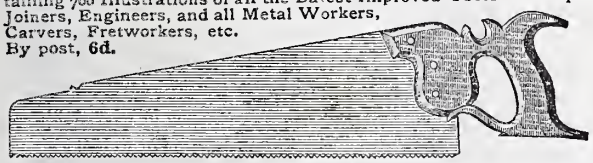
These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

TOOLS. *Buy from the MAKERS, the Oldest Established and the Best House in London.*

NOTE.—Our New Illustrated 200-Page Catalogue is now ready, containing 700 Illustrations of all the Latest Improved Tools for Carpenters, Joiners, Engineers, and all Metal Workers, Carvers, Fretworkers, etc. By post, **6d.**



OUR NOTED CAST-STEEL HAND-SAWS.

16 in.	20 in.	24 in.	26 in.	28 in.	Rip or Half Rip.
3/9	4/-	4/9	5/-	6/6	CARRIAGE PAID.

NOTE THE ADDRESS:— **MOSELEY & SON, 323, High Holborn, W.C.**

THE TAM O' SHANTER HONES

Are Praised by all Classes.

Try one of these famous Hones. No clammy oil required in sharpening; use water. Prices, uncased, for Knives, Razors, Plane Irons, Axes, &c., from 9d. to 1s. 6d. each. In neat cases, 1s. 6d., 1s. 9d., 2s., and 2s. 6d. If sent by post 3d. extra, and 4½d. for Joiners and heavy Hones at 1s. 6d., uncased. *To be had at the Ironmongers', Seedsmen, Nurserymen, &c. If they cannot be obtained there, write direct to*

JOHN C. MONTGOMERIE,
Hone Works, Dalmore, Ayrshire.

Monthly, 4d.

CASSELL'S

TIME TABLES.

WATERPROOF FLUID GLUE.

(Patent.)

By post, **1s. 3d.** *and* **8d.**

WATERPROOF GLUE CO.,
62, Dale Street,
LIVERPOOL.

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

MASON'S WINE ESSENCES.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER.

These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of Mason's Extract of Herbs makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a Bottle of each for 16 stamps.

NEWBALL & MASON, Nottingham.

Agents Wanted.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

RUBBER STAMPS.

H. SAVAGE, Manufacturer and Patentee.

Rubber Stamps, Rubber-faced Type. The "Climax" and other Dating Stamps. Patent Ink Pads, &c. &c.

Makers of Boxes, Mounts, Presses, Vulcanizing and Moulding Machines, Brass Turned Ovals and other Shapes.

MATERIAL and all Supplies for the Trade. State your requirements to

H. SAVAGE, 33, CHEAPSIDE, LONDON.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.
37, CHANCERY LANE, LONDON, E.C.

Post free on application.

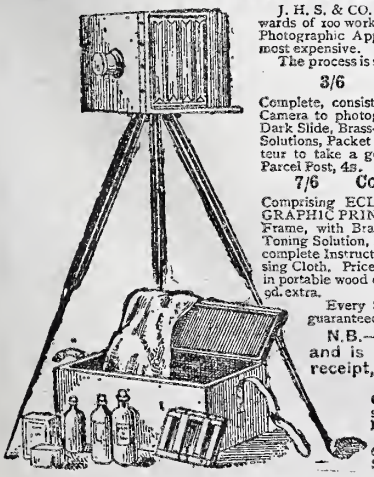
CASSELL'S CLASSIFIED CATALOGUE.

J. H. SKINNER & CO., EAST DEREHAM, NORFOLK,

MANUFACTURERS AND IMPORTERS OF

PHOTOGRAPHIC APPARATUS AND FRETWORK MATERIALS.

Timber Yards, Sawing and Planing Mills covering about Two Acres near Railway Station.



J. H. S. & CO. have now a large Factory with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description, from the cheapest to the most expensive.

The process is simplicity itself. Full Instructions supplied with each set.

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

Every Set is carefully examined before being sent out, and guaranteed to be in working order.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase money.

Better Sets, 10s. 6d., 21s., 42s., 100s., and upwards. Complete Catalogue of Photographic Apparatus, one stamp. J. H. SKINNER & CO., EAST DEREHAM, NORFOLK.

Wholesale Agent for London—J. MOTHERSILL, 60, Holloway Road, N., and 6, Southampton Row, where Samples may be seen.

J. H. S. & CO. keep regularly in stock about **120,000 FEET OF FRETWOOD,** solid and 3-ply, veneers, &c., besides a very large quantity of Logs, Planks, and Boards, Carving and Turning Wood, &c., and **200,000 FULL-SIZE DESIGNS for Fretwork, Wood Carving, &c.,** besides an immense Stock of Joiners' Tool Chests, Fretwork Outfits, Drills, Saw Frames, Hand and Treadle Machines, Saw Blades, &c. &c.

Specialities for 1888 & 1889.—Books of New Designs, FRETWORK No. 1, containing 12 Large Sheets, price 1s. No. 2, containing 20 Sheets of larger and more elaborate Patterns, 2s. 6d. Book of Wood Carving Designs, containing 14 Patterns, price 1s.; these are all New Patterns, not sold in any other form, and would, if sold separately, cost three or four times the amount charged. Fretworker's Handbook and Workshop Guide, price 1s. New Designs. All Patterns greatly reduced in price.

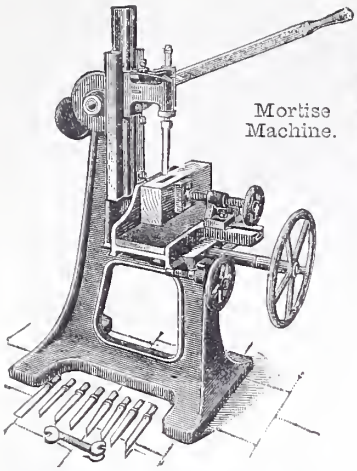
Complete Fretwork Outfit, comprising 12-inch Steel Frame, 48 Saws, Awl, File, 4 Designs (with sufficient planed Wood, gratis), and 1s. Handbook on Fretwork, price 3s. 6d., carriage paid. 12 feet Assorted Planed Fretwood, 3s. 6d.

☞ Special Fretwork Design, in commemoration of Her Majesty's Jubilee, size, 30 in. by 26 in., price 2s. 6d.

JUST PUBLISHED, NEW CATALOGUE of Machines, Saws, Designs, Wood, &c., 56 pages, 600 Illustrations, with Instructions, 4d., post free. Good Fret Saws, 1s. 4d. per gross; best ditto, 1s. 9d. per gross.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.



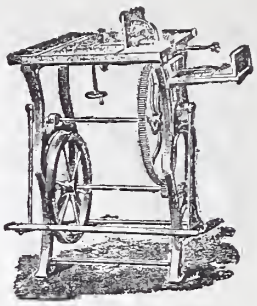
Mortise Machine.

We Recommend our

PATENT SAW.

It will do TWICE the work of other Treadle Saws.

We Supply CASTINGS, FORGINGS, &c., for Lathes—for Amateurs to fit up their Own.

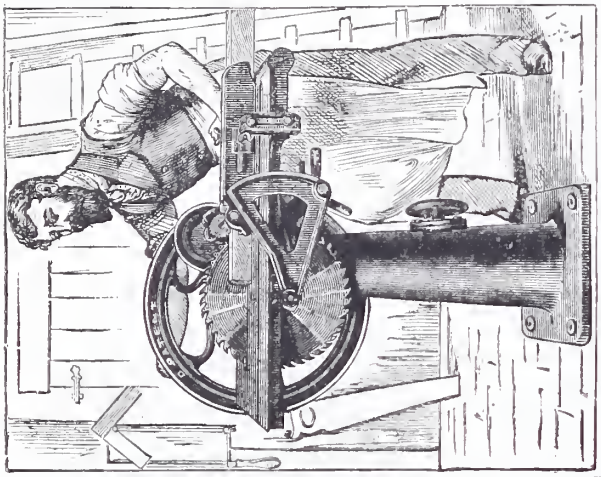


Patent Saw.

BRITANNIA CO.,

100, HOUNDSDITCH, LONDON.

ALL LETTERS—BRITANNIA CO., COLCHESTER.



"THE LEYTON"

New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

FRETWORK AND CARVING.

Highest Award—Gold Medal for Tools and Patterns.

Machines, Designs, Tools, Wood, Mirrors, Hinges and Fittings, Varnish, etc.

T. N. writes:—"I got a First Prize from one of your Designs."

R. W. A.:—"Received your Catalogue today, and consider it the best I have seen."

R. B. M.:—"Machine to hand, am highly pleased with it."

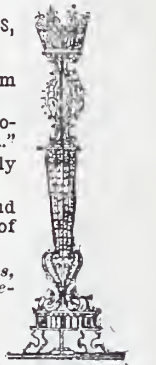
J. A. S.:—"I have taken Eight First and One Second Prize with various patterns of yours."

Illustrated Catalogue of all Tools, Wood, etc., and 500 Miniature Designs, free for Six Stamps.

NO. 731.

OCCASIONAL TABLE SIZE 26½ X 15 INS.

NO. 730.

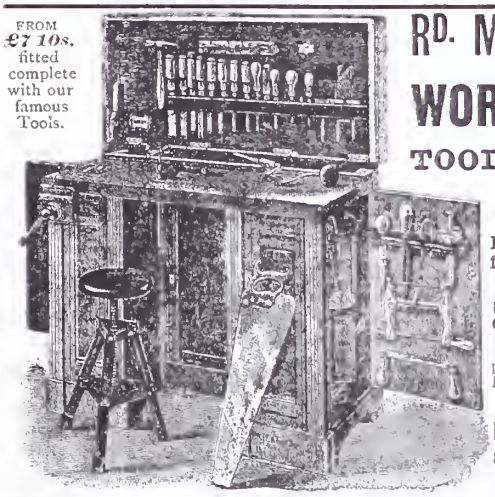


FLOWER OR LAMP STAND, SIZE 44 X 12 INS.

Harger Brothers,

SETTLE, YORKS.

FROM £7 10s. fitted complete with our famous Tools.



RD. MELHUISH'S PATENT WORK BENCH AND TOOL CABINET.

Illustrated Lists Free by Post.

Excellence of TOOLS for Wood Carvers and all Metal Workers.

Bronze Medal - 1884.
Gold Medal - - 1890.

We hold the most complete Stock of Tools and Hardware in this country.

RD. MELHUISH & SONS,
84, 85, 87, Fetter Lane,
LONDON.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic WEAKNESS speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be Healthy and Strong permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place).

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

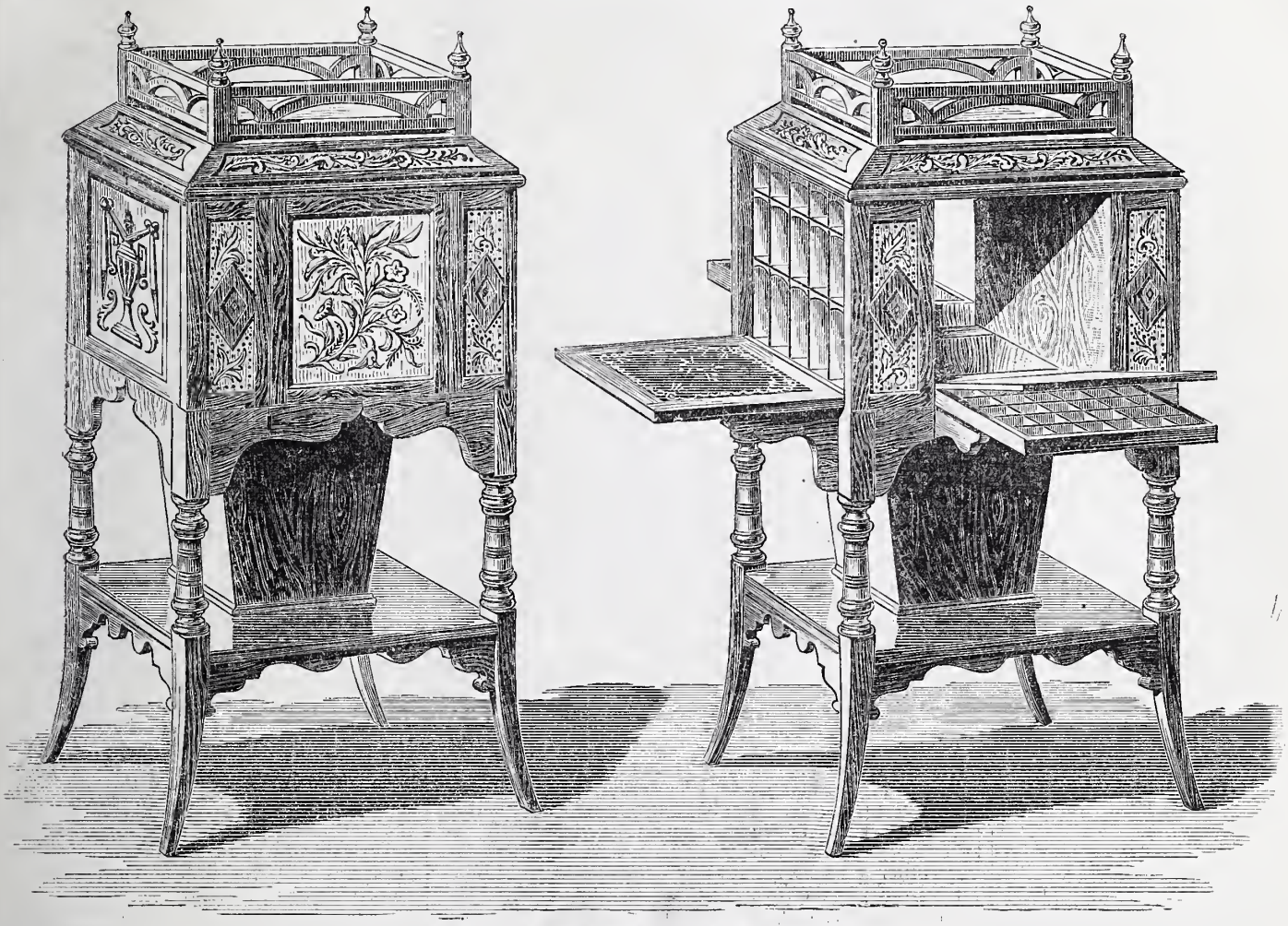
WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 56.] SATURDAY, APRIL 12, 1890. [PRICE ONE PENNY.



A LADIES' COMBINED WORK TABLE AND ESCRITOIRE.

Fig. 1.—Work Table and Escritoire shown when completely closed. Fig. 1 A.—Work Table and Escritoire shown when fully opened.

A LADIES' COMBINED WORK TABLE AND ESCRITOIRE.

BY JAS. SCOTT.

[*For other Diagrams and Working Drawings illustrative of this Paper, see page* 53.]

WE must not forget the ladies in WORK. Although it cannot be called, and is not meant to be, a ladies' journal, I daresay there are very few among its readers who are not possessed of either a wife, sister, or sweetheart; and I know that young ladies generally, if they may think some of the periodicals their male relatives are in the habit of reading are rather too dry for *them*, always have a wish—which they seldom let remain unsatisfied—to look over the illustrations, and pass their opinions upon them.

It is with this in view that I give to my readers this week something that is essentially a ladies' article; and I hope that it may find favour in the eyes of some fair—or, for the matter of that, dark—lady, who will successfully persuade her husband, brother, or betrothed, as the case may be, to make one for her; and what man is there who would not make, when it lay in his power, at least one heart happy?

This article has what designers generally term a "busy" look about it; but there is not very much work in it, considering the several uses to which it may be put. On one side we have a door that forms a writing-flap, and pigeon-holes for stationery; on the opposite side there are twelve small drawers, which will be found very handy for keeping small articles in; on another side is a box which is intended as a receptacle for reels of cotton, and which shuts up flush with the sides of the article; and on the opposite side to this there is still another box, which is divided into compartments, as shown in Fig. 5. In the centre there is a well to hold loose pieces of needlework, etc. The top, being flat, affords a nice place for the display of a vase of flowers or a globe of fish; and if the lady's skill is also brought into the work, a pretty and useful article should be the result.

Those among the beginners who have a knowledge of joinery sufficient to enable them to put together small articles, but who do not feel confident enough to try their hand at such a job as is here shown, should read the excellent articles given in various numbers of Vol. I. by Mr. Adamson.

In dealing with the making, we will take the top part first. Fig. 3 shows how the middle board must be cut to allow the

movable brackets to fit in; and it will be noticed that the two which support the writing-flap are hinged to the leg block; while those that support each of the two side boxes are cut in half; one half being fitted under the middle board and against the leg block, and the other half being hinged to it. On the side of the drawers there is no need to cut any away; but on the opposite side, where the writing-flap comes, it will be necessary to cut it away the whole length. From each of the other two sides a piece 12 in. in length must be taken off.

The blocks of the four turned columns that fit into the corners are each 1½ in. square in thickness. In the centre is a space 12 in. square. The two large brackets are each 10 in. long, and the four smaller ones 6 in.

Fig. 2 gives the plan of the top carcase. The two boards forming respectively the back of the drawers and pigeon-holes will each be 23 in. long and 15 in. high. The four ends to be attached to these backboards will each be the same height, and 5½ in. wide. In Fig. 7 we have the half-elevation of the pigeon-holes for stationery. Each of them will be about 4 in. wide: the top holes will be 2½ in. deep, those in the middle 5½ in. deep, and the bottom ones 6½ in. The partitions dividing them would be substantial enough if made of ¼ in. wood; and they should not come flush with the front, as ½ in. space must be allowed for the writing-flap. On the opposite side the drawers will, of course, come flush with the front, and the partitions dividing them might be either ⅜ in. or ½ in. thick. The top drawers will be 2¼ in. deep—if the divisions are ½ in. thick; the second row 2½ in.; the third row 3¾ in.; and the bottom row 4 in. Some, however, may prefer them all one size; and it will not be a difficult matter to reckon the size of each, if so. They may be fitted with knobs or brass handles; knobs are preferable if made in light wood, brass handles if made in dark wood. Each one might have a small lock, one key fitting them all.

The top board should be a trifle more than 23 in. square, and should be rounded on the edges.

The board to which the top fretwork framing is attached should be 18 in. square. The four side-pieces should each be 23 in. long on their bottom edge, and 18 in. long on their top edge. They may be any width, the top, of course, being raised or lowered according to the width. The four corner posts should each be about 3½ in. high, and should be surmounted by turned ornaments. The fretwork may be of any pattern.

We now come to the reel box and its opposite companion. The reel box will be 12 in. wide, 15 in. long, and 2½ in. deep. These measurements include the lid. The size of the compartments is quite optional. Two small fastenings should be fitted to it: one to secure the lid, the other to secure the box when flush with the side. Fig. 4 shows the elevation of it. The box on the other side (Fig. 5) might be the same size exactly, and similarly fitted as regards fastenings.

Unless these two boxes are made to fit rather loosely, it will be advisable to make the front, which comes in contact with the top board, either on the cant, as in Fig. 12, or rounded, as in Fig. 13, as the boxes will then work in and out the easier. If the maker wishes to do away with the fastenings on the lids of these boxes, he had better fix a strip of wood across each side of the large opening, so that when they are in a perpendicular position the lids will not fall down inwards.

The writing-flap will be 22 in. long and 15 in. wide. This, and the two boxes, should be secured by means of a pivot at each end, which is driven into them and through the side pieces. If, however, the maker would prefer hinges, he *must not cut the board* (Fig. 3) *at the edges*, as I have shown. They should then come flush with the pillar blocks, and thus can receive the hinges. In this case the brackets should be the same make and shape, and should be fastened *under* the middle board: it will then be found that the two boxes and writing-flap will be on the slope when resting upon them, instead of quite horizontal, as I show them. This may be an advantage in the case of the writing-flap, and, perhaps, may be preferred on account of its allowing the introduction of a moulding round the edge of the middle board, which can scarcely be placed round it if the flap, etc., work upon pivots.

The bottom of the well will be 9 in. square; the top, 12 in.

The height from the floor to the top of the pillars will be 28 in. According to the depth of the well so will the length of each foot be. These feet spread out from each corner. The most convenient depth for the well will be 16 in., and whatever the depth agreed upon, the size of each of the four or five boards composing it can easily be ascertained. I say four or five, because, if joined into the bottom board, only four will be required; whereas, if made as a separate box, it will require five boards. If the depth I have given is decided upon, each of the four sides will be 17½ in. long, 13 in. wide on top, and 10 in. wide at the bottom. A narrow moulding should be glued round the bottom of it, to add a finish to it, and to hide where it joins the bottom board.

The four shaped pieces between the feet need little commenting upon. It is surprising what a pretty effect such pieces produce upon any article of furniture in which they are properly introduced.

Fig. 8 shows the shape of each of the four small brackets, if it is intended for the boxes to work upon pivots. The larger portion of it should be secured to the pillar block and the under side of the middle board, while the smaller portion is hinged to it. In my measurements I have allowed sufficient for joinery. The large top, middle, and bottom boards might each be ⅝ or ¾ in. thick, and the remainder of the carcase ½ in. thick.

I should not advise castors to be fastened to the feet, as in that case it would be rather unsteady when used as a writing-table. The writing-flap is certainly not very large, but certainly the average young lady would prefer it to be small.

For the ink-bottle and pen-rack there is plenty of room, or spaces could be purposely made for them.

I said at the beginning of this article that a pretty job might be made by the addition of the skill of the young lady for whom it is intended. The reel spaces might be lined with silk, satin, or plush, and the compartments shown in Fig. 5 might be treated in a similar manner. Then a few pieces of satin, silk, or ivorine might be painted upon, and secured to the top and sides by means of plush-headed or brass-headed studs. The lining of the writing-flap could also be performed by the lady. The front of the flap as well might have a few flowers painted upon it, and a few gilt lines round it; so also could the fronts of the boxes.

Then, again, if she is fond of colour, she might use some pretty enamel to paint the whole article in; but some judgment must be used in selecting the colour or colours, as the job would, in my opinion, be less effective if in any very dark colour; whereas, the light and shade to be obtained by the use of a light and not too glaring enamel might produce a pretty effect. It will generally be found that articles that have much curved shaping about them look well in dark colours, by reason of the light reflected upon the prominent parts; but that in things that have a square appearance, if made in a light wood or painted in a light colour, the shadows that are thus cast effect a happy contrast; and although it seems paradoxical, a happy contrast is a happy harmony.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

MODELLING.

MODELLING IN CLAY—THE MATERIAL AND ITS COST—PREPARATION—KEEPING IT IN ORDER—HOW TO TREAT IT WHEN THE MODEL IS MOULDED—CARE OF CLAY WHILST IN THE MODEL.

IT may be said of modelling that it is the exact reverse of carving. The carver cuts down to his form, and perfects it by clearing away all superfluous material; the modeller, on the other hand, builds up to his form, and perfects it by adding material wherever required. And this essential difference it is well for the young modeller to bear in mind, for the beginner, especially if in any way used to handling the chisel, will feel tempted to use his tools in cutting his material into form rather than to use his thumbs in building it gradually up. This temptation will have to be resisted.

Various materials have been used for modelling, but of these the most important, and the one with which we have to deal at present, is clay. The best clay for the purpose is generally considered to be Devonshire pipe-clay. This certainly has all the qualities that a reasonable modeller can desire. It is—what is of the first importance—highly plastic, yielding readily to the touch; its cool grey colour is pleasant to the eyes; it is cleanly; and it is in most places to be procured readily and cheaply. Any tolerably pure clay will, however, serve the modeller's purpose, and some workers prefer clay which, owing to the presence of iron, has a warm brown tone. This is merely a matter of taste.

As dug from the pit, no clay is fit for use. It needs to be tempered and prepared. If the modeller buys his clay in the rough, his ordinary plan is to lay it on a strong table or bench, and thoroughly beat it with an iron bar, picking out as he does so all stones and other foreign matters. Some persons sift a little fine sand into the clay during beating to make it work more freely, and if the modelling is to be on a large scale, this is an improvement.

On the wharves of most of our large towns clay is to be bought in the rough at, say, thirty shillings or forty shillings per ton; but most modellers buy it ready prepared. In this state it is to be bought at potteries, pipe-makers', and plaster figure moulders' by the pound; a penny a pound is often charged for it, but by the hundredweight the price is much lower.

For use, the clay should be so soft as to be easily moulded into any shape and spread out smoothly by the thumb, but it should not be so soft as to be sticky. If clay is too soft, exposure to the air will

soon dry and harden it sufficiently; if any lump should be a trifle too hard, two or three holes may be punched in it with the finger and filled with water, and a wet cloth wrapped round it. This will soften it in a few hours; but if clay should be found much too hard, the better plan is to break it up in small pieces, soak it for a time in water, and then beat it up again as at first. Not otherwise will it be brought to that regular consistency of softness throughout which is essential to proper modelling.

That it may always be ready for use, some arrangement is necessary for keeping the clay moist. If the modeller works on a large scale, he will do well to have a bin made of stout boards, lined with zinc soldered together at the corners, and having a tightly-fitting lid. For work on a smaller scale, a glazed earthen pan with a lid answers the purpose admirably. A pan known as a "bread pan," capable of holding enough clay for a bust, is sold at earthenware shops for about two shillings. If the lid fits well, a very little water in the bottom of the bin or pan will keep the clay in proper working order for months.

Should clay be allowed to become perfectly dry, it can be soaked again with water, but it will then crumble down to a kind of mud, which will seem for the time to have lost its cohesive properties. It will need drying to some extent, and after that quite as much beating and tempering as at first. It is, therefore, better not to let clay get quite dry, if it can conveniently be kept moist.

In my preliminary sketch I mentioned that when the plaster mould had been taken, the original clay model was dug from it and thrown aside; but by this it was not intended to imply that the clay forming that model was of no further value. Clay is not only none the worse, but decidedly the better, for having been used. The tempering it receives in use makes it work more smoothly and freely than new clay. When dug from the mould, however, it will not be fit for immediate use: it will be too hard. The best way of treating it is at once to break it up into pieces of, say, the size of walnuts, and put water to it. After due time for soaking, it will need beating up again, but it will want less tempering and work better than if it had been allowed to get quite dry; and as in the process of casting more or less lumps and chips of plaster are sure to have found their way into it, these should be carefully picked out. And at this point I would wish to impress upon the young modeller the necessity for always having his clay thoroughly beaten and tempered; if it has in it hard lumps and is not of a regular consistency, it will not be possible for him to work smoothly, rapidly, or pleasantly.

Some readers of these papers, desirous of obtaining an insight into the actual process of modelling, may, perhaps, consider that the mere management of clay is being dwelt upon to a tedious extent. It is, however, necessary that this information should be given; and for convenience of reference it is better that it should be given altogether in a preliminary chapter like the present. Such readers can, if they like, pass on to the next chapter, and turn back to this by-and-bye, when they find a need for the information contained in it; for before closing it we shall have to follow the same subject still farther.

Something must be said with regard to the management of clay in the actual model. The necessity for keeping it wet has already been spoken of. At the first building up the clay model does indeed rather need drying than damping, and has to be left uncovered for a space in order that it may set. But after this, which takes but a few hours, more or less, according to the size of the model, wet cloths have to be kept over it, except during the time that the modeller is at work; and should this be for long together, a moistening now and then will be desirable. For throwing water over a model, some sculptors use a syringe having a rose pierced with minute holes. This is necessary for works of very large size; but for busts and works on a less ambitious scale, this sprinkling can best be done with the instrument of Nature's providing: namely, the mouth. Nothing blows a cloud of spray so fine as to thoroughly moisten all the surface without running off in streams as the mouth. The plan is to fill the mouth with water, and blow it out through a small opening at the middle of the lips; the knack of doing this is easily acquired. The uncleanliness of the practice—if it be uncleanly—is a thing that one soon ceases to notice.

Before the modeller leaves his work he wraps it in wet cloths. In the earlier stages it matters little what these cloths may be, or how they are put on; but as the work progresses he puts tolerably fine calico nearest to the clay, keeping his thick coarse hempen wraps outside. As more delicate work is put in, and the surface receives greater finish, he does not care to have his model touched by any cloth whatever. His ordinary plan for its protection is to stick wooden skewers into those parts where there is no delicate modelling to be injured. By these the cloth is kept away from the clay: spots are always to be found where the skewers will do no harm; and the holes made by them are easily stopped before casting.

Sometimes, instead of skewers, a regular frame of wooden spars or of wire is made to fit over the model, and if the work has to be kept in the clay for a long time, this plan has its advantages; but wood is better for such a frame than metal, for when exposed, as it must be, to constant damp, iron wire rusts and iron-moulds the cloths, and copper grows green and poisonous. For busts and the like, a large frame covered with oil-cloth to fit over the inner wrappings is an excellent thing, and thus protected, the model may be kept in good working order for months, and even for years.

There is another way in which models in relief may be kept damp, and that is by working them on a background of plaster; but this is only applicable to medallions and other small matters which are but little raised from the background. The highly porous nature of plaster enables it to take up a great deal of water, and of this the clay will suck enough to keep it sufficiently moist for a reasonable time without wet wraps.

A minor point in connection with the keeping of clay in models is that of avoiding fungoid growths. To this end it is well that wherever wooden supports are used in the clay they should be of the pine or deal kinds. These resinous woods do not encourage the growth of fungus as do elm and most other timbers, and such growths in one's model are, to say the least, disagreeable things; though it must be admitted that in this country they do not become so formidable as they sometimes do in Italy.

Thus far then with regard to the material used in moulding. In my next paper I will describe the tools and appliances used in the work.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

THE "APIS" HIVE.

In designing a hive which was to be a standard form for my own apiary, and which, for want of a better name, I call the "Apis" Hive, I was governed by the following considerations. It should be capable of taking ten standard frames, and a dummy or zinc queen excluder; it should have double walls all round; the floor board should be movable, to allow of easy cleaning, the alighting board should be very broad and extend down almost to the ground. It should be suitable either for doubling or supering, the roof being able to hold a super-crate without any riser. The porch should be ample, and afford a good protection to heavily-laden workers returning home from foraging in showery weather, and it should be provided with a gutter, to prevent the water from dripping on the alighting board. The roof, as I said, should be deep enough to take a single crate of sections, and be high-pitched, so as to throw off the rain rapidly, and not let it lodge and soak into the wood. Finally, the whole should be within the capabilities of a moderately clever amateur: that is, not very difficult to make. Fig. 1 is a fairly correct view of my hive complete. The floor is nailed to two 9-in. boards placed on edge, and the alighting board is secured to the same. The brood-nest rests on the floor, and three slips of wood keep it in place. The porch and slides are secured with a couple of brass screws, so that they can be removed for doubling; the entrance way is cut out of the thickness of the bottom, so there is no space to fill in the upper of the doubled hives.

The hive, I think, is a good one, and fulfils all that I require of it.

Now to proceed to its construction. First, as to the wood required. Yellow pine would certainly be the best, but it is fairly expensive, and on that account would be beyond the pockets of some; next comes red deal; and last, perhaps, white deal. In any case the wood should be quite dry and seasoned. *For the brood-nest* the following pieces will be required: viz.—2 pieces, 17 in. × 8½ in. × ⅝ in.; 4 pieces, 17 in. × 9 in. × ⅝ in.; 2 pieces, 20¾ in. × 9 in. × ⅝ in.; 8 pieces, 17 in. × 1 in. × ⅝ in.; 8 pieces, 7 in. × 1 in. × ⅝ in.; these are all finished sizes. I begin with the brood-nest, because it is the principal foundation from which all our other dimensions must be taken. Its internal measurements, when complete, will be 17 in. × 14½ in. × 8½ in., thus allowing ¼ in. at each end of the standard frames, and the thickness of the top bar under them, for bee-way.

I may here remark that it is almost as quick and as easy to make two or three hives as to make one, all the pieces can be cut out so easily in duplicate; the planing can be done so rapidly when the hand is in, and the gluing and nailing of two is not a much longer job than of one. With regard to planing, it cannot be done too particularly. It is not enough to have the surfaces smooth, they must be true also; and to secure this, I generally finish them with the long trying plane. The wood should also be planed to a uniform thickness of ⅝ in.; the ¾-in. boards of commerce will, with care, clean up to this thickness.

Although I have given the dimensions of the various pieces as they will be required

when nailing together, yet they will not be prepared and cleaned up in those short pieces; for instance, the two pieces 17 in. × 8½ in. × ⅝ in. would be left in one until they were planed, and if two hives were in course of construction, four such pieces, measuring something short of 6 ft., could be manipulated at once; so with the others.

Taking now the board which forms the first item in the list: when planed, it will measure 8½ in. × ⅝ in. × 34¼ in., the extra quarter inch in length being allowed for cleaning.

Run the marking gauge along one face ⅜ in. from the edge and bevel down to the mark, leaving somewhat less than an eighth of an inch flat on top, then cut the piece in two, 17⅛ in. long.

Now make out the four pieces, 17⅛ in. × 9 in. × ⅝ in., and the two 20⅞ in. × 9 in. × ⅝ in., these being without a bevel, and being each ⅛ in. longer than the finished sizes.

Next take the bevelled pieces, lay them on the bench with the bevels up, have the strips 1 in. × ⅝ in. in readiness, a pot of good hot newly-made glue, a packet of joiners' brads 1 in. long, a sprig-bit to suit, and a hammer. Give a good coat of glue to the flat piece below the bevel or to one side of the strip, lay the latter on the board, with its edge to the lower angle of the bevel, rub it up and down two or three times to spread and press out the glue, put a few sprigs into holes previously made, and nail the strip to the board. Nail another strip with equal care to the lower edge of the board, and when this is done, nail short pieces at the ends, fitting them in nicely and gluing them well, so as to make a trough ⅝ in. deep, which should be water and air tight.

Do the same with the other bevelled piece, and when the glue is dry clamp the two together face to face, and, with the trying plane set fine, true off the ends square, both to the faces and edges. Then the slips may be anointed with glue, the pieces 20⅞ in. long laid on, with their lower edges on a level with the lower edges of the bevelled pieces, and projecting equally at each end, and nailed first with a few 1 in. sprigs, and afterwards with 1½ in. sprigs placed about 3 in. apart.

Two of the 17⅛ in. × 9 in. × ⅝ in. should also have strips nailed round them, even with the edges, and other boards 17⅛ in. × 9 in. × ⅝ in. nailed over them again in such a way as to form complete, closed in, air-tight boxes. These should be clamped together and the ends cleaned off true with the trying plane, as before; the length ought to be made 17 in.

If we treat the four hollow planks thus formed as the sides of a box, we shall have the brood-nest made. The longer boards attached to the bevelled pieces form a sort of rebate, into which the front and back fit nicely. The ends and rebates should be glued freely, and nails driven both from the sides and from the back and front.

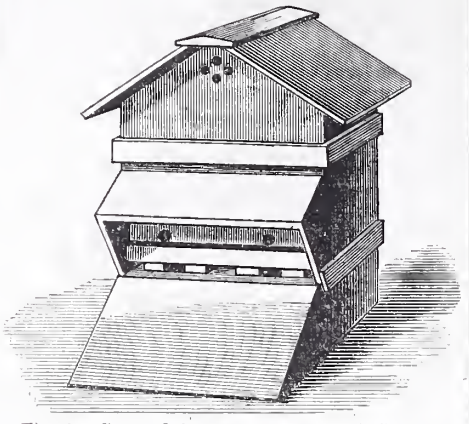


Fig. 1.—General Appearance of "Apis" Hive.

These latter will require to be 2½ in. long at least, and should be carefully bored for. Fig. 2 shows the brood-nest at this stage. I there show the plan which I sometimes adopt in fastening the parts together with round-headed screws having washers under their heads.

Of course, I need scarcely say that the brood-nest should be quite square, and that it should not be in winding, but sit flat and true on a perfectly level surface, which we hope to make of the floor board presently.

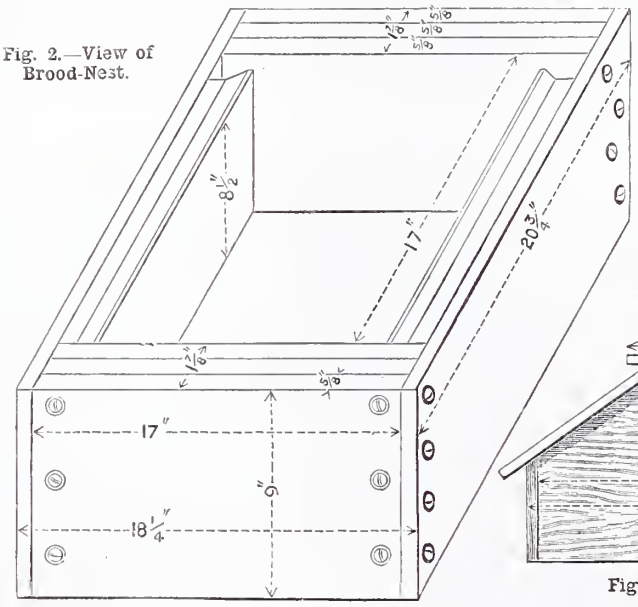


Fig. 2.—View of Brood-Nest.

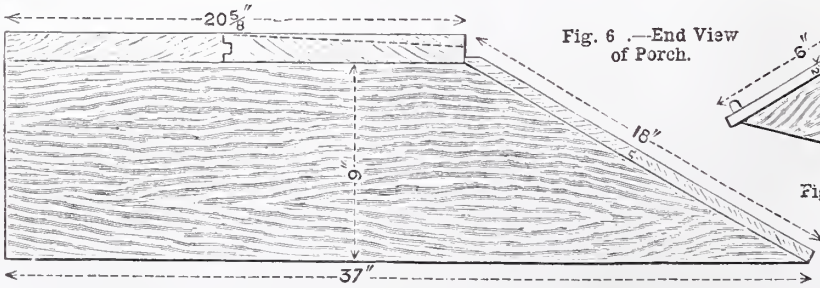


Fig. 6.—End View of Porch.

The ends of the boards which project must be planed to a level with the front and back with the trying or smoothing plane, and the four sides brought to a finish with sand-paper, if necessary. We now turn to the floor. Its dimensions are ⅛ in. less than the length and breadth of the brood-nest, and it is made of wood 1¼ in. thick. For it the following pieces are required: 1 piece, 4 ft. 10 in. × 9 in. × 1 in.; 2 pieces, 1 ft. 6¼ in. × 11 in. × 1¼ in.; 2 pieces, 1 ft. 6¼ in. × 9 in. × ¾ in. As before, they may be planed in twos or threes, and separated only at the last minute, when about to be put together.

A distance of 21 in. may be measured along one edge of the board, 4 ft. 10 in. × 9 in. × 1 in., and the same distance, 21 in., measured from the other end along the opposite edge. These points being joined by a straight line, the board can be divided into two along this line, which will give us the two supports upon which the floor rests.

The pieces 1 ft. 6¼ in. × 11 in. × 1¼ in. may now be taken in hand, and joined together edge to edge. The best plan is to tongue and groove them—an operation which has been explained in a former number of WORK; but if this is not practicable, they may be dowelled together, or even nailed, using plenty of glue. Care must be taken that they are out of winding, and when the glue is dry the top must be gone over with the trying plane until it is as true as it is possible to make it. The under side, too, especially along the edges, must be made fairly level.

There is now a piece of wood 22 in. × 18¼ in., and we must plane the edges, and cut the sides until we get it 20⅝ in. × 18⅛ in., having the angles all right angles, so that the square shows it true all round.

The entrance way may now be cut in it. We decide which side is to be the front, find its centre point, and measure 4 in. from it towards each end. Then square lines, from those points, to the front edge; and, with the tenon saw make cuts ⅜ in. deep, and extending 6 in. or 8 in. from the front, and sloping upwards towards the centre of the hive. The part between these saw cuts may now be removed with a chisel and plane, finishing off, if desired, with a rasp and sand-paper. The entire floor may now be secured to the supports placed on edge, either with screws or nails, the supports being not more than a quarter of an inch from the edge of the floor board. The two pieces 18¼ in. × 9 in. × ¾ in., when planed and joined together edge to edge, form the alighting board. It is not so important to have this true as the floor board, but some care should be taken to see that the joint is good, and the edge which abuts against the floor must be bevelled so as to suit the slope of the alighting board. I generally secure it to the floor board with a glued joint and a few sprigs, but the floor may be made to

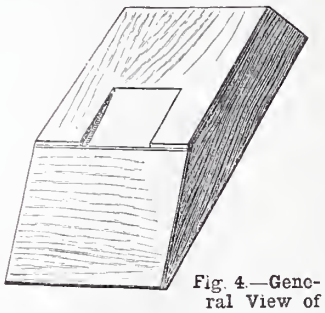


Fig. 4.—General View of Floor Board, etc.

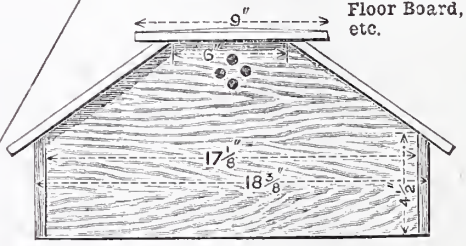


Fig. 5.—End View of Roof.

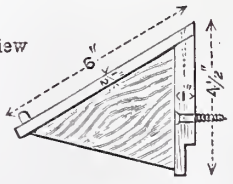


Fig. 3.—Side View of Floor Board and Stand.

[For continuation, see page 54.]

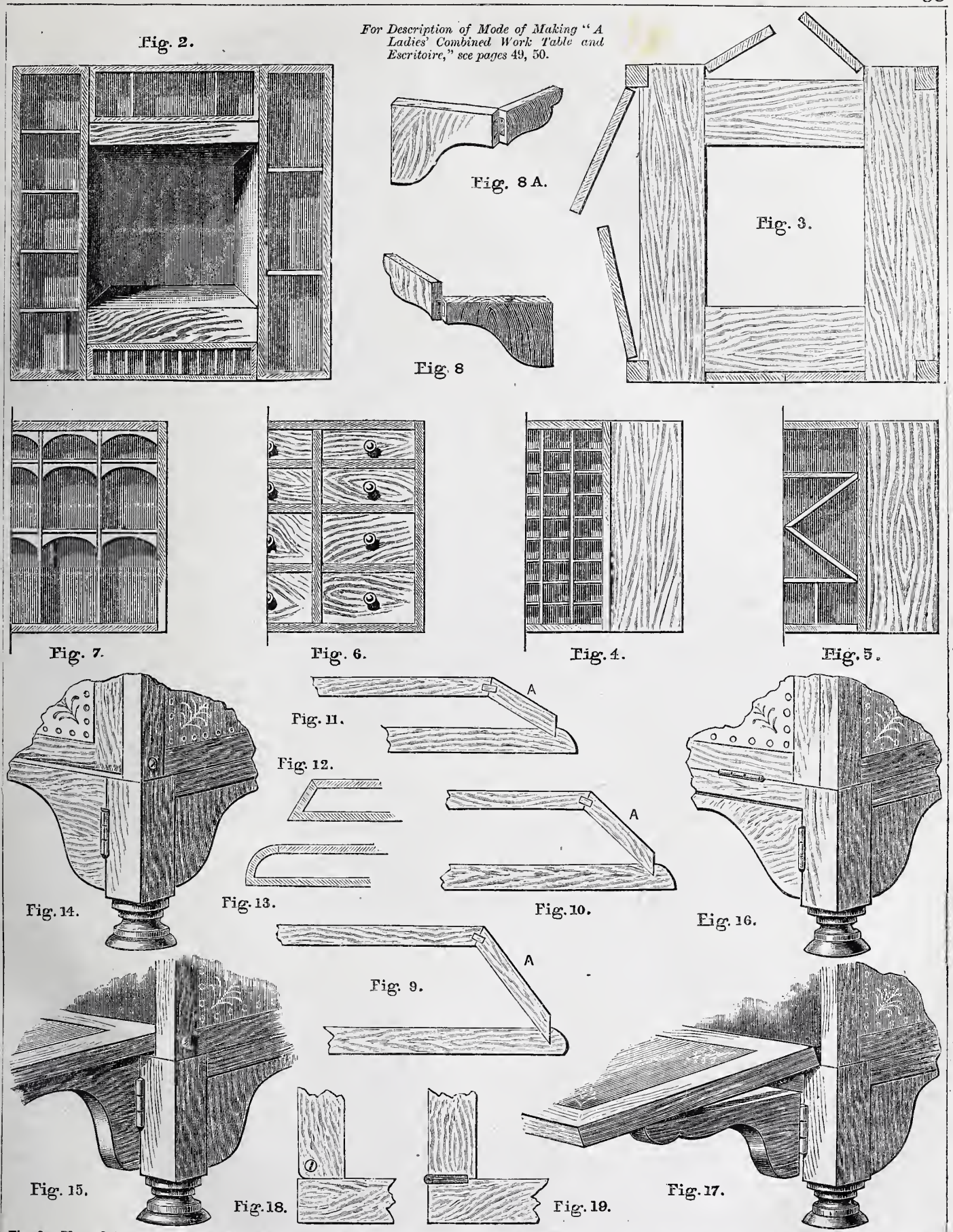


Fig. 2.—Plan of Carcase. Fig. 3.—Middle Board, showing Brackets. Fig. 4.—Half Elevation of Side containing Reel Box. Fig. 5.—Ditto, Needle Box. Fig. 6.—Ditto, Drawers. Fig. 7.—Ditto, Stationery Holes. Fig. 8.—Mode of cutting Smaller Brackets if Boxes work on Pivots. Fig. 8 A.—Ditto, if Hinges are used. Figs. 9, 10, 11.—Various Heights of Small Top Boards according to Width of Narrow Side Pieces (A). Figs. 12, 13.—Mode of shaping Front of Reel Box to afford freer Motion. Fig. 14.—Pivoted Flap in position. Fig. 15.—Ditto, as Writing Table. Fig. 16.—Hinged Flap in position. Fig. 17.—Ditto, as Writing Table. Fig. 18.—Section of Flap if Pivots are used. Fig. 19.—Ditto, if Hinges are used.

overlap it by putting a rebate on its lower edge. The top edge of the alighting board must be planed to an angle, so that about ½ in. is horizontal, which will serve as a support for the slides. Fig. 3 is a side view which shows the floor and alighting boards and their supports. Fig. 4 is a general view of the whole.

The Roof now demands our attention, and for it we must make out and plane up the following pieces: viz., 2, 17⅛ in. × 9 in. × ¾ in.; 2, 20⅞ in. × 4½ in. × ¾ in.; 3, 25 in. × 9 in. × ¾ in. The pieces first on the list are to be cut to the shape shown in Fig. 5. The centre of one being found, a line is to be squared across it, and 3 in. towards each end measured along the edge; lines may be drawn now from these points to points at the ends of the board 4½ in. from the edge, and triangular pieces cut out, leaving the board as is shown by the inside lines (in Fig. 5). The narrow pieces are to be nailed to form the sides, and the top edges planed down to the bevel of the ends. Two of the 9-in. pieces, 25 in. long, may now be nailed to the ends and sides, and the top edges having been bevelled, the top piece may be nailed on. All these pieces, of course, should be well glued, which will make a much better job than nails alone. It would be well to have the top piece 1 in. thick in the middle, and to taper it to ½ in. at each edge. This will throw off the rain effectually. I sometimes have the side pieces 11 in. wide, which will permit me to have the top narrower, and, therefore, with a greater slope. Another plan I sometimes use is to have the roof consist of a number of strips 4½ in. wide, overlapping each other after the manner of weather boarding, but it is rather troublesome, for the ends must be cut into steps to suit the boards. Another plan still—and perhaps the best of the lot—is to cut the ends, from the centre of the top to the 4½ in. point, and to board it up like the roof of a house, without any flat piece at all at the top. The boards may be placed edge to edge. Then the whole top is to be covered with a piece of strong calico stretched tightly, and tacked under the eaves with a slip of wood covering the tack heads. A few coats of paint will make this quite water-tight, and as good a protection as it is possible to have.

The ventilation holes I have not yet mentioned. They may be bored either now, or, perhaps better, before the roof was put together. I bore three or four 1-in. holes in each end with a centre-bit, and nail a piece of perforated zinc inside to prevent the bees getting in.

If the brood-nest be now placed on the floor, it will be found to overhang it by $\frac{1}{16}$ in. all round, and the roof will overlap the brood-nest by a similar amount all round.

We must now procure seven slips of wood 2 in. wide, ½ in. thick, and 22 in. long to nail round the roof and brood-nest, so as to cover the junctions of the various parts. They should be planed at an angle of 45° almost to a feather edge on top, and the lower angles just rounded off. The roof will have slips all round, but the brood-nest only on three sides, the front being reserved for the porch. The slips may be mitred together at the corners, but it is almost as well to have them overlap.

The porch is made of four pieces of wood, two being the length of the front: viz., 18⅛ in., and 5 in. × ½ in., and 4 in. × 1 in. respectively. The inch piece has a rebate 1 in. wide and ½ in. deep cut in its under edge, and the top is sloped to the angle the porch is to assume—about 30°. Then the top piece is nailed on to the bevelled edge, taking care to push it so far back that the edge can be planed flat at the back, then the triangular pieces are fitted and nailed in place. The entire porch is fastened to the brood-nest by means of a couple of brass screws, oiled before they are inserted so as to be easily withdrawn. To prevent the drip from the porch falling on the alighting board, I sometimes plough a gutter along the front of the porch, but usually I nail a slight piece of wood, rounded on the top edge, to the porch. This I bend in the shape of a bow, so as to direct the water towards the sides of the hives.

The doors or slides are the only part remaining to be done. If the brood-nest is brought to a level with the front edge of the floor board, it will be found that they can slide nicely on top of the alighting board, on the horizontal part prepared for them, and at the same time break the joint between brood-nest and floor board. If the porch is screwed just a little above the lower edge of the brood-nest, it will be found that pieces 4½ in. × 1½ in. × ⅜ in. will slide easily and act well as doors; little buttons may be attached to them by which they can be moved, but it is scarcely worth the trouble to do so.

Fig. 6 is an end view of the porch, which shows fairly its construction.

In making a hive, or indeed any other piece of work, it is of the utmost importance, if things are to be done with despatch, to have everything done methodically. While the saw is in the hand and the wood laid out, do all the sawing, then do all the planing and gluing, and so on. I therefore append a list of all the pieces (just fifty in number) required for this hive, as far as we have gone. The thickness of the wood may be varied, but the dimensions that I have given in the following table will, I think, be found about the best for the purpose in view:—

No. of pieces.	*Length.*	*Breadth.*	*Thickness.*	*Object.*	*Remarks.*
	in.	in.	in.		
1	58	9	1	Floor board supports	Must be cut into two, as Fig. 7.
2	18⅛	11	1¼	Floor board	To be joined edge to edge.
2	18⅛	9	¾	Alighting board	Do.
2	17	8½	⅝	Brood-nest	Finished sizes, top bevelled.
4	17	9	⅝	Do.	Finished sizes.
2	20⅞	9	⅝	Do.	Do.
8	17	1	⅝	Do.	Do.
8	7	1	⅝	Do.	Do.
3	22	1	½	For slips round brood-nest	Must be cut to length as required.
2	17⅛	9	¾	For roof	To be sloped for ends.
2	20⅞	4½	¾	Do.	May be cut from one 20⅞ in. × 9 in. × ¾ in.
3	25	9	¾	Do.	Will be changed for a roof either weather boarded or calico covered.
4	22	2	½	Slips	Will be cut to length as required.
1	18⅛	4	1	Porch	To be rebated in lower edge.
1	18⅛	6	½	Do.	
2	—	—	⅝	Do.	Triangular pieces.
2	4½	1½	¾	Doors	
1	18½	1¼	¼	Gutter	To be bent like bow, with its highest part towards the hive.

In my next paper I will describe how I made my Cowan Hive, and then I will go on to interior fittings. A Drawing-room Observatory Hive I look upon in the light of a luxury, and so will postpone its consideration for the present. If any readers wish for a paper on one, perhaps it may come later on.

LAWN MOWERS: THEIR CARE AND REPAIR.

BY GRASS GREEN.

With the advent of Spring, a thousand and one readers of Work will doubtless lay aside their winter hobbies, and turn to their gardens, and their lawn mowers will be brought out for inspection and use.

Of course it is very dirty, at least ninety-nine out of every hundred will be, and it will be the object of this article to briefly and concisely describe the process necessary to put it into working order. Looking through a list of repairs, including several hundred machines by different makers, we find that nearly one-half are of the chain type, and of these a large majority are by T. Green & Sons, who were the original patentees of this pattern; since, however, their patent has expired, several other prominent makers have adopted the chain, thereby acknowledging its superior claim.

I will divide my paper into two parts, taking first the repair, and then the care, of lawn mowers.

Let us suppose that the dirty machine is before us, how shall we proceed with it and what special tools shall we require? Take the tools first. I will suppose the reader has the spanner supplied with each machine; to these he may add a common stiff scrubbing brush, an old knife, a lamp chimney brush, and some petroleum; a handful of cotton waste is also useful.

Not a very mechanical outfit, you remark. Well, no; one must admit they savour more of a housemaid's kit, but practice has proved them to be the most suitable articles for cleaning a lawn mower: they are eminently useful, and Work is nothing unless it is useful.

Cleaning.—Now take your machine all to pieces, taking care, if you are a novice, to mark each part, so that refitting may be done without mistakes as to hand and position of each part.

If it is intended to repaint the machine you may burn off the old paint, taking care to burn the paint and not the castings; the scrubbing brush will greatly assist this operation, and, when finished, the new coat will take to the iron smoothly and well.

If, however, the mower is to retain its old coat, it will suffice to scrape off the thickest of the dirt and then thoroughly wash and clean with the petroleum, taking particular care that the bearings are well and thoroughly cleaned. If it is a chain machine, let the chain soak, and then work it well with the hands—a rather dirty job, but the petroleum will in that way work out the grit and dirt, and render the chain easy and pliable; finally brush it well both inside and out. The cylinder may be scraped and brushed, but on no account subjected to heat, and this remark holds good, too, with the bottom blade. The lamp brush comes in here, and is admirably adapted for cleaning out crevices and curves.

Grinding.—Every part being clean, the next step is grinding. To effect this, fit the

sides to the sole plate, and get the cylinder into its proper bearings; now prepare the grinding paste, made of 90-hole emery powder and oil mixed to the consistency of cream. Next rig a small cranked handle to the spindle and revolve the cylinder quickly in the direction opposite to that of cutting, applying the paste meantime, until the cutting surfaces of the cylinder and bottom blades are true with each other. A simple tool for applying the emery may be made by tacking a piece of leather or cloth on a wood slat, and then blocking it out with wood at each end, so that the leather stands clear of the wood slat. Smear the leather with the emery, and apply over the whole length of the cylinder. Grinding is rather tedious work, but absolutely essential, and will repay doing thoroughly.

To test the edges, moist tissue paper is a good test. If the machine will clean cut this at any point over its length, it may be safely considered properly ground.

Occasionally the knives in the cylinder may be so much out of truth that it is advisable to have them ground true in a proper mower grinding machine; most engineers have one of these, and will execute the job for a few shillings.

Bottom Blade.—A word about this important part, which should be quite flat and slightly turned upon its front edge. A warped sole plate will only cut part of its length, and leaves an objectionable rib on the lawn where it misses. When the turned edge has become worn, it will be cheaper to replace with a new one; returning and setting the front edge is difficult, and takes a lot of time and practice, and an undrilled plate can be bought for about 2d. or 2½d. per lineal inch.

The same remarks apply to the chains, pinions, and other wearing parts. Your ironmonger will procure any part for you at a reasonable charge.

I knew a man who undertook to make good a mower chain, which he did by driving out all the rivets, drilling out each hole in every link, and then riveting up again with larger pins; the job took about ten hours, and finding that his time cost more than a new chain, the experiment was not repeated. Chains for machines under thirty inches cost from 5s. to 6s. 6d.

Bearings.—A handy tool for boring the cylinder brasses by hand may be made by forging a small boring tool on a half-inch round rod with a T handle; both brasses are fixed *in situ*, with the tool threaded through one side, which forms a guide while boring the opposite brasses. The tool must be reversed to bore the second.

This method is far better than filing, to do which properly and truly requires much practice, and indeed is well-nigh impossible. One other wearing part is the wood roller fixing. These may readily be made good by bushing with a brass plug, and then drilling to size of spindle.

One very common cause of failure is looseness of knives in the cylinder. These are usually fixed with copper wire, and the defect may be remedied by removing the old and inserting new wire. Copper wire is best on account of its ductability, and it should be of such a gauge that a little pressure is required to drive it home. To effect this caulking, fix the cylinder in a vice and insert the knife in the slots provided in the collars, drive down the end of the wire horizontally between the knife and the collar, then double the wire back, and repeat the operation until the wire is on a level with the collar. After recaulking, the cylinder *must* be trued and ground in a proper grinder as before mentioned.

As regards our second part, three brief rules will enable users to get good results from their mowers:—

1. Keep them oiled.
2. Keep them clean.
3. Keep them adjusted.

The first should require no comment, but experience has taught us that many users neglect this all important point. No machinery works well without a proper lubricant, and lawn mowers are no exception. Use the best oil, and don't forget that the chain and knife edges will equally respond to the magic touch of the oiled feather; neatsfoot, sperm, or salad oils are best. Rule number two requires no further remark, but I would suggest that the lamp brush be kept in the shed, and used for brushing out the grass that necessarily accumulates about the mower. Adjusting is most important; most machines are provided with set screws by which the cylinder may be raised or lowered to the bottom blade. A badly adjusted mower will spoil itself and its user's temper at the same time. Adjusted too low, the cylinder and the bottom blade will cut each other, and only mangle the grass, or if set too high it simply won't cut at all, and if unevenly adjusted a combination results, in which one end cuts nothing, the middle may cut the grass, while at the other end the cutting edges will be engaged in the society game of cutting one another. The tissue paper test before mentioned is a good method to employ for adjusting.

Two other points of adjustment are the drum fixing for tightening the chains and the wood rollers, which regulate the length of cut; by raising these the grass may be cut shorter and *vice versâ*.

Choosing a New Machine.—A little disinterested advice on this point may not be out of place, for, of course, every trader will back his own machine against all others.

For general purposes I recommend a chain machine by any good maker, notably by Green & Sons, of Leeds and London, or Ransomes of Ipswich, both of whom turn out admirable and reliable machines. The latter firm also produce some excellent geared machines, as also do Shanks, of Arbroath and London.

The American type are too numerous to mention in detail, but most of them are admirably suited for long and coarse grass, and, if small, for borders and slopes.

For small lawns and small incomes, nothing beats Ransomes' New Paris mower, which is at once cheap, reliable, and easy to use—a ten-inch machine is listed at 45s., with box, and off this a substantial cash discount can usually be obtained.

In conclusion, always bear in mind that a lawn mower is quite as much a machine as a bicycle or sewing machine; treat it as you would either of those, and it will serve you quite as well.

A CUPBOARD BEDSTEAD.

BY L. IVOR POOLE.

THAT a bedstead which can be folded up and concealed within, or made to resemble some other piece of furniture, is no new contrivance is well known, though to a great extent "combinations" of this class have given way to the lighter and more convenient forms of folding-beds. They are, in fact, a trifle old-fashioned, but that is no reason why they should be forgotten altogether. "The chest contrived a double debt to pay, a bed by night, a chest of drawers by day," may be as useful occasionally still as it was when Goldsmith wrote his "Deserted Village," and with this idea the following suggestions are given:—

It must not, however, be imagined that the thing referred to in the above quotation actually fulfilled the purposes of the two articles of furniture which are named. Fortunately there are not many of us who are so prosaic as the individual who wondered how it was that any one could allude to "sermons in stones, books in the running brooks, and good in everything," when it obviously ought to be "sairmons in buiks, stanes in brooks, and bad in most things," or it might be necessary to say that the chest enclosed a bedstead and was so finished as to resemble a chest of drawers when closed. The piece of furniture portrayed in Fig. 1 is, however, not designed to imitate the said chest, for, as the title indicates, it is a cupboard with little or nothing to distinguish it from an ordinary small wardrobe when closed. Such an appearance is perhaps to be preferred, savouring less of the sham, but perhaps the chief feature of the contrivance is its great simplicity. This will commend itself to most of those who are likely to require such a "spare bedroom," for reference to Figs. 2 and 3 will almost render any detailed account superfluous.

Fig. 2 represents the arrangement with the bedstead down, one door being indicated. The dotted lines show the folding part of the bedstead within the cupboard. Fig. 3 gives a front elevation with the bedstead enclosed. One door is shut; the other, that on the right, open, and thrown back to show the hingeing, the arrangement of this being also seen on the other, though apt to be overlooked by those whose observation is not sufficiently trained to enable them to perceive that the door is hinged on, and not within the ends.

The whole thing is so simple that it can scarcely be necessary to go into the minute description, the hints to be given being for men who may be supposed to have acquired a reasonable amount of skill and intelligence. They will know that the material is, of course, wood, which must be dry, that the joints must be properly made, that the more care taken with the work generally the better it will be, and that if they prefer to adopt any other detail of construction they may do so without feeling that they will be doing wrong. Glance at the general construction: First of all we have a full-length bedstead measuring 6 ft. 6 in. from end to end, and 1 ft. 3 in. high. The width is not of much consequence, as it can be anything in reason, though Fig. 3 represents it as being 3 ft. Were it not more than 2 ft. 6 in., a single-door cupboard would do very well, the door being arranged to open at the most convenient side. The height of the bedstead when extended may also be varied considerably, remembering that the lower it is the less will be the depth required of the cupboard from back to front, though its height will have to be proportionately increased. As represented it is about 1 ft. 7 in. deep by 7 ft. 3 in. high, including the cornice, which is merely an ornamental feature, and not an essential part of the construction.

The cupboard ends are shown as being in one piece from top to bottom, but, as this may make it rather cumbersome for removal, the alternative of making it in two portions, as frequently seen in wardrobes, may be

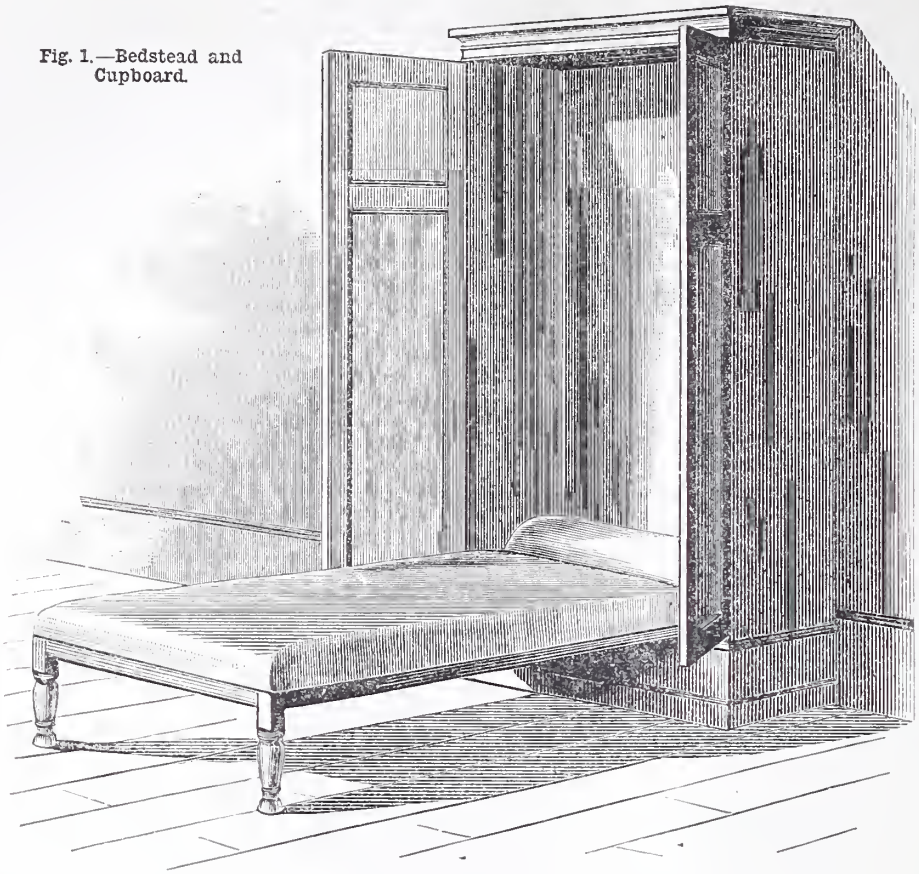


Fig. 1.—Bedstead and Cupboard.

adopted, the division naturally being between what in these would be called the hanging part and the drawer case. In Fig. 2 it will be seen that the bottom of the former and the top of the latter are combined by two bearers, one at the back and the other in front. These, of course, are securely fitted into the ends, the best joint for the purpose being the dovetail.

On top of them, and fastened to the ends, are the fixed portions of the bed rails, the movable parts being hinged on to these as shown. The side rails and foot end are fastened into the legs, and when it is said that the transverse laths to support the bedding are dovetailed and fastened into the frame (Fig. 4) to prevent them falling when the bedstead is folded, no further remarks need be made about this part of the work.

The lower part of the cupboard may very well be utilised as a place to keep extra bed-linen or other articles in. As will be seen, it is represented with a fall-down front, but, of course, a drawer may be substituted for this, or it may have a couple of doors opening in the usual way. The bottom is placed close to the ground in order to make the available space inside as great as possible, so that the plinth is added more for the sake of appearance than anything else. Were the plinth formed in the usual way, and put on below the bottom, naturally a good deal of the space inside would be lost.

The fall front may be secured with a spring catch, or with lock and key. To prevent the hinges being strained it will be advisable, if when open it does not rest on the ground, to fasten a joint stay or chain to it. Instead of gaining access to this lower receptacle from the front, a lid may be arranged to the top of the fixed portion of the side rails, the advantage of this construction being that the contents may be secured by locking the upper doors.

Trifling alterations of the details may be advisable, but these will no doubt suggest themselves.

The doors are made in the usual way, and may either have two panels, as in the illustrations, or only one panel each. In fact, what may be called the decorative portion of the work can be varied to almost any extent according to the taste and skill of the maker, the essential constructive features remaining unaltered.

Fig. 5 gives a suggestion for a folding footboard, which, hinged as it is shown to be, occupies very little space, and will no doubt be a comfort to those whose toes have a propensity to work down.

By making the supports at the bottom end fold under, the cupboard may be shallower from back to front than stated. Fig. 6 indicates how this may be managed, the legs there being shown connected by a couple of rails or stays, and hinged to the frame instead of as shown in Fig. 2. The hinges of course are so arranged that on raising the frame the legs hang down against it. By a very slight modification they may be arranged to fold within the side rails.

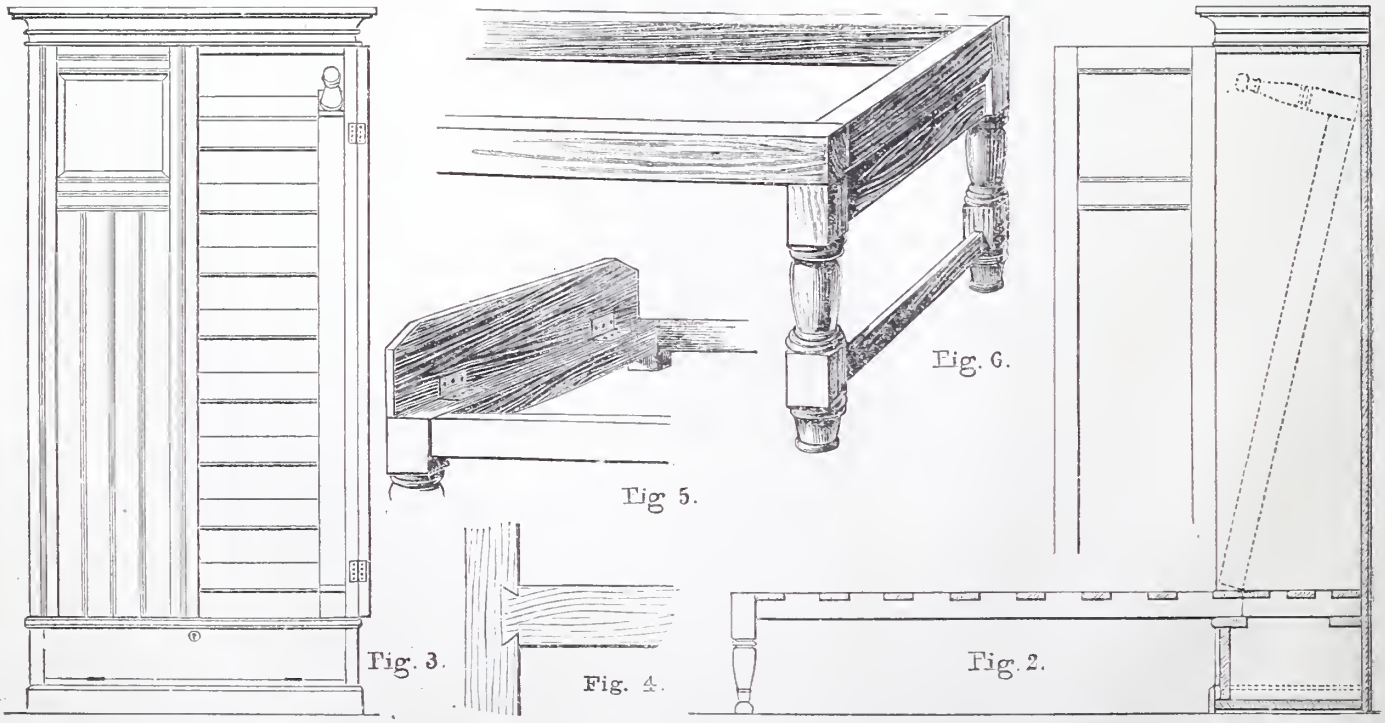


Fig. 2.—Side Elevation of Cupboard Bedstead. Fig. 3.—Front Elevation of Cupboard Bedstead. (Scale of Figs. 2 and 3, ½ in. to 1 ft.) Fig. 4.—Lath dovetailed to Frame. Fig. 5.—Folding Footboard. Fig. 6.—Folding Legs.

Ample space is afforded for a thin mattress and the necessary articles of bedding in the cupboard; but if these have a tendency to push the frame too far forward so that it is apt to fall on the doors being open, a turn buckle on the under side of the frame, fitting into spaces cut in the ends, will prevent any mishap.

Only the general features of the construction have been touched on, as it is hardly possible to conceive a simpler contrivance, and the remarks have not been written for novices altogether, though even they can hardly meet with any difficulty they cannot overcome. I don't think it can be necessary to tell any readers of Work, however inexperienced they may be, that at the bench they must stand on their hind legs, but it will afford great pleasure to assist those who don't require quite such elementary directions as far as possible in "Shop." If, therefore, any readers feel that they cannot understand some of the details of construction, they may be assured of friendly advice to help them if they will state where the difficulty arises. My friend, Dulwits, is not a mechanical genius; he wants to learn "how to make all sorts of things, you know," beginning at the beginning, but he cannot master the technical advice to get on his hind legs: till he does, I fear very much he will not be worth anything. It may interest some who sympathise with him to know that he has been advised to consort with the lower orders of creation, beginning with the pony—the Jerusalem variety—as being congenial.

HOW TO HANG FORGE BELLOWS IN ROOF.

BY JOHN HEWITT.

It is just twenty years ago since I was at my wit's end to do this seemingly simple operation. I was wanting to move into a more convenient shop; one was to let, but, for the life of me, I could not see how it would do, unless I could use the ground-floor space, where in ordinary usage the bellows should be, whether circular or "long shape." The shop was not high enough to hang a pair in the roof, as is usually done, so I was in a fix; a larger shop with two double-handed hearths I must have, and no other could I find.

After thinking over how I could fix a pair aloft, so as to have the space underneath, long and anxiously, I at last hit on a plan, and soon had it all at work in my mind's eye; so off I went and took that shop, and began moving into it. When I began fixing the bellows close to the roof, every one thought I was "cracked," and all wanted to know how I was going to blow them; and as I am very poor, even now, at sketching my ideas, and could not do so then, I could only say "wait and see." Scores came to laugh, even a practical bellows maker amongst them; and to hear the remarks as to what I should certainly be if I blew those bellows hung up in that way, made me almost think I was going to demonstrate I was the cleverest inventor that ever lived or would live. When all was in working order, and each had tried them, the general feeling was one of disgust, that such a simple and practical mode of hanging a pair of bellows had not been thought of before; they could not *then* see anything "clever" in it.

Seeing a paragraph in Work on bellows, signed W. P., on page 606, Vol. I., which says, "I presume the long bellows you have bought are second-hand ones, as those who now go in for new bellows buy the circular ones, as they are easier fixed and take up less room"; and thinking many others do not yet know of the plan, I thought I would just send you a sketch and particulars, for if hung in this manner, they take up less room than circular ones, can be fixed at any angle to the hearth, and practically consume no power in the way of friction in the process of blowing, besides being cheaper in first cost.

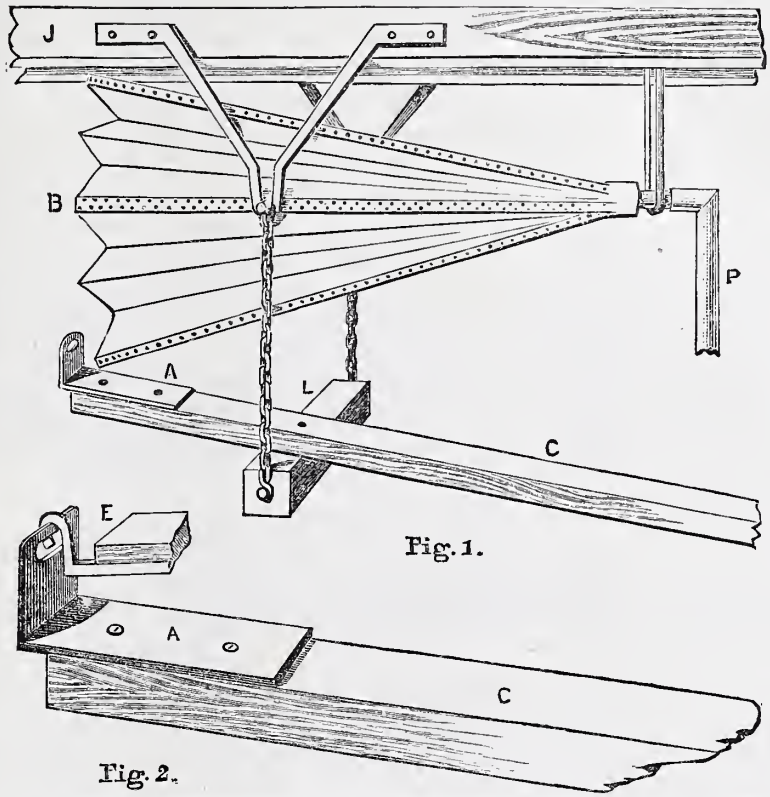


Fig. 1.—Plan to hang Bellows in Roof to have Ground below available for other purposes—J, Joist in Roof; P, Blast Pipe; L, Fulcrum in Chains; C, Rack Staff; E, Hook on Bellows; A, Iron Plate with Eye for Hook, E, to work in. Fig. 2.—Enlarged View of End of Rack Staff.

I think the sketch will explain itself. B, Fig. 1, are the bellows hung to the roof timber, J; L is a block of wood hung with chains to the bellows pins, for the rack staff, C, to work on as a fulcrum; a pin goes through C and L. The position and leverage of rack staff, C, is regulated by the position in which this pin passes through both or either, and its height by the length of the chains; P is the blast pipe. Fig. 2 shows how the rack staff is connected to bellows. At the bottom of all long shape bellows is a hook, E; this is engaged in an eye in plate, A, fastened on the rack staff, C; the top side of this eye should be nicely rounded, then, as you blow the bellows, it rolls in this hook without any friction. Previous to hanging the bellows this way, I had to fix a weight at E to pull the bellows down, but afterwards they went down quite quick enough, and blew very much easier too. The weight on the long end of rack staff keeps A, and hook, E, in position. There is one great advantage gained by the plan, viz., the *leverage* is always the same *at every part of the stroke* as the fulcrum *moves:* no other plan I have seen does this. The leverage can also be quickly adjusted.

I have blown and worked with a very many pair of bellows in my time, but with none can I acquire such a degree of "touch" as with those hung this way. With a skilled workman, it is not merely a blast he wants—he can have this with a fan or long chimney—he requires to vary that blast in the nicest way possible with some kinds of work; hence I think, if not generally known, it will not be unacceptable to readers of Work.

ADAPTATION OF SEWING MACHINE FOR FRET-SAW MACHINE.

BY C. H. M.

As many subscribers take an interest in fret-saw work, it may not be out of place to describe a fret-saw machine, which I made some time ago from an old sewing machine, especially as it embodies a method of controlling the direction of the cut which is the reverse of that generally adopted.

In the ordinary method of directing the cut, it is necessary to turn the piece of work which is being operated on so as to feed it against the teeth of the saw, and the beauty of the curves produced depends on the steadiness with which this can be done.

Also, however small an opening is being cut out, the work must at least be revolved completely round, and the size of the piece of wood that can be dealt with on any particular machine is limited to the distance that can be reached from corner to corner.

Now as a sewing machine has generally a comparatively small span, I adopted the course of making the saw revolve on its axis in place of turning the wood round, and with the result that it was possible to deal with a piece of wood twice the width of the span of the machine and of unlimited length.

Although in the first place I tried this system because the span of the sewing machine was so small, I found it a great improvement upon the usual method. Obviously, the saw can be turned on its axis in a fraction of the time taken to carefully turn the wood round, and it therefore results that curves and angles can be followed much more quickly. The cut is much cleaner, and bolder curves and sharper turns can be made.

To appreciate the difference in the facility of manipulation, take a sheet of stiff paper with a fret-pattern sketched on it, and hold a pencil in a fixed position, lightly pressing on the paper. Then try to follow the

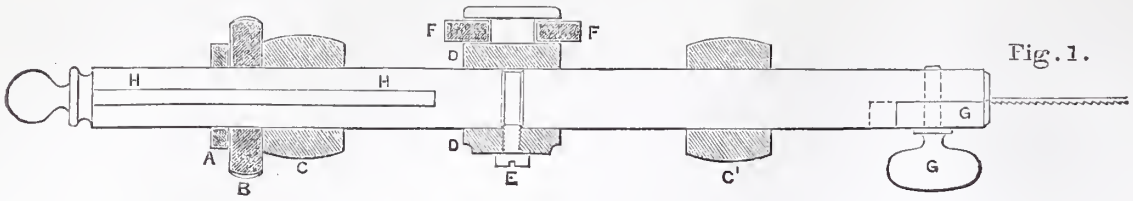


Fig. 1.

Fig. 2.

Fig. 1.—Needle Bar of Sewing Machine altered for use in Fret-Saw Machine—A, Piece fixed to C to hold Washer (B) in place; B, Washer with knurled edge, shown in plan in Fig. 2; C C', Bearings through which Bar is driven up and down; D D, Connecting Piece; E, One of the three Set Screws, the points of which project into the Groove in the Bar, and carry it up and down while permitting it to revolve axially; F F, Part Section of the Lever by which the Bar is driven up and down through the Connecting Piece, D D; G G, Small Vice at End to hold the Saw; H H, Keyway by which Bar is revolved while in motion up and down.

pattern, first while assuming that the pencil will only mark in one direction and turning the paper to follow the pattern, and secondly, taking it that the pencil marks in any direction, and keeping the same end of the paper constantly towards you. The latter method will be found to be from two to three times the quicker, and a much more pleasant occupation.

In the next place a sewing machine generally has a short stroke, say only 1¼ in., but by the method I adopted of mounting the saw this was not a disadvantage, except that fewer teeth being brought into play the saw becomes blunt, and must be renewed the sooner. On the other hand breakages occur less frequently when the wood has not to be turned round.

The following is the description of the alterations to the sewing machine:—

1. The hole in the bottom of the needle bar plugged up, and a finer hole drilled to suit the size of the saw to be used, or the end of the needle bar fitted with a pair of vice jaws having a central nick to accurately determine the position of the saw when nipped in place, for it is important that when the needle bar is revolved the saw shall run true.

2. A groove turned or filed round the top of the needle bar, by which it can be driven up and down without interfering with its revolving movement.

3. A long keyway cut very truly along the upper end of the needle bar, by which the bar can be revolved without interfering with its upward and downward movement. The needle bar thus altered is shown in Fig. 1.

4. The saw works through a small hole in the surface plate of the machine, and this hole is bushed with a piece of steel of extreme hardness, otherwise it rapidly wears away. Where the surface plate is cut up with the feed gear, the plate is filled in solid again, and the hardened steel bush is inserted with its small hole accurately under the centre line of the needle bar, this accuracy being obtained by marking off its position by a sharp point fixed in the needle bar for the purpose for a moment. The steel bush, which is at least a quarter of an inch deep, has its small hole bell mounted top and bottom to avoid cutting edges, which would damage the saw, the bottom bell mouth being large to facilitate threading the saw into place.

5. The means employed of turning round the needle bar is a washer with a fixed key, made preferably of steel and with a knurled edge to give a good hold to the thumb, by which its motion is guided as the work proceeds. (See Fig. 2.) This washer and key must be a good working fit to the needle bar, that is, the bar should slide through easily when lubricated, but there should be no shake, especially in the key and keyway sideways. The position of this washer is at the top of the upper bearing of the needle bar when in place on the machine.

6. The usual presser, by which the sewing work is held down, is altered so that at its lowest position it rests on its stop, when it is a little more than the thickness of the wood above the surface plate. The work can thus slide freely under the presser, which holds it from jumping up, but the presser can be raised against the action of its spring when the work has to be taken in or out. A wide spreading fork at the bottom of the presser allows enough of the pattern to be seen between its jaws.

Beyond dismounting all the parts of the sewing machine which are not necessary for its proper working as a sewing machine and the fitting of a blower to carry off the sawdust, there is no other alteration made to the machine.

My experience is that there is no necessity whatever, with a short stroked machine such as I am describing, to highly strain the saw by screwing it up between the jaws of a frame, as is done in the usual hand tool. I found that the needle bar drives it up and down, while the bush in the face plate keeps it in proper line above the face plate. I found a slight tendency for the loose end below the plate to "whip" round, and so catch and break, but this was easily prevented by attaching a light elastic cord, having a tension say of from a quarter to half a pound.

This attachment may be made by softening the end of the saw in a candle flame and bending it into the form of a hook. It will be found that the steel from which these saws are made is of very poor quality, and they will not stand much bending even when soft. It seems a pity they are not made from square wire of a quality equal to pianoforte wire. Before putting the saw into the machine, the back should be filed smooth and the corners should be taken off; it will then work better against the side of the round hole in the surface plate, and it will also turn better in its cuts. As the top teeth wear out, the top of the saw can be broken off, as it is not, of course, necessary to work with a whole saw when so short a stroke is made by the machine. This system of holding the saw at the bottom by a hook necessitates threading the saw from below, first through the face plate and then through the wood; if this is not liked I have no doubt that a small vice jaw below could be used attached to the elastic band, but probably the elastic band would then have to be much stronger to set the vice jaw in motion quickly enough.

When working the machine the wood is easily guided by one hand, since there is no turning about to do, while the thumb of the other hand is kept constantly on the knurled washer by which the saw is turned about, so that its teeth face the line of the pattern continually. It is not necessary to see the direction of the teeth; indeed, this could hardly be done while the machine is running, but the feel of the cut tells where they are. The machine is of course driven by foot.

OUR GUIDE TO GOOD THINGS.

6.—Broughton's Patent Combined Square, Mitre, and Bevel.

This handy appliance, the invention of Mr. Valentine Broughton, 7, Halford's Lane, Smethwick, Birmingham, who also manufactures and offers it for sale, is a useful combination of the square and bevel. The bevel is a sliding one, working on a screw in the stock of the instrument, which passes through a long slot cut in it. When not in use the bevel may be placed in the stock as shown in Fig. 2. Fig. 1 shows the bevel placed against the blade of the square for marking mitres, its proper position being indicated by a mark cut diagonally on the blade of the bevel, the outer edge of which is graduated in eighths of an inch. In Fig. 3 the square and bevel are shown as set for work required, and by the combination the change of tools for setting or marking out purposes is obviated. A scriber can be fitted and carried in a slot in the stock as shown in Fig. 3, and degrees can be cut on the stock to set the bevel to any angle required. The combination is certainly a desirable one, and will doubtless find favour with workmen. I do not know the price at which it is sold.

The Editor.

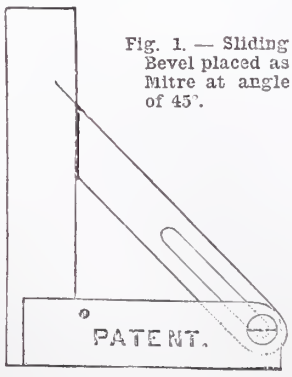
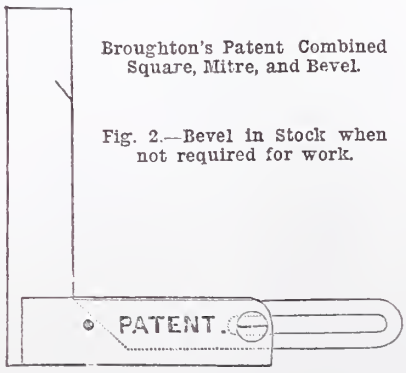


Fig. 1. — Sliding Bevel placed as Mitre at angle of 45°.



Broughton's Patent Combined Square, Mitre, and Bevel.

Fig. 2.—Bevel in Stock when not required for work.

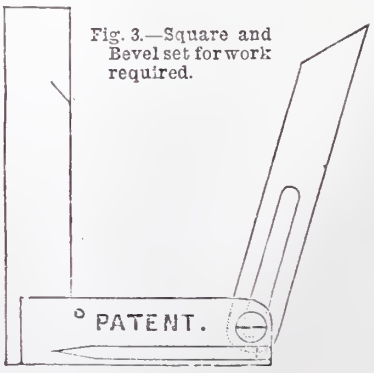


Fig. 3.—Square and Bevel set for work required.

SHOP:

A Corner for Those who Want to Talk It.

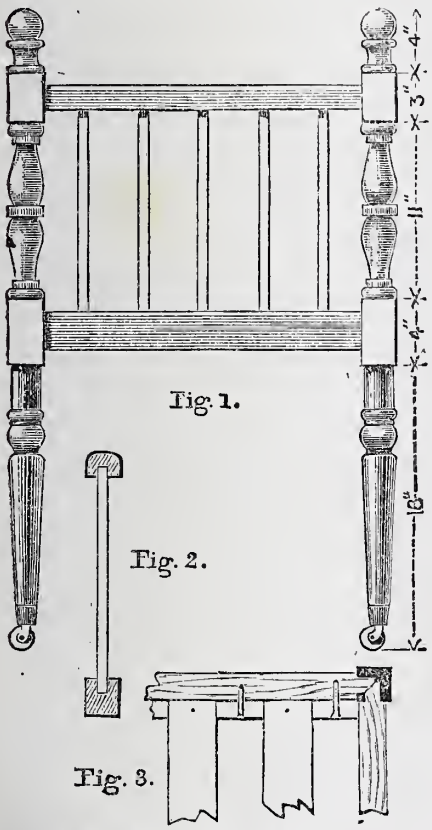
NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Child's Cot.—F. J. A. (*Stoke Newington*) writes:—"With reference to the reply of J. G. W. to Clyde-side on page 732, Vol. I., of Work, I enclose sketch of baby's cot which may be useful. I have two of this pattern now in use, a double one 4 ft. 6 in. by 2 ft. 6 in., and a single one 4 ft. by 2 ft.; these dimensions are very convenient for the purpose, and have the additional advantage of being 'stock sizes,' so that

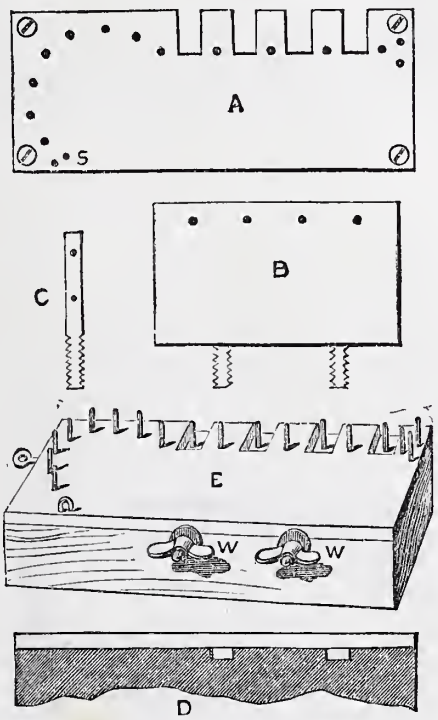


Child's Cot. Fig. 1.—End. Fig. 2.—Section through Spindles. Fig. 3.—Section showing mortising of rails into uprights and arrangement of laths in bottom.

there is not any difficulty in getting mattresses, etc., to fit. The four uprights I had turned by Messrs. Duffy & Son (at a cost of about ninepence each) out of 2-in. stuff; the top rail is 1½ in. square, with the top corner or edge rounded off; the bottom rail 2 in. by 1½ in.; these rails are mortised into the uprights as shown in Fig. 3. The design might be elaborated by having the spindles turned to match the posts, but mine are made of ¾-in. round rods which can be procured at most wood-yards in 12 ft. lengths; holes are bored in each rail to receive these spindles, which are glued in, and must, of course, be put in before the rails are fastened to the uprights. I do not think that sacking nailed to the frame as suggested by J. G. W. would be of much use for the bottom, for the simple reason that the children would dance it out in about a week; mine is made of laths 3 in. by 1 in. with a space of 3 in. between each; they are let into a piece of 2-in. by 1-in. stuff, which is screwed against the long bottom rails, as shown in Fig. 3. To simplify the construction if required, the four uprights might be made out of 2-in. square stuff, stop-chamfered and castors omitted. The cot may be finished by painting or staining and varnishing, or with Aspinall's enamel. I should have used the latter method if I had been acquainted with it at the time I made my cots; as it is, the larger one is painted in purple-brown and varnished, and the smaller one is painted with black bicycle enamel picked out with gold paint."

A Simple, Easy Method to Braze a Band Saw.—G. W. (*Bournemouth*) has kindly written on this subject, and his communication is acknowledged with thanks. It is, however, unnecessary to insert it, as full instructions on the subject have been given in the article "How to Mend a Broken Band Saw," in page 13 of this volume.—Ed.

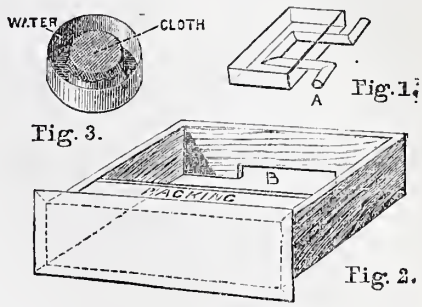
Straightening Bird-Cage Wire.—H. S. (*London, N.W.*) writes:—"In No. 27 of Work (see page 429, Vol. I.) there is a query asked for straightening bird-cage wire, and I hope the enclosed will suit him and also other readers of Work. A is a top plate of iron ⅛ in. thick, 10 in. long by 4 in. wide, and dots on same denote where holes are to be drilled for pins to be inserted and riveted upon reverse side. B is a plate of ⅛-in. iron 6 in. by 3½ in., showing pins which slide in the slots in plate A. The two projecting pieces, C, on plate B are two pieces of ¼ iron wire flattened for half their length



Straightening Bird-Cage Wire—A, Top plate of iron for block, E; B, Plate carrying Pins to be placed under A; C, Iron to be fastened to under side of B; D, Diagram showing slots in side of block for C; E, Wire drawing block complete, with Washers, W W, under Thumbscrews.

(2 in.), and with two holes drilled in them and plate B, so as to rivet them to under side of B, the other half to be tapped or screwed to take two small wingnuts or thumbscrews. The whole of it is mounted on a wood block 1 ft. by 4½ in. by 4½ in., and has leather washers between top plate, A, and wood block underneath the screw holes in A, so that B can just slide easily backwards or forwards in slots cut in the left side of wooden block. G. C. should make the top plate first and file the slots, then put plate B under it (with right-hand edges flush with each other), and then mark the places for holes in B about ½ in. from right-hand edge. Next get the two pieces like C ready, and rivet them on after screwing them, and then cut the slots in left-hand side of wood block for them to slide in. A 1-in. screw eye to be put in end of block so as to slip over a nail in the bench to hold block whilst being used. Pins to be about ⅛-in. iron, and 1½ in. or 1¾ in. long. To use this put wire through the staple and round the curve, and on inside of first pin of B, so that the wire is between pins on A and B. Then put pressure on with thumbscrews from left-hand to suit wire according to thickness. D, showing slots in side of clock for C; C to be fastened to under side of B; E, showing wire drawing block complete, with washers, W W, under thumbscrews. I wish Work every success."

A Simple Incubator.—J. T. R. (*Newcastle*) writes in reply to A. R. (*Manchester*) (see page 654, Vol. I.) regarding the lamp, and how it is used:—"I beg to inform him that the tube which runs through the tank is turned down or elbowed at its entrance, and turned up at its exit, as in Fig. 1. The chimney of the lamp is allowed to enter the tube at A, and care should be taken that the chimney is only a shade smaller than the tube. Any lamp will do providing the consumption of oil is not too great for the pocket of the operator. A difficulty will, most likely, arise as to where the lamp should stand. I adopt the plan of allowing the incubator to project a little over the end of the table, and then fix a bracket on the end rail just sufficiently easy to allow of the lamp being taken out for refilling and trimming. With regard to the drawer and its position, I am afraid our mutual friend, the Editor, has, in his discretion, suppressed some part of my letter and sketches, but as I have not a copy of my communication, I will not press the indictment. The drawer is the size of the tank bottom in width, plus the thickness of packing and wood at the front in length. The appearance of the drawer when made is as shown in Fig. 2.



A Simple Incubator.

The drawer has not any bottom, and a piece is cut out of the back piece at B to allow of the drawer being withdrawn without touching the damper, which latter article rests on the floor of the incubator. Now as to where you put the eggs. If your drawer is 6 in. deep, and you are going to attempt a hatching of hen eggs, a piece of small mesh wire netting should be procured and fastened all round the inside of drawer 2 in. from top. This is the actual bottom of the drawer, upon which a piece of flannel is laid, and upon which the eggs are placed. A 16-in. square drawer will hold about sixty eggs. The damper is placed over a hole bored through the floor of incubator (by the way, said incubator must stand on feet an inch or so high to allow air to get to this hole), say, 1½ in. diameter. The damper made of tin is not easy to describe, and the Editor must, therefore, oblige by reproducing my sketch. A piece of coarse canvas must be placed across, and the edge hangs over the inner circle of tin into the water placed therein. I trust this will enable A. R. to understand the construction of a really useful incubator."

Combination Bedroom Suite.—J. S. (*London, N.*) writes in sequence to T. B. R. (*Hull*) (page 555, No. 35, Vol. I.):—"Certainly I am not offended by your remarks. I thank you for your suggestions, but I cannot quite agree with you in one or two things. (1) Concerning the side door, I may say it does not show the thickness. See reply to One in a Fix, page 29, Vol. II. (2) The back of the looking glass might be made less objectionable by hinging a piece of wood 3 or 4 in. wide the whole width of the door, so that it will answer the same purpose as that shown when the door is down. (3) If the wash-hand basin were in a drawer, what would support that drawer when it is pulled out? You might have a pair of brackets hinged like those under a table flap, but they, or, I think, any other method, would be equally as unsightly as the glass door projection. (4) You will see that in my written article I say that space, etc., were what I considered mostly; therefore, if the cupboard is made ten or twelve inches wider in front, it will make a much bigger job than I intended. (5) The glass door could most certainly be made lower down if required, so that the fastening can be the easier reached, but the average Englishman is tall enough to reach it where I have placed it. However, do not think that I am following in the footsteps of M. Eiffel, by placing the desired object where it will require some exertion to attain it. Personally, if the fastening were 7 ft. high, I could manage to reach it without laying myself open to ministerial reproof. (6) Perhaps, if some of the wood were thicker, it would be preferable, although I stated it ½ in. intentionally, as the quantity of wood used in the article would counteract the thin appearance it would otherwise present."

II.—Questions Answered by Editor and Staff.

Printers' Rollers, etc.—J. R. M. (*Edinburgh*).—J. R. M. is impatient. If Work were twice the size it is, it would be quite impossible for some of the answers to be published for a week or two afterwards.—J. W. H.

Taking Out a Patent.—Test (*Cleckheaton*).—Probably before this can appear, Test will have read in Work some remarks on registration, in continuation of the paper on Patents. Whether registration will in his case be sufficient, depends on his invention. Registration protects shape or pattern only, which a patent is said not to do. If the invention is an instrument having any mechanical action, a patent will be needed; if it consists in a shape or pattern only, registration will suffice. The stamp or form for registering a design (to be got at a post office) is 10s.—C. C. C.

Violin Necks. — J. W. (*Battersea*).—Give the neck a strong coat of vandyke brown dissolved in ammonia; this will sink deep into the bars. When dry, sponge the colour off until you get the shade you desire. I should not think of treating any other part in the same way. You will have particulars of the whole process when the papers on violin making (which are waiting their turn) are published.—B.

Wainscot Painting.—W. B. (*Walsall*).—I conclude it is grained-oak colour that you require, and not a plain white-lead paint. For the former, give your new work two coats of any light oily paint, then a coat of buff, made from white-lead, patent driers, and linseed oil and turps, in equal proportions of the latter, and stained with yellow ochre to a strong buff. Then purchase or make your graining colour, using burnt Turkey umber for the basis, and rub on thinly and comb with one or two varieties of steel combs, drawing it along the grain of the wood. When dry, coat with hard drying oak varnish. Previous queries recently answered on graining will apply equally well to your case. Remember that each coat must be laid on evenly and not too thick, and that each in turn is thoroughly dry. The depth of ground, or last coat, governs generally the finishing colour, allowing for the further darkening from the graining colour. If you merely require plain oil paint, this will be best made with white-lead and yellow ochre and burnt umber, in about the proportions of two of each of the first to one of the umber, adding patent or liquid driers, and beat up with two parts linseed oil to one of turpentine.—F. P.

Brazing Cycle Joints.—G. L. (*Sheffield*). —(1) This may be readily done on an ordinary smith's fire, using charcoal instead of the ordinary smithy coal. Borax is a chemical bought as a powder. Spelter is simply soft brass turnings or filings. The borax acts as flux in soldering, penetrating to every part of the joint to be brazed, when applied in a moist state to the heated joint. Proceed as follows:—Have the fire bright and clear, without smoke, and gathered to as small compass as possible; moisten some borax in a saucer; heat the joint over the fire, but not up to red heat; apply the borax all round the joint, when it will fizzle and flow into all parts. Put some wet borax inside the tube, and let it run down to the joint; put in also some spelter in the same manner, and on the outside; bind a piece of soft brass wire round the joint—the wire less than ⅛ in. thick; place the work over the middle of the clear fire, but without allowing the brass on the joint to touch the cinders; blow steadily, and place a piece of wood over the joint—the burning wood will throw its heat down upon the joint; apply now and then some dry borax on the joint at the brass wire. The borax will melt first, leaving the part wet and greasy-looking. When the iron is up to a clear red, but not white, heat, the brass wire will melt, as also the spelter inside. The moment it melts remove from the fire, scrape off the scale with a bit of iron hoop or old knife, and lay the work aside to cool of itself. When cooled with water while yet red it makes the steel tube brittle. (2) To clear sofa of moths, have all the stuffing taken out and teased of hair; coat the frame several times with paraffin, using a brush; wash the canvas; after teasing the hair, burn some sulphur under it, then let upholsterer do up the sofa. No moths after that.—A. S.

Flattening Sheet Iron.—H. S. (*Clapham Junction*).—See "Wrought Iron and Steel Girder Work," page 167, Vol. I.—F. C.

Sun-Dials.—ADALIA (*Asia Minor*).—A paper on the construction of sun-dials, vertical and horizontal, appeared in WORK, No. 54.

Microscope.—A. C. C. (*Battersea Rise*) asks how to make a double eye-piece for the microscope described in WORK, No. 22, "how the lenses are arranged, likewise the prism." Now I have to confess that I do not know what A. C. C. means, unless he wants to know how to make a binocular microscope. This arrangement involves a second tube, also a prism, but whether this is what the correspondent means I cannot divine. If he will state what he requires distinctly, I will help him as far as I can, but he must understand that to make a binocular involves much more manipulative skill than an ordinary microscope, and when made will not be of much practical service.—O. B.

Glass Grinding. — E. S. (*Tottenham*) asks:—"Can any one tell me the sort of tools I want for grinding glass, and the way to set about doing it when I have got the tools?" Is not this somewhat vague? For instance, one can grind glass with a common grinding stone, or, if such a tool is difficult to use, well then it can be ground on a doorstep. But, seriously, what does E. S. wish to do or make? Is it lens grinding, speculum grinding, or what? Until that is made clear nothing can be done. Perhaps E. S. will say what he wants to do, then we will help all we can.—O. B.

Tinfoil for Mirrors.—B. J. C. (*Silvertown*).—You ought to experience no difficulty in procuring tinfoil in London. Any of the mathematical instrument makers, such as Dale, in Ludgate Hill, will be sure to have it. I have sometimes got it at a chemist's shop. If my memory serves me, I have paid about 1s. 6d. per lb. Glass, when silvered in this way, is not usually painted on the back, but when by the chemical process, it needs painting for protection.—O. B.

Printers' Roller.—J. R. M. (*Edinburgh*).—To mould a composition roller for letterpress work, the mould consists of two iron semi-cylindrical pieces hinged together. In it is placed a wooden roller-block half its diameter. It is then closed, and the composition in a melted state is poured in, and allowed to cool, when the moulding box is opened and the roller taken out. The smoother the iron mould is the better is the surface of the roller. It should not, however, be used for a day or two; nor should it be kept in a hot place or a damp one. Turpentine will clear from it the ink, which should be done every time it is used. If it loses its suction or bite on the form and table, it may be sponged over with water and left to stand a few minutes, which revives it. Type may be also cleaned with turpentine or paraffin oil if of wood, and should be slightly oiled afterwards and wiped with a rag. Metal type is cleaned with pearl-ash and water and a brush, and afterwards rinsed in water. Any printer's broker will have moulds for casting rollers, will supply "compo" ready mixed for melting and running into the mould, and sell the roller blocks and handles for any size of roller. The composition may be of any thickness from three-quarters of an inch to twice that, or even more still.—J. W. H.

Case for Stuffed Birds.—F. M.—I send a rough sketch of birdcase, but F. M. does not state the size he requires it nor how many birds he wishes to put in, neither does he say if he wishes it square or canted sides; of course all the above directions would help me to give a more complete description. If your correspondents will give me full details I shall be pleased

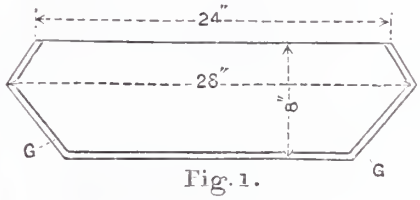


Fig. 1.

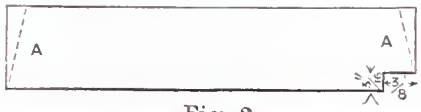


Fig. 2.

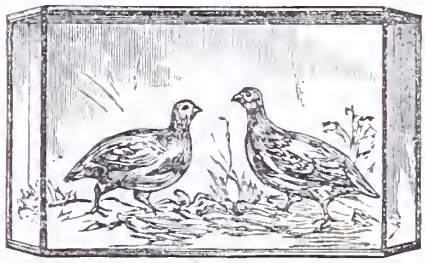


Fig. 3.

Case for Stuffed Birds — G G, Groove for Glass; A A, Section of End Pieces.

to help them, but I cannot find time to solve the problem of what each individual exactly wants. To make a canted corner case to hold, say, a pair of grouse with rockwork, procure two pieces of dry pine 24 in. long, 11 in. wide, and ½ in. thick: plane them up and join them together side by side by groove and tongue, making a tight joint and gluing them securely; then take two pieces each 8 in. wide, ¾ in. thick, and 28 in. long. After planing up cut them like Fig. 1, then run a rabbet round the front as shown in section and along each end; then procure two more pieces 18½ in. high for uprights at back ends, the same strength as the top and bottom; run a groove up one side of these the same size as the others in the top and bottom, then nail them together, and you have a case that will look well with gilt moulding round the front and up the angles. After nailing the two end pieces on to the top and bottom, bevel the ends as shown in section of end piece to let the back lie close; trim it to size required and nail it on; sandpaper it well up, and then you will have a case strong but light; you can put in your birds to taste and use gilt moulding to finish.—W.

Gold in Bookbinding. — P. C. (*Manchester*).—If you have a "blocking-machine," as you call it (the proper term is "blocking-press"), the method of procedure in gold-blocking is as follows:—Light the gas which is to heat the press, and, of course, the stamp, as you cannot get gold to stick on any bookbinding material without heat. While this is going on, prepare your books or book-covers, as the case may be. If they are cloth, give them one coat of glaire—being an apprentice bookbinder you will surely know what glaire is—and allow them to dry thoroughly. If they are of leather, wash them first with paste water and give two coats of glaire, allowing the first to dry before applying the second. When all is ready, see that the press is hot enough, and, having arranged your stamps, or block, and gauges, lay on the gold on the covers in the usual way, using olive oil—sparingly—for cloth and morocco, and lard for calf. Be careful to lay on sufficient gold to cover all parts where the design is to appear. Place the cover in the blocking-press up to the gauges and pull the lever or handle the full way and back again sharply, if the press is a little too hot, especially in cloth work, as the glue is apt to melt and come through the cover. It may be necessary to rest awhile with the pressure on the cover in the case of leather work; take the cover out and rub off the surplus gold with the gold rag and clean with rubber. If you proceed in this manner, and get plenty of blocking to do, you will soon become an efficient blocker. Experience is the teacher in these matters.—G. C.

Bicycle Repairs. — A. W. — A. W. does not state whether he means new tires on new wheels or simply repairing tires of old or used wheels. To put a new tire on a new rim, clean the hollow of rim with a cloth dipped in paraffin; dissolve the cement in an iron ladle over the fire; when it is liquid enough to run like syrup, pour it evenly all round the rim, having first heated the rim by turning it round slowly over a fire. When the rim is fairly warm all round, and the cement poured on, go rapidly round it with a hot poker; then place the rubber tire on all round, as rapidly as possible, taking care not to twist it; that is, keep the same side of the rubber up all round. If the rim and cement have been sufficiently hot, the rubber will hold by simply pressing it into the hollow with the hands and rolling it sideways. If the cement does not ooze out at the edges, then the under side of the rim must be heated over a gas or lamp flame. When you feel the rubber rolling smoothly, and see the cement oozing at the edges, then the rubber will hold. The superfluous cement is cleaned off after it has hardened. To put on an old tire that has come wholly or partly off, go round the exposed hollow rim with the red hot poker, pour new cement on the places that are thin and bare, place the rubber in position, press it with the hands, and operate with the gas flame as above, if necessary. Cement, 1s. per lb., of W. A. Lloyd, Waeman Street, Birmingham.—A. S. P.

Veneers.—P. C. (*Bedfordshire*). — You can get all kinds of veneers in every thickness at either of the following firms:—J. Latham, 124 and 125, Curtain Road, E.C.; A. H. Farmer, 49, Austin Street, Shoreditch; or L. Marshall, 14, James Street, Old Street, E.C.—A. J. H.

Dulcimer Dimensions.—ANXIOUS (*Norwich*).—If ANXIOUS will control his anxiety a short time longer — that is, until he reads this — he will acquire all the information he seeks, as the papers which appeared in the first volume of WORK on "The Dulcimer" answer the whole of his questions fully and explicitly. In constructing his instrument he evidently made the mistake of supposing that a simple hollow box would answer the purpose, and so neglected to provide it with "braces," "lining-blocks," and "inside bridges." If such was the case, it is no wonder that his "back" gave, and his "belly" became hollow. It is not improbable that he has altogether missed the first paper that has appeared on the subject. With regard to the Xylophone, the *best* wood for the purpose is rosewood, but very good instruments may be made from yellow pine. They can be made, in fact, from almost any wood that is free from knots: the more dense kinds giving, as a rule, the best results.—R. F.

Bamboo Canes.—J. D. (*Edinburgh*).—Apply to Mr. F. Westbury, Great Dover Street, Boro', London, S.E.—I daresay he would make you up an assorted bundle of bamboos for 10s. If not you cannot do better than get them from some good local cabinet maker who sells bamboo fancy furniture.—D. D.

Converting Blinds.—A. L. B. (*Stoke Newington*).—You will experience no difficulty in removing the wire gauge from the frames. These may afterwards be filled with stained glass. But as this is comparatively costly one or other of the substitutes may suit you better. If so I can recommend "Glacier," which is an excellent imitation, inexpensive, and easily applied. I daresay you know it can be got at Perry's, Holborn Viaduct.—D. A.

Articles in WORK.—T. W. (*Pateley Bridge*).—Sketching in water colours cannot at present be taken up in WORK. Any paper you like to send in on approval will be carefully considered, with a view to publication.

Mail Cart.—H. W.—I designed Fig. 6 at the suggestion of a reader of WORK. I improved upon the ordinary mail cart by making the seats to lift or fall to allow the riders to stand up when tired of sitting. In the design the footboards look stronger than the cross-bars, which in reality should be *vice-versâ*, the cross-bar being 1 inch square of ash or oak, and the footboards ½ inch thick. After I had designed Fig. 6, the idea occurred to me to improve the mail cart further by fixing a box underneath the seat, having a hinged lid in the centre of the seat to place small purchases, etc., in the box. The box must not touch the axle, or the springs would not be of any use to save the cart from jolting. This idea is happily carried out in Fig. 8. As these two designs were specially designed for WORK, and the improvements have not been patented, I think you need not be afraid of infringing upon them. Of Fig. 3 I, however, cannot speak, it being illustrated

and showing the general way of making them, and as being the principle upon which all the others are made.—W. P.

Iridescent Silver Leaf.—J. H. (*Birmingham*).—Iridescent or "Peacock" silver is of German manufacture, and owes its colour (as we imagine) to exposing the leaf to the fumes of some weak acid made warm. If, as we conclude from one of his other queries, J. H. is a printer and requires the leaf for printing purposes, we may tell him that its appearance on small type scarcely repays the trouble of using it; but that on large type, and especially by artificial light, its effect is exceedingly good. The leaves are to be procured at 12s. per 1,000 from Mr. W. Hofer, 37, Upper Thames Street, London, E.C.—S. W.

Preserving Skeletons.—SKELETON (*London, W.C.*).—We would suggest a careful cleaning of the bones with, say, an old tooth brush, and a strong solution of potash or soda. If they are not then of a good colour, they can be further bleached by exposure to sun, air, and dew, or more quickly chloride of lime. For articulating (that is uniting the joints) wire is best, and in any case the vertebræ will have to be threaded on wire and the skeleton generally supported by it. In the case of small bones, or where the surface of contact is broad, a strong cement (such as isinglass and acetic acid) will serve, but this will scarcely do for the main joints of legs and wings. In small animals the natural ligaments may often be left to tie the joints, and are safe when well dried. As regards a work on taxidermy, SKELETON will probably find the directions in Dixon's "Rural Bird Life" (Longmans, 5s.) about what he requires. Waterton's system of setting up birds, etc., without wires, is printed with the better editions of his "Wanderings in South America."—M. M.

Cheval Screen.—S. N. (*Dalston, E.*).—The dimensions of the cheval screen were not given exactly on purpose that every one who wished to construct it should modify it accordingly. If you take the height of the desk flap at that of an ordinary writing-table, the other proportions matter little. The uprights and shelves should not, I think, be over 5½ inches wide. The thickness depends so much on the texture of the wood used. What would be absurdly clumsy in rosewood would be, perhaps, insufficient in ordinary deal. Wood ¾ inch thick was in view when the designs were prepared, mahogany being quite staple in that thickness.—J. G. W.

Clock-Case Carving.—(*Hexham*).—Had you given the rough dimensions of desired clock case, I would have tried to add a sketch with this; as, however, you do not say if it is a bracket, a grandfather's, a miniature, or a Dutch clock you would like to set in carved wood, I fear you must wait until a paper in hand on carved clock cases finds space to appear.—E. B. S.

Monochrome Paper.—H. C. (*Bethnal Green*).—The bookbinder's end-paper you enclose is the right material, but totally unsuitable in design. If my memory serves me, Messrs. Johnston are the makers of very pretty patterns printed in soft greens, greys, cinnamons, and fawns, that look excellently well. Probably no stationer would keep these, but at the larger binding factories you could probably obtain a few sheets. The cost is not great, but the makers, I expect, sell them only in quires of twenty-four sheets of one colour and design. There are soft colour patterns in printed cottons and muslins hardly more costly that might be used, but these would necessarily increase the trouble of manufacture.—E. B. S.

Rivet Holes in Chair.—J. H. (*Manchester*).—If you cannot manage to find the positions of the rivet holes from a study of the drawing, in which they are shown pretty clearly, you should take a few thin slips of wood, cut to the same width as the framing of the chair, and experiment with them, fastening them with screws to represent the rivets. By doing this you will be able to shift the positions of the screws until the proper place is found; you can then put the rivets in the chair to correspond with the screw holes. Of course you must not expect that the chair when finished will fold perfectly flat; few folding chairs do, but it will fold into a much smaller compass than when in use, and so can be the more readily stowed away when not required.—G. LE B.

Vegetable Ivory.—J. S. (*Staleybridge*).—It is not worth your while attempting to make a substitute for ivory for turning. The natural substance known as vegetable ivory is only suitable for small things, and not sufficiently good for much work being spent on it. Xylonite is pleasant to work in and inexpensive, but cannot be got in pieces over 1 inch thick. The address of the makers has already been given in these pages.—D. A.

Metal Watch Cases.—S. S.—I am sorry to say I cannot give any information on this subject. I believe some are made in Birmingham; probably any readers there might help.—J. T. V.

Studio Camera.—H. W. (*Gateshead*).—A description of such a camera may appear after a time, but not just at present.—E. D.

Polishing Table Top.—E. C. (*Reading*).—Certainly. To polish your pitch pine table top, use ordinary white French polish. This can be bought, or you may make it yourself, by dissolving bleached shellac in methylated spirits. The proportions used vary considerably, but if you take 6 oz. shellac to each pint of spirit you will do very well. Of course the more shellac the thicker the liquid will be, and *vice versâ*. Before applying the polish you should fill in, that is to say, stop up the grain of the wood with some filling, of which one of the best is some whiting mixed with oil and polish. The oil should be raw linseed, and should be slightly in excess of the polish. The filling is best when of a fair working consistency, not soft enough to flow, but softer than putty. Rub this well into the wood, and then clean off the surplus before it becomes hard. You must then body up, and afterwards spirit off in the usual way. If you are conversant with ordinary French polishing on dark wood, you will observe I have given you no directions for oiling your pitch pine top, and in case you may think this is an oversight, I may add that oiling should be, or rather may, with advantage, be omitted. Oil will darken the wood unpleasantly, and in a short time cause it to assume a dirty appearance. The stopping you have used to fill up defects in the wood is not a good one. Instead of beeswax alone a mixture of it and resin is preferable for obvious reasons.—D. A.

Frame Gilding and Varnishing.—A. R. (*Rochdale*).—Your friend is quite right in telling you that the gold bronzing will blacken. There are two ways of using these bronzes: one is to go over the article with varnish or Japanese gold size, and then, just before it gets hard, to dust or rub on the powder with a piece of soft wash-leather. The other way is to mix it in solution with shellac and methylated spirits, or other similar articles, and apply with a brush. It is not often used with gold size, as you did it, since it must lose a large amount of brightness in mixing with this liquid. Some bronzes last longer than others, but it is difficult to judge them when buying as to this quality; they all discolour in time, however. The sample sent is a bright gold colour, and is, so far, of good quality. If you consider it worth while, the bronze can be preserved by a very thin coat of white-hard spirit varnish, or a little white shellac dissolved in "methylated" will answer. This is the only varnish suitable: oil varnish would give the bronze a very coarse and common appearance.—F. P.

Plating Figures.—BRASSOLINE (*Glasgow*).—I expect from our querist's query he means the lacquer that is sometimes applied to these figures. But he can also obtain that dark red colour by means of working a cyanide copper solution with a silver anode, or he can do it also by means of the artificial colouring mixture. A suitable lacquer to use is, dissolve in ½ pint of methylated spirit 4 oz. of clear seedlac and ½ oz. of dragon's blood. These should be well pulverised together before being added to the spirit; this should be done in a glass bottle. The bottle should then be placed in some warm water and gradually boiled; but be careful and see that the spirit does not also boil into the fire, on account of its being so inflammable. *Colouring Mixture.*—Mix a powder well in a mortar: sal-ammonia, 1 oz; copper acetate, ½ oz.; saltpetre, ½ oz.; sulphate of soda (Glauber's salts), ½ oz. When well mixed and wanted to be used, mix it into a paste with a little water, and cover the article with it; gently heat the article till it turns of a greyish colour, then allow to cool, and wash the mass off with warm water and polish with rouge. This is the method I use, and always with great success, and I believe it is the method generally used in Clerkenwell for similar work. If you do not manage to get on with these receipts write me again, stating your difficulty, when I will try and help you.—F. W. M.

Aquarium Dish.—G. T. A. (*Stockton-on-Tees*).—The glass for aquarium can be obtained through any china and glass dealer. Should you have any difficulty, however, buy a cheap epergne with an escalloped dish (that is what I did), and knock off the lower part; you then have a dish with a central hole, price about 1s. The jet is an ordinary "oil can nozzle" (trade term); order from any tool shop. For getting a good effect you must fix this true, so that the column of water falls equally all round, and gives that pretty spray which is absent in a badly-fitted jet.—C. M. W.

Printers' Varnish.—J. A. G. (*West Rainton*).—We should not advise J. A. G. to attempt to make printers' varnish; we assure him it is cheaper to buy than to make. So is boiled oil, to say nothing of the danger of its taking fire, unless it is very carefully watched, or done by steam-heated "jacketed" vessels. If it takes fire it is useless. Gold size, which is also used in coloured inks, is also difficult and tedious to make, and like varnish and boiled oil is much better made in large quantities by an experienced man, in point of certainty and quality, than in the small quantities within an amateur's means. Inks are cheaper to buy than to make, but J. A. G. can, if he prefers it, save the cost in cash by substituting his labour in the grinding. The writer questions very much whether he will save even that, as even with a steam-power mill, the colours for 2s. coloured inks are often ground fourteen times before they are fine enough for use. However, J. A. G. can begin by purchasing at the paint shop, or artist's colourman's, the dry colours he requires, and proceed to grind them with boiled (linseed) oil, as stiff as his strength will allow of, over and over again, until he can see no particles at all, but a very smooth silky surface as the muller leaves it. A glass muller on a marble slab, or a granite one, gives the best results. When thoroughly ground add a pinch of sugar of lead, a few drops of Japan gold size, enough L. P. varnish to let it down to the consistency required, and a little thin litho varnish, if required thinner still or to be transparent. If a tint be required it may be obtained in one of two ways, either by using flake white with the colour, till the right shade is obtained, which is a bodied colour, or by using very little colour, thinned down with litho varnish and gold size, till a very transparent shade is obtained, according to the exigencies of the job. Beware of using a steel palette knife for any aniline colours; a bone paper-knife is better, as iron and steel cause coagulation of these. Vermilion is also blackened somewhat by such contact. A nickel-plated palette knife injures no colours, and is easily cleaned. Terebine is the best cleanser of mullers, slabs, and knives.—J. W. H.

Electric Alarum for Clock.—SEA BOOTS (*Bermondsey*).—You will find full instructions on how to fix an electric alarum on an American clock in No. 32 of WORK, published on October 26th. Further details on how to fix the wires, and connect them to the bell, will be found in replies to ONE IN NEED (*Coventry*) and H. E. C. (*Woodford*). This correspondent wishes he had known WORK before, and says, as he is "a poor man" he is unable to get the back numbers. Well, I am a poor man, but I have got a tidy little library of books, and I don't mind telling you how I got them. I do not smoke tobacco, but set aside my tobacco money for books. My bookcase, with its goodly rows of books, is a case of permanent "smokes." Go and do likewise if you want a nice little library. If you really desire intellectual pleasures, and are prevented by lack of means, give up some gratification of the animal appetite, and spend the money on intellectual pursuits. By giving up half a pint of beer a day for a month, all the back numbers of WORK could be obtained. The first four chapters on Burglar Alarums are found in Nos. 20, 27, 31, and 34.—G. E. B.

Patent Idea.—J. W. (*Newcastle*).—J. W. cannot patent an *idea*. What is required for patenting is a manner, method, or mode of doing something, which must be novel, useful, and not in use by the public at the time of making the application. The purpose mentioned by J. W. is no doubt an important one, and it has occupied the minds of many persons for many years past. If J. W.'s mode of carrying out the idea is simple, practical, and better than the others, and he is in the position to get it taken up by those who would require to use it, it may be worth while to patent it. This, however, must be better known to J. W. than to us, and if he is satisfied that he can turn it to account, and desires to carry it out, on his sending us further particulars we can then say what we think. Our readers should carefully remember that a mere idea is unpatentable, only an actuality—*i.e.*, the embodiment of the idea in a practical form—can be patented, and this, if properly done, and the thing is in a new field, then it gives the inventor the right to any mode of carrying out the object, and protects his rights by making improvers pay him part of their profits, as they would have to pay him for working in his field.—Z.

Broken Mainspring.—S. M. (*Manchester*).—You might, I think, do the mainspring all right. Take the barrel out, and send or take it to a tool shop or watchmaker's, and get a spring to suit; get him to punch a hole in the end of it, if there is not one, and see that the hook fits in nicely, then wind it in by the arbor; oil the cover of barrel, also the bottom, and give just a spot or two on the spring; if it is a horizontal with stop-work, wind up the spring and count the turns it makes—it should be about five; set it up half a turn—that is, put on the key, and wind it up half a turn, and put the finger piece on, letting the shoulder of stop work rest against the solid piece on the star wheel, then there will be power on when the stop work is all down. Now the hairspring. Take out cylinder, and send it or take it to a tool shop with the old spring on it, and get the nearest you can. You can roughly guess if it will do by holding the end of spring, and see how far the cylinder drops; then try the new one by passing the cylinder through the centre of hairspring, and hook it in the slot, and see how far it drops; if too far, take hold of the spring farther in from end—say, half a turn farther—and repeat till you get it as near as possible, to drop the same distance; then you have a guide where to pin the loose end. Now take off the old one, collet and all, take out the pin that fastens the inner end to the collet, pass the end of new one in, and replace collet on the cylinder; then the outer end must be passed through the stud as far as where you held it last when measuring the drop, and on looking either on the edge or top of balance, you will see a dot mark; bring the stud in a line with the dot and top cylinder pivot, then it will be in beat; put in cylinder, and test it for time; if losing, draw spring in through the stud farther, put it in beat, and try again, or if gaining let the spring out of the stud. I trust this will help you, but it is a rather delicate job to do for a novice.—A. B. C.

Model Manchester Dynamo.—J. G. (*Manchester*).—J. G. wishes to know how to wind a small model of a Manchester dynamo (pole pieces, 4⅞ in. by 1⅛ in. by ¾ in.; cores, 3 in. by 1 in.; armature channel, 2⅝ in. by 1⅛ in.) so as to get the best result in lighting 10-volt incandescent lamps. Wind 2 lbs. of No. 24 silk-covered copper wire on the fields, 1 lb. on each core, and from 3 to 4 ounces of the same wire on an H girder armature. The utmost you could get from such a small machine, driven at the rate of 3,000 revolutions per minute, would be current enough to light two small 10-volt lamps. You may not get even as much current as this, for the performance of the tiny machine will depend much on

the perfection of the winding of its coils, fitting of the various parts, and adjustment of the brushes. A little loose winding, imperfect insulation, or bad connection will spoil all.—G. E. B.

Battery for Electric Lamp.—A. O. P. (*Birmingham*).—The size of battery required will depend upon the voltage of the lamp to be lighted, and the candle power of light desired. You will find full information in my articles "Model Electric Lights," which will appear shortly.—G. E. B.

Defective Alarum Battery.—B. B. (*Halifax*).—As the battery has run down in less than six months, it proves, either that it was made up of bad material, and badly put together, or it has been overworked, probably by leakage. This may be due to defective switch, defective insulation in the alarum system on the clock, or bare wire touching the staples and these driven into damp wood, or thickly painted wood. When a battery is thus exposed to leakage, the zincs soon blacken, the porous cells get coated with nodules of salt, and a strong odour of ammonia is given off from the cells, whilst the battery soon runs down.—G. E. B.

Dining-room Couch.—W. (*Huddersfield*).—Unless you are acquainted with "frame" making and upholstery, which I may assume you are not, it would be impossible within the limited space of "Shop" to give such directions as would be of use to you. To describe the frame or wooden part of the couch at all adequately, would occupy two or three pages, and the upholstery as many more. The subject, however, is noted for treatment on some future occasion.—D. A.

Rocking Boat for Children.—W. H. (*St. Leonards-on-Sea*).—I fear it will be impossible to give a detailed description of this for some time, meanwhile the following suggestions may be of use to you. A couple of pine rockers of exactly the same size and shape. Brace them in the centre with a board connecting the two. On this board place a seat for two children back to back. At each end of the rockers connect by a plank to serve also as seats. Such a boat will do for four children. If these hints are not enough let me know where your difficulty lies, and I will try and remove them either in "Shop" or, if possible, by arranging for a short illustrated article. The demands on space, however, are so great that I cannot promise this.—D. A.

Painting Articles of Furniture.—W. R. (*Sheffield*).—I am truly sorry for your disappointment "at not finding names of colours to finish articles in" given in WORK, but apart from the fact that everything cannot be treated of first, the subject of colouring is rather one for suggestion than for didactic treatment. The colour of articles of furniture is so much a matter of personal taste, that not knowing what yours may be, it is almost impossible to offer you that assistance which I should wish to. A great deal depends on the surrounding colour, that is to say, the colour of the walls, curtains, etc., of the room, the furniture is to be in; you do not tell me this. If I were you I certainly would not paint the articles in four colours, for the more you have the greater the difficulty in getting a harmonious result. I think you will do better by limiting the number to two. Be guided by the following general principle. Try to avoid a patchy effect, and do not let the colours be too violent in contrast. Thus, though orange and blue, green and red may be complementary colours, and form a correct harmony, they are obviously inappropriate for bedroom furniture, for in a bedroom one naturally wants quiet and restful colours, colours of low tone. For bedrooms the prevailing taste is to have the furniture, when painted, in very light colours, little more indeed than white tinted. This, however, is objectionable to some, or let me say in some rooms, for if the walls are dark, the lightly-coloured furniture is apt to be garish-looking. The endeavour should be, in a really artistic room, to have all in harmony both in colour and tone. A skilful decorator can so apply the brightest colours that they all blend in one harmonious whole, and none assert undue prominence. The effect obtained is one of richness and bloom, but to get this requires artistic perception and training. I cannot advise you yet awhile to aim at such ambitious work. If you want dark colours, try a ruddy brown and dull green, while if you prefer light, use one pinkish tint, and the other a pale blue. If you wish to further decorate you may apply a few lines or simple ornament in darker tints, just to emphasise the others. Black is useful for this when very sparingly and judiciously employed. I do not know the designs of your articles, so cannot give directions for the different parts, which must be treated according to your own discretion. Finally, after having endeavoured to show you the principles you should go on, though briefly, for the subject is almost inexhaustible, I may recommend you to paint your furniture in the two prevailing colours of the wall paper of the room the things are to be placed in. The decorative effect of the whole can then hardly fail to be pleasing. As you have a maker's colour card you can easily name those likely to suit. It might occasionally be more convenient for a few readers if colours were to be always referred to according to a particular maker's sample cards, but you must remember that there are other makers besides the one you name. It would give an undue prominence to his manufactures, and be rather unfair to others equally good, besides hampering the majority of readers in their free selection. Of course if there were any special reason for naming any particular fancy colour it would be given, but I think you will agree with me that these exceptional cases should prove the rule. I shall be glad to hear what colours you adopt, and I may be able to give you a few more hints for future guidance. It will not be a very serious matter for you to repaint all or part, and if you can send a rough sketch of the furniture, it may be of some assistance to me in advising you.—D. A.

Silvering Glass.—J. W. (*Muirkirk*).—This work is not suitable for an amateur, either by the pure silver or the old mercurial process. The latter, however, offers the best chance of a certain amount of success being attained, though the other is so much less costly that except as a matter of experiment or curiosity you may as well give up the idea of silvering your own mirrors. Briefly, the process is as follows:—The surface of the table must be perfectly smooth and flat. On this spread tin foil, and dab it down till all creases and wrinkles are gone. Then pour some quicksilver on it, and work it on the foil till the two are, to some extent, amalgamated. Put a little more quicksilver on, and on top of it lay a sheet of clean smooth paper. Above this place the glass, which must be quite clean and free from grease. The paper may then be drawn away to remove air, and any dirt that may be floating on the quicksilver. Let the glass remain undisturbed for several, say, twenty-four, hours, after which it should be placed on edge for the superfluous quicksilver to drain off. Be careful that the tin foil used is pure. Easy as the process may seem, it is one that requires skilful manipulation, especially when the glass is of any considerable size.—D. A.

Drawing to Scale.—T. J. (*Monmouth*).—(1) T. J. asks how to draw a scale, and suggests that "this may be a big question." Not at all. T. J. must first select a unit of superficial measurement, such as an inch, a foot, a yard, a rood, an acre, a square mile, or a geographical degree of the superficial area of sixty miles (geog.) long by sixty miles wide. Now drawing to scale means simply this, that on the paper this unit is to be reproduced in true proportionate size instead of its actual size. Suppose T. J. takes a foot-rule, 1 in. wide and, of course, 12 in. long, and wishes to show it on a very small piece of paper. He then has only to draw twelve equal divisions for the length, and take one thereof for width; and whether his divisions are tenths, eighths, quarters, or half inches, matters not, for the proportions are accurately represented, viz., 12 to 1. Enlarging is just the same. Take any unit, and in the drawing make every unit the same number of times bigger: the proportion will be maintained. So far, nothing can be simpler; now, then, treat every fractional part of the unit chosen precisely in the same way, so long as you keep to the same proportion and make the same number of divisions in the small scale or large scale drawing as exist in the chosen unit of the drawing you are enlarging or reducing. Things which are equal to the same thing (or, we may say, supposed to be represented—larger or smaller makes no difference on paper as equal) are equal to one another. T. J. can buy accurately-divided scales on wood or ivory, termed "Universal," where the inch is divided into every possible number of parts, which he can follow in reducing, only keeping in mind the fact that if he makes one division of his drawing represent one division of his copy, he must represent every other equal division by an equal division, and not by any different one in his drawing. That is all. (2) The adhesive material used for postage stamps is called "dextrine;" it is simply starch superheated or baked at a high temperature, and, when cold, dissolved in water like gum arabic, when it forms a mucilage largely used in the manufacturing arts. Its adhesiveness as compared with starch was discovered accidentally, after a large fire in a starch warehouse; the heat had converted the starch into dextrine—then unknown—and the water used to extinguish the flames had combined with it, forming a mucilage that does not mildew.—J. W. H.

Wood Engraving.—J. D. R. (*South Wales*).—The fullest treatise we know is John Jackson's "History of Wood Engraving;" it is, however, probably out of print. A superb work on the subject is by the greatest wood engraver that ever lived—W. J. Linton—and is now being largely sold; its price—necessarily high—alone limiting the sale of what will be the great standard work on the art for all future time. Order of your bookseller.—J. W. H.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—D. M. & Co. (*Manchester*); J. W. (*Glasgow*); G. H. B. (*Smethwick*); W. W. (*Sussex*); L. & Co. (*London, W. C.*); A. B. (*Brighouse*); WATCHMAKER; BOATS (*St. Leonards-on-Sea*); A. W. S. (*Halifax*); W. M. (*Birmingham*); ABINGDON; CONSTANT READER; BOATS (*Wakefield*); R. B. (*Highbury*); A. H. O. (*Lewisham*); H. H. W. (*Pimlico*); P. F. F. (*Highbury, N.*); C. E. H. (*Rotherham*); W. D. C. (*Liverpool*); F. J. H. (*Salford*); A. R. (*Hillsboro'*); C. S. (*Aldershot*); Z. Z. Z.; J. T. (*Newport*); FOCUS; P. A. (*Glasgow*); MAGNET; BROMIDE; G. G. T. (*Edinburgh*); S. F. W. (*Edinburgh*); PAINTER; S. C. & SON (*Salop*). ROUGH CARPENTER; T. J. (*Dowlais*); W. W. (*Elswick*); TECHNICAL; W. E. (*Hinckley*); AN IMPROVER; A. G. (*Burton-on-Trent*); J. H. M. (*Ashfield*); W. C. (*Glasgow*); S. J. A. (*Hampstead*); FRITZ (*Upper Holloway*); J. O. M. (*Woolwich*); C. D. (*Camberwell*); T. B. (*Plymouth*); W. E. B. (*Rotherham*); A. B. (*Bradford*); H. W. L. (*Ealing*); H. J. T. S. (*Guernsey*); J. S. (*London, N.*); DIXA (*Aberdeen*); R. C. (*Ashton-under-Lyne*); J. M. B. (*London, W.*); SLACK; R. J. (*Scarboro'*); H. E. (*Clapham*); J. M. (*Glasgow*); W. E. (*Heckmondwike*); E. F. (*Walsall*); G. P. (*Islington, N.*); W. B. (*York*); TO PO; S. L. A. (*Hampstead*).

Trade Notes and Memoranda.

AMONG the lectures to be given in the 136th session of the Society of Arts are the following:—One by Mr. George Findlay, the general manager of the London and North-Western Railway, upon "Modern Improvements in Facilities for Railway Travelling;" another by Sir Douglas Galton upon "M. Girard's Sliding Railway," with which Mr. Gladstone was so much struck when recently visiting Paris; and a third by Mr. Frederick C. Danvers upon "The Records of the India Office." Five courses of "Cantor Lectures" will be delivered, these being upon "Modern Developments of Bread-making;" "The Electro-magnet;" "Stereotyping;" "Some Considerations Concerning Colour and Colouring," and "Sugar, Tea, Coffee, and Cocoa: their Origin, Preparation, and Uses."

WHEN Tangye Brothers, the well-known engineers, had but a small concern in St. Paul's Square, Birmingham, they purchased the patent of a hydraulic lifting jack, and proceeded to manufacture large numbers of the article with which a man can lift more by the pressure of a single finger than can be raised by the combined strength of two men working the old screw-jack. But at that time labour-saving apparatus was not so readily taken up as now, and the patent jack remained on the hands of Tangye Brothers so long, that serious financial difficulties, consequent upon the capital being locked up, stared the little firm in the face. Just at that time the *Great Eastern* had been completed, and unsuccessful attempts made to launch her. Then came an offer of £10,000 to any firm who would undertake to convey the great ship to the water. Tangyes accepted, and with their hydraulic jacks lifted the leviathan completely from her cradle, and into the river. Thus they not only secured the much needed capital, but also the best possible advertisement for their jacks. Mr. Richard Tangye, in telling the story one day, characteristically concluded with:—"And so we launched the *Great Eastern*, and the *Great Eastern* launched us."

WORK.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [6 R

Complete Fount of Rubber Type.—Two alphabets, to form any word or name, box, pad, ink, and holder, post free, 1s. 6d.; extra alphabets, 6d. per set; figures, 3d. Business, address, and pocket stamps equally cheap.—W. C. PRESTRIDGE, Manufacturer, Cumberland Street, Bristol. Established 1870. [2 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [3 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

"Roll Call" Pipes.—Healthful, Luxurious, THIRSTLESS Anti-nicotines. Briars. Post free, 1s. 8d.—ALLEN DEWSNAP, 65, Pikes Lane, Glossop. [5 R

The "Postable" Floral Tripod (see WORK, Jan. 25th), post free, 1s. 6d.; pair, 2s. 9d. Bamboos supplied.—S. J. EATON & Co., 2, New Inn Yard, Tottenham Court Road, W. Agencies granted. [1 S

Notice.—We take in Exchange Lathes and various tools for better. Catalogue, 6 stamps. List of Second-hand, 2d.—Britannia Co., Colchester.

Largest Stock of Engineers' and Mechanics' Lathes, Shapers, etc. Stocks and Dies. Forges, etc.—Britannia Co., 100, Houndsditch, London.

Call and select from our stock at 100, Houndsditch; but all letters addressed Britannia Tool Factory, Colchester.

Britannia Co. supply Gas or Steam Engines, and fit up workshops complete. Terms, Cash or easy terms. [8 R

Walker's Turning Patterns, accurately drawn, 1st and 2nd series, 1s. 7d. each.—WALKER, 41, St. Helen's, Ipswich. [2 S

Diamonds for Drilling China and Glass. Usual sizes, 6d., 8d., 10d., and 1s. each, best quality.—A. MELVILLE, Market Place, Salisbury. Estab. 1777. [3 S

Microscope Slides.—Gorgeous polarising, brilliant opaque, and entertaining Slides, 3 × 1, 5s. dozen. Catalogue free; microscopes, mounting apparatus, etc.—HENRY EBBAGE, 344, Caledonian Road, London. [4 S

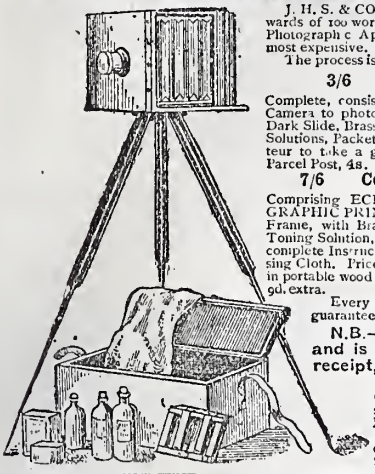
Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields, etc. Each packet, 1s. 100 Decorator's Stencils, 60 sheets, 2s. 6d. All post free. Lists free.—F. COULTHARD, East Cliff Terrace, Bournemouth. [5 S

J. H. SKINNER & CO., EAST DEREHAM, NORFOLK,

MANUFACTURERS AND IMPORTERS OF

PHOTOGRAPHIC APPARATUS AND FRETWORK MATERIALS.

Timber Yards, Sawing and Planing Mills covering about Two Acres near Railway Station.



J. H. S. & CO. have now a large Factory with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description, from the cheapest to the most expensive.

The process is simplicity itself. Full Instructions supplied with each set.

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 0d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

Every Set is carefully examined before being sent out, and guaranteed to be in working order.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase money.

Better Sets, 10s. 6d., 21s., 42s., 100s., and upwards. Complete Catalogue of Photographic Apparatus, one stamp. **J. H. SKINNER & CO., EAST DEREHAM, NORFOLK.**

Wholesale Agent for London—J. MOTHERSILL, 60, Holloway Road, N., and 6, Southampton Row, where Samples may be seen.

J. H. S. & CO. keep regularly in stock about **120,000 FEET OF FRETWOOD,** solid and 3-ply, veneers, &c., besides a very large quantity of Logs, Planks, and Boards, Carving and Turning Wood, &c., and **200,000 FULL-SIZE DESIGNS for Fretwork, Wood Carving, &c.,** besides an immense Stock of Joiners' Tool Chests, Fretwork Outfits, Drills, Saw Frames, Hand and Treadle Machines, Saw Blades, &c. &c.

Specialities for 1888 & 1889.—Books of New Designs. FRETWORK No. 1, containing 12 Large Sheets, price 1s. No. 2, containing 20 Sheets of larger and more elaborate Patterns, 2s. 6d. Book of Wood Carving Designs, containing 14 Patterns, price 1s.; these are all New Patterns, not sold in any other form, and would, if sold separately, cost three or four times the amount charged. Fretworker's Handbook and Workshop Guide, price 1s. New Designs. All Patterns greatly reduced in price.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, 48 Saws, Awl, File, 4 Designs (with sufficient planed Wood, gratis), and 1s. Handbook on Fretwork, price 3s. 6d., carriage paid. 12 feet Assorted Planed Fretwood, 3s. 6d.

☞ Special Fretwork Design, in commemoration of Her Majesty's Jubilee, size, 36 in. by 26 in., price 2s. 6d.

JUST PUBLISHED, NEW CATALOGUE of Machines, Saws, Designs, Wood, &c., 56 pages, 600 Illustrations, with Instructions, 4d., post free. Good Fret Saws, 1s. 4d. per gross; best ditto, 1s. 6d. per gross.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

Bovril.

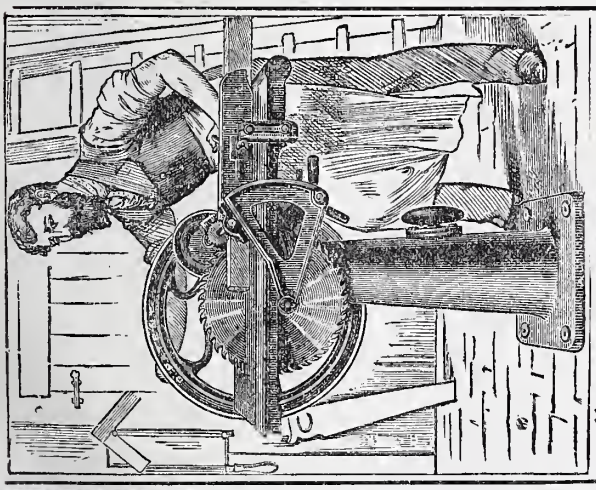
Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.



"THE LEYTON"

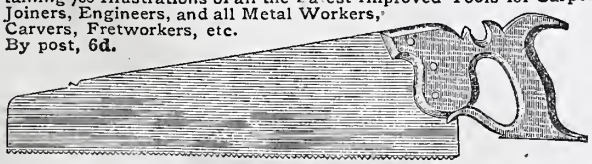
New Patent Circular Saw Bench for Hand Power. Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

TOOLS.

Buy from the MAKERS, the Oldest Established and the Best House in London.

NOTE.—Our New Illustrated 200-Page Catalogue is now ready, containing 700 Illustrations of all the Latest Improved Tools for Carpenters, Joiners, Engineers, and all Metal Workers, Carvers, Fretworkers, etc. By post, **6d.**



OUR NOTED CAST-STEEL HAND-SAWS.

18 in.	20 in.	24 in.	26 in.	28 in.	Rip or Half Rip.
3/9	4/-	4/9	5/-	6/6	CARRIAGE PAID.

NOTE THE ADDRESS:— **MOSELEY & SON, 323, High Holborn, W.C.**

? How do you do? WITHOUT JUDSON'S DYES? 6d. POWDER AND LIQUID.

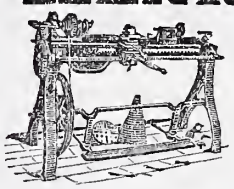
Ladies note this! Six 30s. Spring Bonnets will be given as prizes for the best Essays on Home and Church Decorations with the assistance of Judson's Specialities; bonnets to be selected by winners from a first rate West End Shop. Six guinea Silk Hats will be given as prizes for Gentlemen Competitors. Full particulars post free from

DANIEL JUDSON & SON, Limited, 77, Southwark Street, London, S.E.

HENRY MILNES,

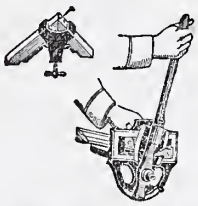
MANUFACTURER OF

HIGH-CLASS LATHES FOR SCREW-CUTTING & ORNAMENTAL TURNING, TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.



Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**



PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine,** any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,

TOOL MAKERS, DUBLIN.

ETCHINGS.

A LARGE AND CHOICE STOCK BY ALL THE BEST ARTISTS.

A Great Variety of **ENGRAVINGS** from the most Popular Subjects.

Hunting, Coaching, and other Pictures of all kinds at Lowest Prices. **SPORTING.**

GEO. REES, 115, Strand (Corner of Savoy St.);

Moulding Dept., 41, 42, 43, Russell St., Covent Garden, London.

Post free on application. *CASSELL'S CLASSIFIED CATALOGUE.*

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.

37, CHANCERY LANE, LONDON, E.C.

NOTICE.—Ask your bookseller to show you copies of CASSELL & COMPANY'S NEW SERIAL PUBLICATIONS.

*** *A List will be sent post free on application to*

CASSELL & COMPANY, LIMITED, Ludgate Hill, London.

ASPINALL'S ENAMEL.

COLOURS—EXQUISITE. *SURFACE—LIKE PORCELAIN.*

Testimonials from the Queen of Sweden, the Marchioness of Salisbury, &c.

FOR ALL SURFACES OF WICKER WOOD, METAL, GLASS, EARTHENWARE, CHINA, &c.

"Simply Perfection."—*The Queen.*

Made in over 100 Colours. Sold in Tins, 4½d., 1s. 3d., and 2s. 6d. For Baths (to resist Hot Water), 1s. 6d. and 3s. Post free, 7d., 1s. 6d., 3s.; 9d., 1s. 9d., and 3s. 6d.

READY FOR USE. A CHILD CAN APPLY IT.

SOLD EVERYWHERE.

ASPINALL'S ENAMEL WORKS, LONDON, S.E.

Telegrams—EDWARD ASPINALL, LONDON. COLOUR CARDS FREE.

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6d. OR FOR 7 STAMPS BIRMINGHAM. [33

GRATEFUL—COMFORTING.

EPPS'S COCOA

BOILING WATER OR MILK.

FRETWORK AND CARVING.

Highest Award—Gold Medal for Tools and Patterns.

Machines, Designs, Tools, Wood, Mirrors, Hinges and Fittings, Varnish, etc.

T. N. writes:—"I got a First Prize from one of your Designs."

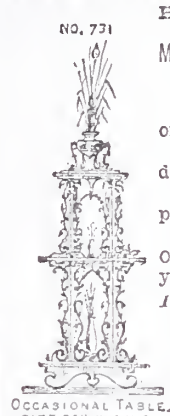
R. W. A.:—"Received your Catalogue today, and consider it the best I have seen."

R. B. M.:—"Machine to hand, am highly pleased with it."

J. A. S.:—"I have taken Eight First and One Second Prize with various patterns of yours."

Illustrated Catalogue of all Tools, Wood, etc., and 500 Miniature Designs, free for Six Stamps.

Harger Brothers, SETTLE, YORKS.



A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 57.] SATURDAY, APRIL 19, 1890. [PRICE ONE PENNY.

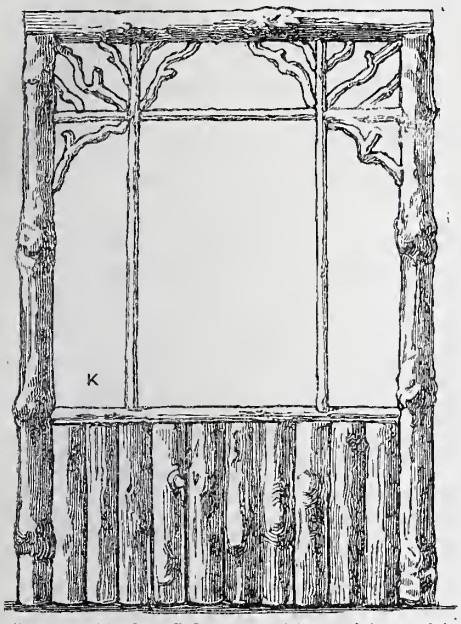


Fig. 1.—Window Side from without (½ in. scale).

AN OCTAGONAL SUMMER-HOUSE;

SUITED TO A GARDEN OF MODERATE SIZE.

BY ARTHUR YORKE.

LAYING OUT THE PLAN—CONSTRUCTION—INTERIOR FITTINGS—RUSTIC MOSAIC—MATERIALS FOR MOSAIC — THATCHED ROOFS — LINING FOR ROOF—MAKING THE FLOOR.

No garden can give its owner the full amount of enjoyment which he has a right to expect from it, or can be called complete, without some sort of summer-house. That people generally are of this opinion is seen in the frequency of buildings of this nature; a great many of these buildings, however, though they doubtless give pleasure to their owners, are far from agreeing with the canons of good taste.

A portion of the questionable taste so shown is perhaps of necessity. Sometimes, especially in suburban neighbourhoods, it is not easy to get really appropriate materials; but the defect oftener lies in the want of proper designs, and in this respect I hope to be able to do some service. The designs which I have to offer are adapted to gardens of different sizes and degrees of pretension — that is, within modest limits. And in our smaller ones that common necessity for doing the best one can with indifferent materials will be a thing borne in mind.

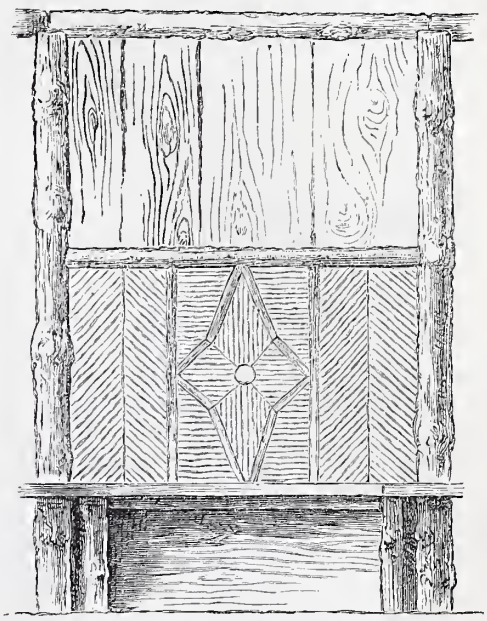


Fig. 2.—Seat Side: interior (½ in. scale).

The summer-house in Fig. 3 is suited to a garden of moderate size, one in which want of space may not necessitate crowding the building close against a wall, and of which the owner may be supposed able to afford the not very costly luxury of proper materials. This octagonal summer-house is not of a size to fit it for the grounds of a palatial mansion, yet it contains a reasonable amount of accommodation, having a continuous seat some 15 ft. long. From side to side each way it measures 10 ft. Fig. 3 is an elevation of the front, and is therefore somewhat more stiff and formal than a perspective view would have been; but it has been given as more useful for practical purposes, since accurate drawing to scale (⅓ in. to the foot) is thus attained.

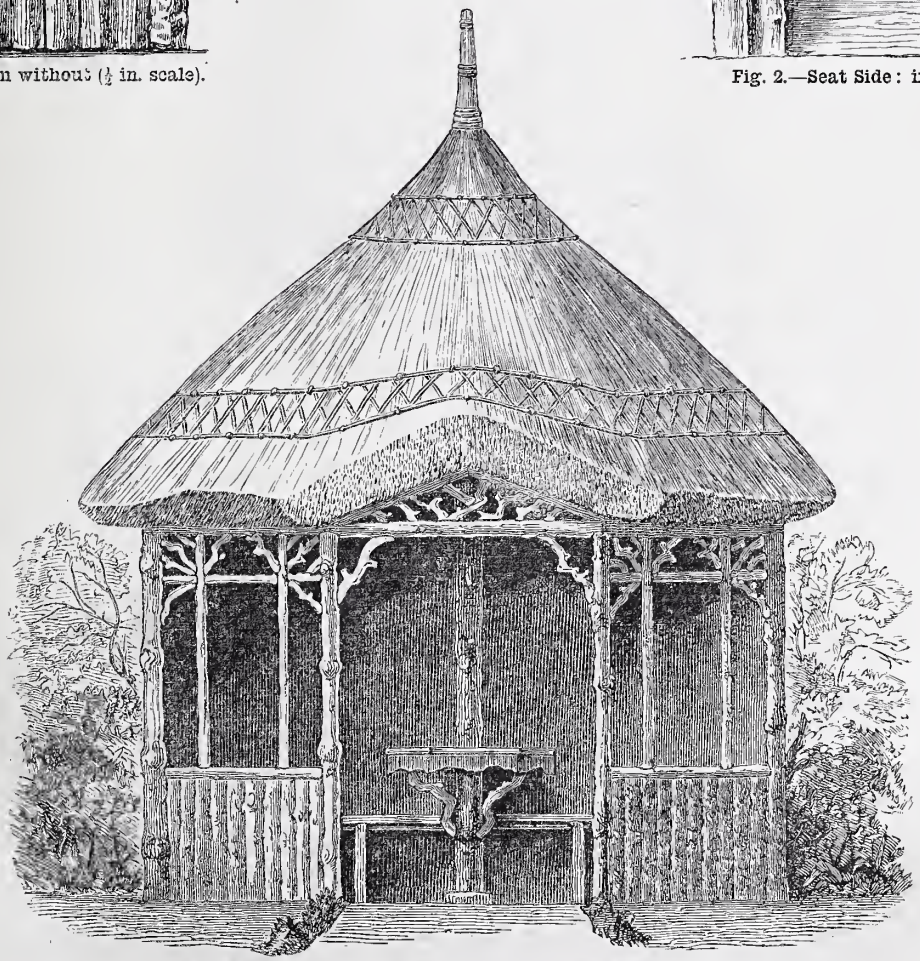


Fig. 3.—Octagonal Summer-House: Front Elevation on scale of ⅓ in. to 1 ft.

Its framework and the main part of it are of the material advocated for garden purposes in my article on "Some Rustic Carpentry," Vol. I., p. 247: namely, larch poles; other woods are, however, as we shall presently see, used for minor purposes. The roof is of thatch. In the arrangement of this building there is a certain resemblance to a tent. It has a central pillar, not unlike a tent pole, which

sustains much of the weight of the roof. In Figs. 4 and 10 this central pillar is marked A, and in the former diagram a dotted line shows how it is surrounded by a fixed octagonal table. Being of first importance, this pillar is somewhat larger than any of the other timbers—say, 6 in. in diameter near its bottom, and tapering as little as may be. A rod of iron or wood rises from its top to form the centre of the straw pinnacle seen crowning the roof in Fig. 3. This pillar shows a height of 11 ft. 2 in. above ground, and it should not be let less than 3 ft. into the soil; for it will need to be firmly fixed, or it may be forced out of the perpendicular during the erection of the roof; when the roof timbers are once fixed in place it will have little further chance of moving. The diagram Fig. 4 is a ground plan, and Fig. 10 is a section showing the timbers from the interior: both are drawn on a scale of $\frac{1}{4}$ in. to the foot.

The eight collar-posts (B, B, B, Figs. 4 and 10) at the corners of the octagon are of somewhat smaller stuff—say 4 in. They show 6 ft. above ground, and should have 2 ft. below. It will be well to gas-tar all the underground work, as recommended in the former article, cited above.

The ground plan of a building in this shape is readily laid out. The space being levelled, a string is taken which has a loop at each end, and is 5 ft. 2 in. long. With a stake driven through the loop at one end as a centre, and with a stick passed through the loop at the other to serve as the travelling leg of the compasses, a circle is struck 10 ft. 4 in. in diameter, and into this pegs are driven at equal intervals (4 ft. apart) to mark the centres of the eight collar-posts. Whilst digging the holes for the posts, these points are kept by drawing two straight lines on the ground which intersect at the peg.

The cross-pieces which rest on the collar-posts, and which serve as wall-plates, are of a trifle smaller stuff than the posts—say 3 in. Fig. 7 shows how they are cut to fit the tops of the posts, and nailed there. In this building there are no mortises, nor, indeed, anything but such simple carpentry as anybody can do with the simplest tools. On these ends above the posts rest the lower ends of the eight main rafters, D, D, D, the upper ends of which rest against and are nailed to the central pillar. The eight intermediate rafters, E, E, E, rest at bottom on the middles of the side plates, and at top are cut to fit upon and between the tops of the main rafters.

The laths used are in this case in no way particular—any sticks will do: they will not be seen, and under thatch there is no necessity that a level surface should be formed by them, as for slates or tiles. They are nailed 6 in. or 8 in. apart.

It will be seen in Fig. 3 that over the entrance a small gable is formed: how this is arranged is shown in Fig. 6. In this diagram the spectator is supposed to look down upon the roof. The laths, when nailed on, will have to run over the little ridge formed by F, instead of keeping the level, as on the other sides. This will cause no special difficulties in the thatching. The thatcher is an accommodating man, who readily makes up hollows and fits his work to any irregularities.

The walls are of larch poles sawn in half. To split a number of heavy poles with the hand saw is tedious work, and it is better to go to the little extra expense of having them run through by the nearest steam saw. The quantity of half-stuff required may be easily calculated; one of these sides will take about five and a half 6 ft. lengths of 4-in. stuff. The tops of these wall-pieces are sawn obliquely to fit against the round wall-plates to which they are nailed. In their lower parts they are nailed to the lower cross-pieces, G, G, G, Fig. 10.

These latter will best be made of rather large stuff quartered, since their upper sides on which the seat-boards rest should be level, as well as their backs, which go against the wall-pieces. The middle cross-pieces are of smaller half-stuff, and should be nailed to the wall-pieces rather than that the wall-pieces should be nailed to them; for they are in a conspicuous place, and nails driven through them and clenched would be unsightly.

The front supports of the seats are let into the ground some 6 in., and rise $14\frac{1}{2}$ in. above the ground line. The seats themselves it will be advisable to cut from inch board, and about $16\frac{1}{2}$ in. wide. I shall speak presently of the manner in which their edges and upper sides will be ornamented.

In the two window sides of the octagon (see Figs. 1 and 3), the space below the windows is filled with whole poles, their bottoms resting on a sill let in level with the ground, and their tops nailed into through a cross-piece of half-stuff (K, Fig. 1). The mullions and transoms of the windows—if such grand architectural terms may be applied to the mere sticks which pass up and across them—are of small straight larch stuff, but the ornamental filling in above is of crooked branches—oak bangles by preference, though apple-wood would do very well. The latter is particularly mentioned because it often happens that an old apple-tree is cut down in a garden such as that in which we now suppose ourselves to be building, and is at once condemned as firewood; yet its stem may have grotesque knots, and its branches picturesque contortions which would make it valuable for rustic work. Whenever rustic building is contemplated, it is well that such wood should be laid by; a single tree would supply all the small quantity of crooked stuff that is required in the present instance. And indeed, when fruit or ornamental trees of any other kind are cut down, there is no harm in considering whether any part of them might not come in usefully for garden carpentry; even the interlaced stems of ivy, when an old growth has covered a wall, have sometimes been utilised to excellent effect.

It may be observed that any chinks between the pieces beneath the windows, as well as in the walls generally, are most readily and appropriately rendered windproof by neatly stuffing with moss. Fig. 1 gives a full front elevation of one of the window sides (they being only seen obliquely in Fig. 3), and it is on the $\frac{1}{2}$ in. scale.

Four stout crooked pieces are used as struts to support the table (drawn to 1 in. scale in Figs. 5 and 8); $\frac{3}{4}$-in. board will suffice for the top of this table, and it will probably be cut from two widths. To give proper strength to the ornamental border (seen in Fig. 8), a second thickness of the board is attached below each corner, extending 3 or 4 in. to each side, so as to allow each of the longer bits of split rod to be fixed, as shown, with *two* brads.

A really satisfactory material in which to finish the top of a rustic table is not easily found. We require something which will give a level surface, and at the same time be in harmony with its surroundings. Board, planed or painted, oilcloth, or any manufactured material, we feel to be out of place; marble or slate looks cold and hard. We can find nothing absolutely level that satisfies our taste, and have to fall back on that old resource in rustic work—rustic mosaic. By this we mean split rods of wood so bradded down as to form patterns. For our present purpose, however, we need to keep the mosaic more neat and smooth than usual. Fig. 5 shows the top of our table thus treated.

The rods most in favour for rustic mosaic are those of the hazel. They are to be bought cheaply and abundantly when the undergrowth of woods is cut. They have a smooth and pretty bark, and the useful size is from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. Sticks of other kinds of the same size can also be used: birch and wild cherry may be named among those with smooth bark, and wych elm and maple among those with rough; willow or withy, again, is of most common growth, and exceedingly useful. In river-side neighbourhoods it is often the most cheap and plentiful of all woods. For mosaic work, it is always peeled, for its bark is unattractive, and its light colour when stripped makes it tell well in contrast to the dark bark of other woods. If used, as it often is, for outdoor purposes in garden carpentry, it should always be peeled. Country carpenters have a saying that withy lasts twice as long without its bark as with it; and in this there is much truth, for the loose bark holds the wet to the wood and causes it to rot. To make it peel freely, it should be cut just as the young leaves make their appearance. The like holds good with other woods; but if it is desired that the bark should hold firmly, the wood should be cut down in dead of winter, when all the sap is down.

The top of our table is supposed to be mainly composed of peeled withy. We can make smoother work with it than with almost anything else. We have in this pattern only the double dark line bounding the star and the single strip round the edge in hazel, and for these we can choose level pieces. So much white will not look amiss in this place, and withy is easily worked. Hazel and most woods twist so much in the grain that it is rarely safe to split them except with the saw, but withy—in short lengths like these, at least—can be split with a hatchet.

In rough carpentry there is no more pretty or interesting work than these mosaics. We have more of them in the backs of the seats (Fig. 2), and on the seats themselves (Fig. 9). On the latter, as on the table top, hazel and withy are contrasted, and form a design in alternate triangles; the separating bands, it may be noticed, have a light strip against the dark, and a dark strip against the light, triangle. Along the edge of the seats one or two strips merely are nailed lengthwise. In such a situation an ornamental edging like that round the table would be too liable to be broken. It is recommended that the back of the seats should be in dark bark-covered woods only, for the mosaic in that position will look better without any mixture of the light-coloured withy.

The upper compartments of the sides with which the backs of those sitting down will not come in contact may be more quickly and yet pleasingly covered with sheets of bark. Elm bark is good for the purpose. It may be peeled in large sheets from the trunks of trees felled in spring, when the sap is rising; and whilst it is drying, should have bricks or stones laid on

it to press it flat. When dried, it is nailed to the walls, and any cracks which appear can be neatly filled with moss. The space beneath the seats is also shown as roughly covered with bark.

The almost conical roof is, it will be observed, a thatched one. In my opinion, no other covering is so pleasing as thatch for a rustic building. Its colour and rough texture harmonise well with the natural wood, and all its associations are of a rustic character; no other covering so effectually excludes the summer heat, and nowhere can one find a retreat so suggestive of coolness, quiet, and repose, as under the low eaves of a thatched building. Thatch has, it must be admitted, certain practical disadvantages — birds and winds are apt to scatter fragments from it in a manner objectionable in a trim garden, and it needs renewing at comparatively short intervals. Yet, in spite of these drawbacks, it is hard to imagine any person of cultivated taste accepting any other covering for a summer-house with thatch at his command.

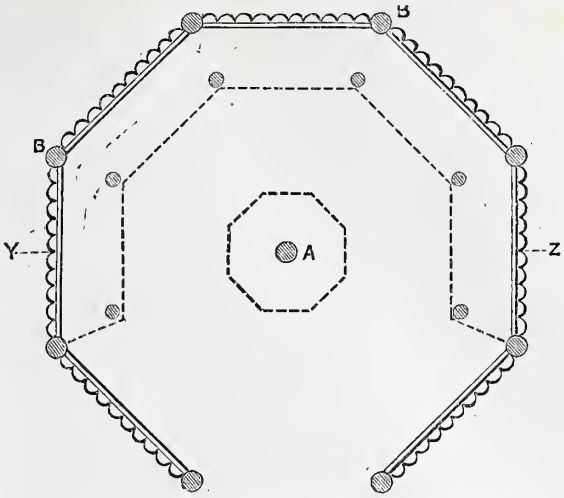


Fig. 4.—Ground Plan of Summer-House ($\frac{1}{4}$ in. scale).

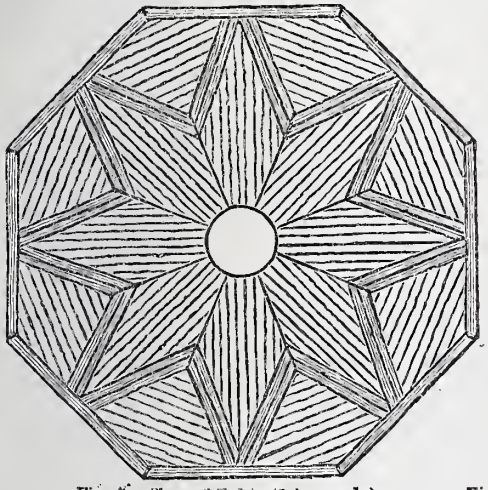


Fig. 5.—Top of Table (1 in. scale).

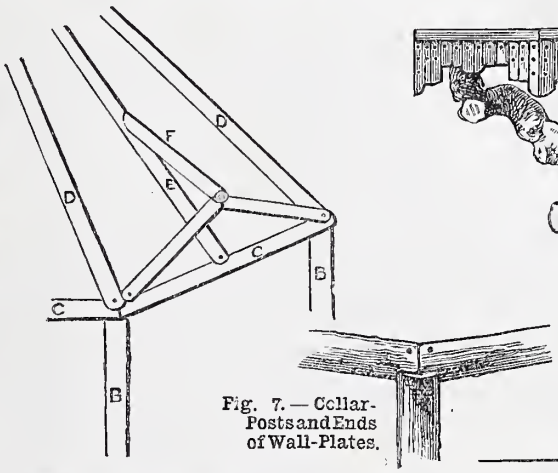


Fig. 6.—Timbers over Entrance.

Fig. 7.—Collar-Posts and Ends of Wall-Plates.

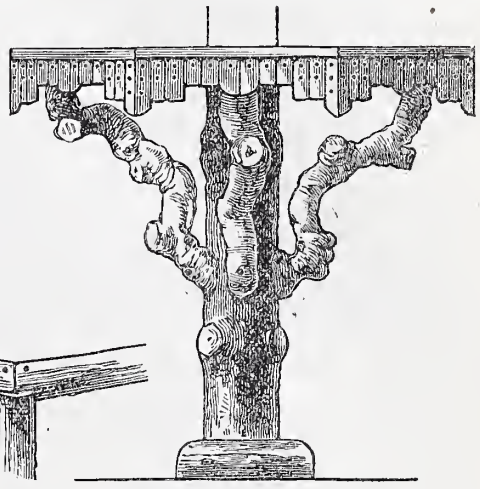


Fig. 8.—Elevation of Table (1 in. scale).

The common saying is that a thatched roof needs re-coating every ten years. Often, no doubt, this is near the truth, yet really good work will frequently stand for almost twenty years. The materials in use in this country are reeds, straw, and stubble. Reeds make a strong thatch, but are not easily to be procured, except in fenny districts. Stubble, which is the lower and stronger part of the wheat stem, stands better than straw, which is its upper and weaker portion; to last properly, however, stubble should be cut immediately after harvest, and should not be left standing, as it frequently is, till the spring, for then the winter rains, collecting in its hollow stems, cause it to rot before it is cut. On small buildings like summer-houses especially, stubble makes a much more compact and sightly roof than straw.

Thatching is not costly or difficult work. In agricultural districts a load of stubble — sufficient to thatch three such buildings as that before us—costs 30s., and a thatcher expects the wages of a first-class labourer only, not those of a mechanic. He needs an assistant, whose business it is to straighten the material into convenient bundles (called "yelvens"), and to supply him as he requires them. If he is re-thatching an old building, he merely thrusts the ends of his new material into the old thatch with a wooden spud; but if he is covering a new roof, he sews down his "yelvens" to the laths and rafters with a huge needle and stout tarred string. He begins at the eaves, laying as wide a breadth as he can conveniently reach on one side of his ladder, this breadth being called a "stelch." He works upwards, each new layer covering the tar-cord which secures that beneath it; and thus he goes on till he has reached the ridge.

In his second "stelch" he is careful to blend together its edge and the edge of that already laid, so that no rain may find its way between them; and in doing this completely lies much of the superiority of good over bad thatching. When laid, the thatch is smoothed down and straightened with a gigantic comb, like the head of a large rake, one end being without teeth, and serving as a handle. In the present instance, the tops of all the stelches meeting in a point are finished and capped by the little bundle of thatching material forming the pinnacle, and which is tightly bound round the rod of wood or iron in its centre.

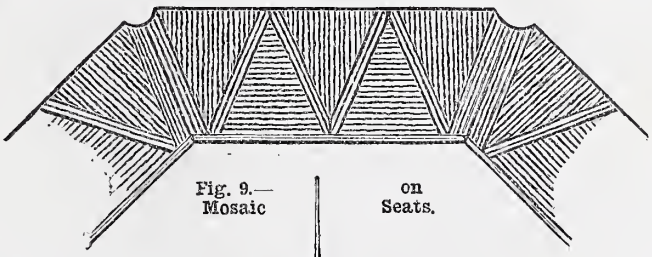


Fig. 9.—Mosaic on Seats.

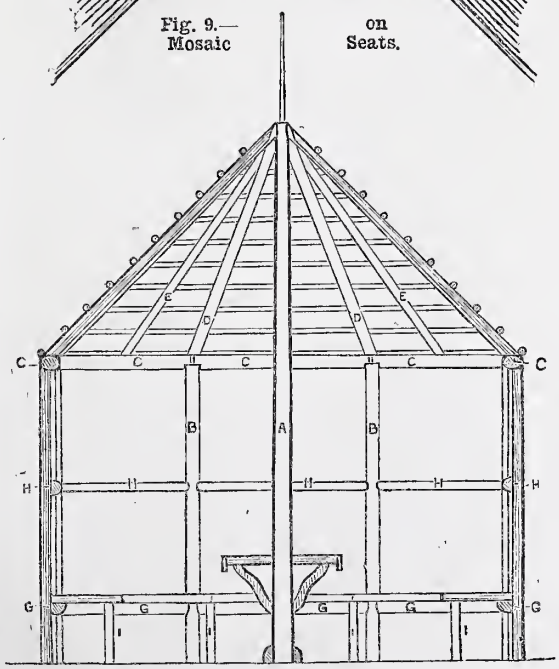


Fig. 10.—Section on Y Z (Fig. 4), showing Framework, etc. ($\frac{1}{4}$ in. scale).

It is usual to bind thatching down with at least two belts of buckles and runners. In our summer-house (Fig. 3) I show two double belts. The buckles have some resemblance to ladies' hair-pins on a colossal scale. They are made of slips of withy, twisted and doubled in their middles and pointed at their ends; the runners are long straight slips of the same. These latter are laid across the thatch, and the buckles, being placed over them, are pushed tightly into it—their points being driven upwards, that wet may not be let into the roof by them. The short diagonal runners seen in the illustration crossing each other between the horizontal lines are used in ornamental thatching only, and are rather for appearance than for use. Lastly, the eaves are cut to shape, and trimmed with paring-knife and shears.

A roof like that before us looks most pretty and cosy within if lined with ling. The ling is fixed in a way somewhat akin to thatching. A layer is placed along the bottom opposite to

the eaves, and secured by a strip of wood nailed from rafter to rafter; the layer next above hides this strip, and so the work is carried on to the apex, where a knot cut from an apple-tree trunk, a bunch of fir-cones fastened together, or some such matter, finishes the whole. In districts where ling is not to be had, gorse or furze in short pieces may serve instead, but stout gloves are required to handle it; or the ends of fir branches may do, if nothing better offers.

It is not always easy to decide on the best way of forming a floor. Boards would look out of place, and are not to be thought of. A pitching of pebbles is more in character: it is dry and cleanly, and especially if some variety of colour is obtainable, and the stones are arranged in some geometrical design, it may add to the ornamental effect. Pebbles are not, however, pleasing to the feet of those who wear thin shoes. Gravel, where it is always dry, is apt to become dusty, and to disagree with ladies' dresses. If, however, gravel should be used, perhaps the best plan to prevent the rising of damp, and to obviate dust as far as possible, is to asphalt it: on the foundation of broken stones and a layer of coarse gravel to put a course of asphalt or of ordinary gas tar, and on this to sift enough fine *washed* gravel to hide it. Yet a wood pavement of small larch poles, cut into 5 or 6 in. billets, and pitched with some attention to geometrical arrangement, will make the most dry and comfortable of floors, and one which will not harmonise badly with any of the decorative work of our summer-house.

BRICKLAYERS' WORK.

BY MUNIO.

Fire Bricks.

Fire bricks are used for lining furnaces, kilns, etc., where intense heat is generated, which ordinary bricks would not stand. They are built with ground fire clay mixed to a paste, as ordinary mortar will not stand the heat. They are of a pale yellow or brown colour; when mottled with black spots, it indicates the presence of particles of iron, and the quality of the bricks is not so good. Those made at Stourbridge are considered the best; but very good fire bricks are made in Wales, various parts of England, and Scotland.

They are made from fire clay, which is found throughout the coal measures. It is composed of silica, alumina, and water; it is called a refractory clay, and owes this quality to its comparative freedom from lime, magnesia, and metallic oxides, which act as fluxes. The composition and quality of this clay also vary very much, even in the same district. When the clay is brought from the mine, it is laid in a heap for a year or more, which causes it to crumble, and the stones and other impurities are picked out; it is then broken up, and ground between edge-stones 6 ft. or more in diameter; a fine grating is fixed in the pan, through which the ground clay falls into the elevators (which are iron buckets running on a chain over pulleys), and carried into a revolving cylinder covered with wire gauze; the fine clay, falling through the wire, is carried into the pug mill and mixed with water, and forced out at the bottom of the pug mill ready for moulding—the rougher portion falls out of the end of the cylinder, and is carried back under the rolls.

The bricks are moulded by hand—the moulding being a combination of slop and pallet moulding—the mould being dipped into water, and the bricks being carried off between two boards. The bricks are dried in a shed, under the floor of which flues are formed, heated by furnaces. When dry, the bricks are walled into hacks till ready for burning.

The kilns are oblong, with fires at one end. An average-sized kiln will burn off in a week.

Quarries for the flooring of kilns are moulded in wooden moulds on the floor of the drying shed, and burnt with the bricks.

Fire bricks are also pressed for facing of walls in a similar manner to red bricks, and moulded bricks for cornices are also made in fire clay, the clay being ground finer than for ordinary bricks; they are also enamelled in various colours, for lining passages, dairies, etc.—the bricks being partially burnt; the enamel is spread on in a liquid state, and burnt in.

Tiles.

Tiles are manufactured in a similar manner to bricks, the principal difference being that as tiles are thinner, more care must be employed in the manufacture, and the clay must be stronger and purer. There are three classes of tiles—viz: paving or flooring tiles, roofing tiles, and drain tiles.

Paving and Encaustic Tiles.

Paving tiles are moulded in a similar manner to bricks, and when half dry, are dressed by hand; then burnt in kilns.

Encaustic tiles are used for the flooring of churches, halls, passages, etc., and are made smaller and of a finer quality than ordinary flooring tiles. They are made in various colours, and laid in ornamental patterns—some have flowers, figures, and ornamental patterns painted on the surface, and burnt in; while in the richer kinds the surface is stamped or pressed into ornamental forms, and the indentations filled in with different coloured clays in a liquid state, and the whole burnt in.

These tiles are manufactured in Staffordshire, Worcestershire, and other parts of England. In most cases the clay for the tiles of plain colours, such as red or buff, is found on the site; while for other colours the clays are brought from another part of the country, or various stains may be mixed with the clay to colour it—thus the addition of manganese gives black, and of cobalt blue.

The plain coloured tiles are made from dry clay, pressed in a very powerful press, from whence they are dried and fired. Surface ornamented tiles are made from plain tiles, the pattern being painted on, and fired when dry.

The encaustic tiles are made from a much finer kind of clay, which has been washed, strained, and boiled. About half the thickness of the tile is formed of this clay in a metal mould, in which it is pressed to receive the pattern or indentation on the face; the remaining half of the mould at the back is then filled with a coarser clay, and the whole is then pressed to receive the proper amount of solidity. The tile is then taken from the press, and the various indentations filled with different coloured clays to form the pattern, and after remaining a few days to stiffen, the surface is scraped level, which brings out the pattern; it is then dried and fired.

Should the surface or any portion of it require to be glazed, the glaze is next applied in a liquid state and burnt in.

The clays for encaustic tiles require very careful selection and manufacture, as if there is any unequal shrinking in drying or burning the face of the tile will be cracked.

Roofing Tiles.

The clay for roofing tiles, after passing through the pug mill, except it be very pure, is cut into slices, to remove any stones that may be in it. Plain tiles are made in a mould, with either one or two nibs or holes on the top, to hang them on the laths of the roof. Pantiles are moulded flat, with one nib on the top; they are then laid on the wash-off frame, and moulded to the curved shape on a block of suitable form; then laid in the blocks (which are wooden shelves about 4 in. apart, running the full length of shed) till half dry; then laid on the thwacking frame and beaten, to correct any irregularity in drying, and the edges trimmed with a knife; then replaced in the blocks till ready for the kiln; they are then piled in the kiln on their ends, and burnt in the same manner as bricks. Hip, ridge, and valley tiles, are made in moulds.

Drain Tiles.

These are tubes 12 in. long and from 2 in. bore upwards; they are used for agricultural drains, and are sometimes made by hand, but generally in a machine worked either by hand or steam power. The clay is forced through a die in the end of a box, and the tiles cut off with a wire, dried, and burnt.

Sanitary Pipes.

These are used for house drains and sewers, and are generally made from fire-clay in the North, and glazed. One end is formed into a socket, and the pipes are put together with spigot and faucet joints, and made tight with cement or puddled clay. The clay for making these pipes must be ground very fine, and washed through gratings with very fine meshes, and run into the "slip" kiln, where it is boiled till it is of a suitable consistency for moulding. The pipes are moulded by steam or hydraulic pressure. The clay is put into a cylinder, at the bottom of which is a circular die the size of the pipe. Outside the die is fixed a metal box, in two halves, for making the sockets, which can be opened and closed by a lever and rods. A movable table is fixed at a suitable distance under the die, which can be raised or lowered by the foot. A cylinder of wood, the diameter of the inside of the pipe and the length of the pipe, is fixed on its end on the table, which is now raised till the top end of the cylinder is against the die; the metal box is now closed, and the piston worked till it is filled with clay; the box is then opened, the piston set in motion again, and the moulded pipe forced through the die and down the cylinder, the socket having been formed in the box. As soon as the end of the pipe reaches the table the piston is stopped, the pipe cut off, the table lowered, and the pipe is carried away on the cylinder to the drying shed, another cylinder being fixed, and the table raised for another pipe.

Junction pipes are made by cutting a piece out of the side of a pipe while soft, and moulding into it by hand the branch pipe. Traps, gulleys, chimney-pots, etc., are moulded by hand.

The kilns for burning the pipes are of a circular form, with domed tops. When the pipes are at a high temperature a quantity of salt is thrown into the kiln, and this, coming in contact with the hot clay, forms a glaze on the surface of the pipes.

PRACTICAL DETAILS OF BOOK-BINDING.

BY GILBERT CLARKSON.

INTRODUCTION—EARLY BOOKBINDING.

IN the articles upon the "Art of Bookbinding," which I purpose to lay before the readers of this paper, I hope to introduce matter which will be interesting alike to the amateur, tradesman, and the lover of books. I am fully aware that no series of magazine articles, however practically and explicitly written, will convert the amateur into a full-fledged tradesman, and thus enable him to take his place in the workshop beside those who have served an apprenticeship of seven years.

That such a thing is not intended by magazine articles is a patent fact, the object in view being simply to give to the intelligent amateur such practical knowledge, not to be had elsewhere, as will enable him to take a delight in his hobby.

There is plenty of room in this world for the amateur as well as the tradesman. I do not think the two classes will ever clash together—that the tradesman will ever find his occupation gone because of another man *trying* to make his own tables and chairs, to build his organ, to fit up an engine for his own use, or to bind his own books.

I will therefore endeavour to give such information as clearly as possible as will enable the amateur to make a fair job of his books without the aid of the workshop appliances in use at the present day.

And to my fellow-tradesman who may know all about the things to be described, I come with outstretched hand, and looking him straight in the face, will ask him to have a little patience with me while I write a little "shop," for the benefit of those who may not have had a city training, and who, from necessity, may have to carry a book through all the successive stages of binding without the aid of a professional folder, sewer, marbler, or gilder.

I have already intimated that I want to interest the lover of books in these articles. And why should I not? He is the man upon whom our trade for a great part depends. He comes into our shops and picks out our best leather, talks in an intelligent manner about the styles, insists on an artistic ornamentation for his books, gives a reasonable time for the execution of his order, pays for it when done, and is so delighted to have it done so nicely that he forgets to ask for discount on his bill. What a pleasure to work for such a man! Would that we had more such customers to deal with. There would then be less talk about the inferiority of the bindings of the present day when compared with the bindings of the "good old days" in the fourteenth and fifteenth centuries. Only the other day I got an old book to rebind; in looking over it, I remarked that this one was bound in the good old days. I fully expected the following question: "Can you tell me why books cannot be so well bound now as they were long ago?" I answered, with just a trifle of annoyance in the tone, "If people were as willing to pay for their binding now as they were then—in the *good old days*—we could do them just as well, and a great deal better." With the advance of civilisation bookbinding has not fallen behind; it is just as able to keep its place in the race as any other handicraft, trade, or profession.

Bookbinding as an art is of very ancient origin. Its rise is involved in obscurity. For all we know to the contrary, the germ of the idea may have been in the minds of our first parents when they sewed the fig leaves together, that first dark morning in the Garden of Eden. This much we do know, that the ancient Hebrews and Greeks had many methods of binding their parchments to preserve them from loss and decay and to enable them to transmit them to posterity. But it was not until after the invention of printing that bookbinding, as we know it, began to be practised.

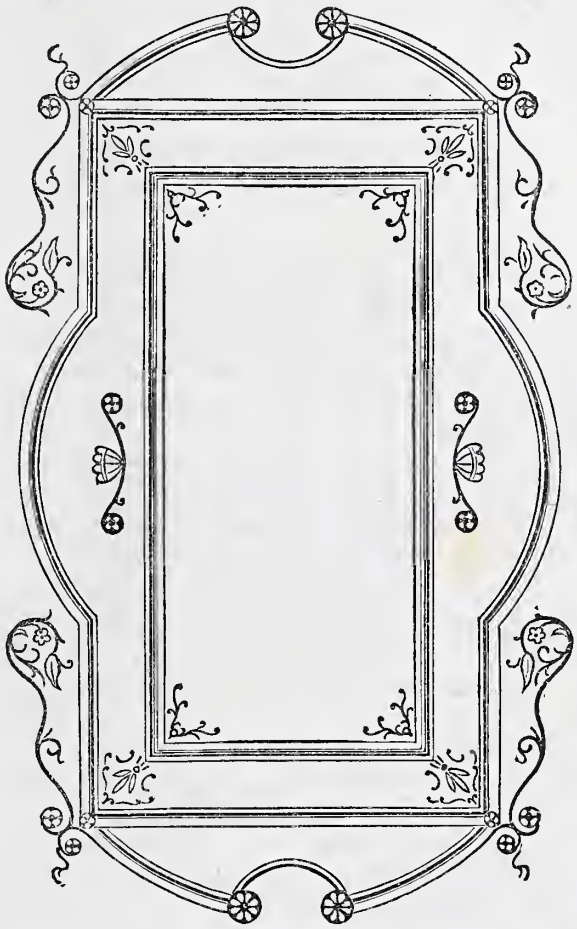


Fig. 1.—Ornamentation of Bible bound in Morocco, 1659.

Printing was introduced into England by William Caxton in the year 1473. It was then a very slow process, and continued to be so for a great many years, consequently the number of books was not very great, and every process belonging to a printed book was included under the general denomination of printing. It seems also from historical data that the binding as well as the printing was executed by the same person. Caxton was a binder as well as a printer, and Wynkyn de Worde, Caxton's successor, left by will some of his plant to Norvell the bookbinder in Shoe Lane. This Norvell seems to have been a bookbinder only; he was what we would now call a publisher's binder, *i.e.*, he bound for the trade; yet Wynkyn de Worde seems to have kept him almost fully employed.

The common cover for early printed books was a kind of parchment or forrel; but velvet was largely used by the nobility and gentry, and some of them caused their books to be adorned with all the splendour the best materials and state of the art could give to them.

The magnificence of these early bindings far exceeds anything known in our day. They were, as I have said, chiefly executed in velvet, which was of different colours, the most common being red ornamented with gold and silver, with pearls and precious stones. A description of one which may be seen in the British Museum, originally belonging to Henry VII., will sufficiently illustrate the point at issue. It is a book of indentures made between him and the abbot and convent of St. Peter's, Westminster, for the celebration of certain masses to be performed in Henry VII.'s chapel then intended to be built. The cover is of crimson Genoese velvet, edged with crimson silk and gold thread, and with tassels of the same material at each corner. The inside is lined with crimson damask. On each side of the cover are five bosses made of silver wrought and gilt; those in the middle have the arms and supporters of Henry VII., with his crown and supporters of silver gilt and enamelled; in the others at each corner are so many portcullises, also gilt and enamelled. It is fastened by two hasps made of silver, and splendidly enamelled with the red rose of the house of Lancaster.

The following quotation from a poet of this period will still further illustrate our point. Speaking of a book, he seems to have become enraptured with its appearance when it was shown to him.

"With that of the book lozende were the clasps,
The margin was illumined all with golden railes;
And bice empictured with grass-oppes and waspes,
With butterflies and fresh pecocke tailes,
Englored with flowers and slymy snayles,
Envyved pictures well touched and quickly,
It would have made a man whole that had been right sickly,
To behold how it was garnished and bound.
Encovered over with gold and tissue fine,
The claspes and bullions were worth a M pounde,
With balassis and carbuncles the border did shine,
With *Aurum Mosaicum* every other line," etc.

But velvet was not the only material used for binding during this period. Silk and damask were also in general use for that purpose, and the highest and fairest in the land were very fond of employing some of their leisure hours in working embroidery for the covers.

Vellum appears to have been introduced for binding in the early part of the fifteenth century, and towards the end of that, or the beginning of the sixteenth century, the art of stamping seems to have arisen.

At the same period, or perhaps earlier, leather was made use of, and it has continued in use until the present day.

Of these stamped bindings many specimens are to be seen in various libraries and among the stocks of old booksellers, and although they are much spoken about, and command very high prices should they happen to be on sale, I must confess that I cannot go into ecstasy over them, for I fail to see any great beauty in them. Perhaps my taste is not sufficiently *cultivated* to appreciate that which is beautiful in art. But, dear me! there is not much to appreciate in a clumsy representation of some saint, or a pseudo-portrait of some king or

queen, and this, for the most part, constituted the ornamentation of the books bound in the "good old days."

But you must not misunderstand me, for there are some very nice examples to be met with, and, before passing on, I will give a drawing of the decorative part of the side of a folio Bible printed at Cambridge. The design is just a trifle straggly, but it displays a degree of taste not often met with in the bindings of that time (Fig. 1).

It will be altogether unnecessary for our present purpose to continue the history of binding. Enough has been written to show that bookbinding is of very ancient origin, and that it was an art of no mean consequence hundreds of years ago.

THE CONSTRUCTION AND MANAGEMENT OF BAND SAWING MACHINES.

BY M. POWIS BALE, M.I.M.E., A.M.I.C.E.

Author of "Wood-working Machinery," "Saw-mills," etc.

In the first place, it may be as well to consider briefly the points to be desired in a really efficient band sawing machine; this is the more necessary as many machines of an inferior description, both as regards design and construction, are placed before users, the result being a considerable increase in the breakage of saw blades and a lessened output of worse quality. It is generally concluded, to make a really efficient machine, the main framing should be rigid and cast in one piece, and of a height not greater than is absolutely required for working. Hollow or "box" framing is to be preferred, but for light machines a stout flange casting may be sufficient; the base of the machine should be extended, and, given these, freedom from excessive vibration in working may be secured.

To ensure easy manipulation of the wood, it will be necessary to bow the main frame sufficiently to allow of ample space between it and the saw. The next most important point is the construction of the saw wheels. These should be of as large a diameter as may be convenient, and combine strength with lightness in the highest possible degree, and be perfectly in balance. An elastic rubber band or cushion must also be provided for the saw to ride on.

In the best practice the old cast iron flanged wheels have given place to light steel or wrought iron ones, made somewhat after the fashion of bicycle wheels and without flanges. The top wheel is arranged to cant, thus directing the saw to run on any part of the periphery and equalising the wear on the elastic covering. The top saw wheel must be mounted elastically, and the author has found for heavy machines two pairs of bearings—mounted in a slide for the top wheel and in standards or pedestals for the bottom wheel—to be preferable to single bearings or the plan of mounting the wheel to run on studs. To keep the saw to its proper tension, and lessen the breakage of the blades, a weighted counterbalance lever, or a spring arrangement, must in all cases be fitted to the top slide. An extremely important matter is the guiding and supporting of the saw blade as it enters and leaves the wood; this may be done by fitting in the table metallic friction guide wheels to receive the back thrust of the saw, an adjustable wooden guide immediately beneath the table—apple or pear wood soaked in oil can be recommended—and a similar guide fitted in an adjustable counterbalanced slide fixed immediately above the surface of the wood. If the work is very difficult and the saw runs out of line, two pairs of movable steel rollers placed immediately above the cut and immediately below the table can be used. With these revolving rollers the friction is very little, and the saw is supported and kept in line. In sawing resinous woods, when it is necessary to keep the blade clean by lubricating it, the author has used with advantage an oil box guide; this consists in forming in a gun-metal guide two oil boxes, one on either side of the saw. The sides of the boxes nearest the saw blade are made adjustable and drilled with a number of small holes through which the oil can percolate; small hard bushes to sweep the saw can also be fitted with advantage, as also saw and chip guards and striking gear.

The table must, of course, be arranged to set to angle: this is usually done by means of a slotted quadrant and stud, but the trouble of unslacking the nut and uncertainty of fixing the table may be obviated by forming a worm on the quadrant, and working it by a worm and hand wheel. The table can thus be set to any desired angle with the greatest nicety.

Before commencing work, the machine should be carefully fixed to a dead level, and it would be well to place beneath the base-plate a sheet of felt, as this has a tendency to absorb and lessen the vibration in working, especially if the machine be placed on an upper floor.

Why do band saws break? that is the question.

Our friend Jones, who considers himself clever, will probably say because they are not strong enough; but when we consider that the limit of endurance of a jointed and strained band saw blade is not less than 180 lbs. for every $\frac{1}{16}$th of its width, something beyond fair usage must account for their constant breakage. I take it the chief causes of breakage may be set down as follows:—

(1) Improperly or badly constructed machines.

(2) Bad saws.

(3) Saws of too thick a gauge for the diameter of the wheels.

(4) Saw wheels too small, too heavy, or out of balance.

(5) Want of elastic tension in mounting the saw wheels.

(6) Too great or sudden a tension, or wheel covering worn, or out of order.

(7) In overcoming the inertia of starting the top wheel, and from the top wheel overrunning the bottom wheel and saw.

(8) From the expansion of working and the omission to loosen the saw blade as it contracts after finishing work.

(9) Improper method of receiving the back thrust of the saw.

(10) From imperfect brazing and the joint being thicker than the other part of the blade.

(11) From chips dropping between the blade and the bottom saw wheel.

(12) Insufficient guides for the saw as it enters or leaves the cut.

(13) Improper teeth or width of blade for the wood or work to be done.

(14) Improper and uneven sharpening and setting.

(15) Improper speed.

(16) Improper working, such as forcing the saw, using dull saws, etc.

There may be other reasons for breakage than above, but these are the chief ones the writer can call to mind at the moment; practical readers can add to the list.

Referring to cause of breakage (No. 1) on the list, we have already given some notes on the points to be desired in a well-constructed machine which will sufficiently answer this.

With reference to band saws (No. 2), the user has to a great extent to place himself in the hands of the saw-maker, as it is difficult to distinguish by inspection the quality or temper of a saw blade. By bending the blade or by setting some of the teeth coarsely you can in a degree judge its elasticity as to its temper, as, should it be too hard, it would probably crack. A blade either too hard or too soft is useless; what is required in a band saw is toughness, and a certain degree of hardness combined. (3) A fruitful cause of breakage of the blades is the use of band saws of too thick a gauge for the size of the saw wheels on which they run. The blades when in work are subjected to several severe strains, the chief of which are bending and torsional; this is particularly the case where thick saws are run on wheels of small diameter, as the arc of contact of the saw and wheel is too sharp. It is a mistake to use thick saws; *a thin gauge saw will stand better than a thick one.*

Although the author is aware that they are thinner than those usually employed, he can recommend the following gauges as most suitable for sawing pine and the softer woods of the *Pinus* family. The lengths of the blades are given in feet, and the thicknesses by Birmingham wire gauge:—Saws up to 14 ft. long, of any width, 22 gauge; 17 ft. long, 21 gauge; 20 ft. long, 20 gauge; 24 ft. long, 19 gauge; 30 ft. long *t.* or 18 gauge *e.* These figures must not be considered arbitrary, but can be modified slightly according to circumstances.

Speaking generally, the smaller the diameter of the saw wheel, so should in ratio the gauge of the saw be reduced. Long blades will stand better than short ones. For cutting the harder and close-grained woods, such as oak, beech, etc., the thickness of the saw should be increased about one gauge.

(4) As we have elsewhere remarked, saw wheels of small diameter are to be avoided; it is also important that the wheels be perfectly balanced: should they be the least out of balance, especially where the wheels are heavy ones, the centrifugal force set in motion when they are running causes a constant lurching or jumping motion on the wheels, which is often sufficient to break the best saw blades. The author prefers to run wheels without flanges on them. (5) A very important point in working band saws is to secure a constant and even tension on the saw blade; at the same time the tension should be elastic, and not rigid, to allow for the expansion and contraction of the saw, as the friction of working sets up heat, which causes the blade to expand, and when the machine is at rest, and the blade becomes cool, it contracts again. Should the saw catch in a knot or nail and give a jump, if the top saw wheel is mounted rigidly it will almost invariably snap, but should it be elastically mounted it will give with the saw, and so save its fracture.

(6) Some operators run their saws at too great a tension, and should this be suddenly increased by the saw striking some hard substance, fracture is the result; or if the elastic saw wheel covering is allowed to get worn the saw becomes twisted in running and breakage often ensues. This latter can

be avoided by arranging the top saw wheel to cant, and so leading the saw to any part of the periphery, and thus equalising the wear on the rubber covering. Should saws be run at too great tension, the excessive friction rapidly alters the granular structure of the steel, which becomes crystallised and soon cracks and fractures.

(7) In working band sawing machines it is important that they should be set in motion gradually, more particularly where the wheels are of the old-fashioned type and heavy, as it takes a little time to overcome the inertia of the top saw wheel, and if the power is applied all at once there is a considerable tendency to snap the blade from the sudden strain put upon it. To overcome this, striking or belt gear can be worked by means of a very coarse screw. This can also be applied to the starting of heavy planing machines with decided advantage.

A fruitful cause of breakage of the blades is the overrunning by the top wheel of the bottom or driving wheel of the saw, and also of the saw itself. When the top saw wheel is running at full speed it necessarily acquires a considerable momentum, and acts somewhat after the fashion of a fly wheel; consequently, when the speed of the saw blade is suddenly checked by its entry into the wood as it commences to saw, the acquired momentum of the top wheel not being checked in a like proportion overruns the saw and the driving wheel, and creeps, so to speak, up the back of the saw, and consequently buckles or breaks it at the point of resistance, viz., where the saw enters the wood. The remedy for this is to construct the top saw wheel as light as possible, make it in perfect balance, mount it elastically, and cover it with a thick band—say ¾ in.—of vulcanised indiarubber. These arrangements will neutralise to a considerable degree the sudden strain put on the saw at starting, and largely obviate the overrunning above alluded to.

(8) *Saw blades should in all cases be slackened out after finishing work.* Notwithstanding the small area of the blade in frictional contact with the wood and the constant cooling action of the air through which the saw passes, a considerable amount of heat is often engendered in the blade, especially in sawing resinous or difficult woods. Consequently, the blade expands considerably, and the slack is taken up by the operator. When work is over, and the friction on the blade removed, it immediately commences to contract. Should it not be at liberty to do this, from the tension not being removed, cracks at the roots of the teeth are the result; consequently, when the saw is started again it flies. When rubbers are put on the wheels new they may give sufficiently to allow of the necessary contraction, but when they become worn and hard or where leather coverings are used the above is usually the result.

(9) Another cause of the breakage of the blades is an improper method of receiving their back thrust. The best way to do this has been the subject of considerable discussion. The author prefers to fit revolving steel discs for this purpose, as the back of the saw blade does not so readily cut into them as with fixed ones. If a disc is allowed to get deeply grooved, the blade gets buckled and twisted, and often breaks.

(10) Imperfect brazing is another cause of breakage. To secure a steady and even motion on the saw blade, it is important that the brazing be carefully and neatly done. There are several methods of brazing: the author can recommend the following as a very satisfactory one:—Take each end of the blade and file down a taper on the opposite side of the saw of about three teeth points, so that where the two ends of the saw are made to overlap each other, the joint, when cleaned off, will be of the same thickness as the rest of the blade. Secure the overlapping ends of the saw well together by a pair of small hand vices, and tie them with fine iron wire. Over this bind tightly with brass wire the full length of the overlap. Moisten the joint with water and cover it with powdered borax. Either take a large pair of tongs and make it red hot, or place the saw in a small forge fire made of charcoal, and keep it there till the brass is well melted. Let the saw cool gradually, file the joint to the same gauge as the rest of the blade, and finish it with emery cloth. If this operation is well performed, the joint will be scarcely distinguishable. Care must be taken that when brazed the overlapping ends of the saw press well together.

(11) Chips may be prevented dropping between the saw blade and the bottom wheel by attaching an angular guard to the frame of the machine.

(12) No comment is needed with respect to insufficient guides.

(13) The proper shape and pitch of the teeth is a matter of great moment in the successful working of band saws. Should teeth be used unsuited to the wood being cut a largely increased friction on the blade is set up, the teeth are rapidly dulled or broken, and the work turned out is inferior. For sawing all ordinary woods of the *Pinus* family ordinary hand saw teeth are suitable, except for pitch pine; for working this wood coarsely spaced and set teeth are suitable.* We can recommend for durability saws with gullet teeth, that is rounded at the root, as they are less liable to fracture than saws with the roots running to an angle, as the fracture in the blade is found almost invariably to commence at the point of this angle. Owing, however, to small gullet teeth being more troublesome to sharpen, the hand saw teeth are now largely employed. For sawing oak, ash, elm, and hard woods generally, more teeth, or points, say, five or six to the inch, should be used, and these filed further back. For heavy sawing, peg teeth with round gullets are to be preferred. For woods of woolly fibre, such as English poplar, saws with deep teeth should be used, with coarse space, and set to allow an easy clearance for the sawdust and overcome its clinging properties. Saws of a width suited to the work should be used, and wide saws should never be twisted round sharp curves, or they will buckle and run out of truth. For straight work a wider saw may be used with advantage.

(14) Care must be taken that the saw teeth are uniformly set and sharpened. Uneven and improper setting causes a considerable amount of tension to the saw blade, increased friction crystallising the steel, and consequent breakage. The teeth of band saws should by preference be set by light, carefully given blows, instead of bending, which, unless very carefully performed, is more liable to buckle the blades and prevent them running true. Several little machines are now made, by which saws can be accurately set to any desired coarseness by a blow similar to that given by a hammer instead of by a bending pressure. A band saw sharpening machine has also been constructed, which automatically sharpens all the teeth alike. By improving the quality of the work and reducing the friction on, and consequent breakage of, the saw blades, these machines should very rapidly earn their first cost.

(15) The speed at which the saw blade travels has much to do with its cutting efficiency. Saws running on small wheels, say, below 3 ft. diameter, cannot be run with safety so fast as on larger wheels. Speaking generally, saw blades working on wheels up to 3 ft. diameter can be run up to 4,500 ft. per minute for soft and medium woods, that is, presupposing a well-constructed machine to be used. For sawing hard woods up to 3,500 ft. per minute, with saw wheels above 3 ft. diameter, these speeds may be increased.

(16) We need hardly say a bad workman may break any amount of saws by forcing them, bending them edgeways, using dull saws, or saws too wide or stout for the work, etc. If in working a properly sharpened and set blade should have a tendency to bind, it probably arises from insufficiency of throat room in the teeth. It would be well, therefore, to try a saw with the teeth set a little further apart: this will not cut quite so fast, but the sawdust will have time to escape, and the binding should be done away with.

In concluding our remarks on working band saws, there is little doubt that—given in the first instance a well-constructed machine, a careful operator, and a saw blade uniform in gauge, width, toothing, sharpening, setting, and temper—a band sawing machine is one of the most money-earning and valuable of all wood-working machines, not only for the ordinary carved work, for which it is generally used, but for breaking down heavy logs, upon which we may have something to say at a future time.

* For illustrations, etc., of these and other teeth, see "Saw-mills: their Arrangement and Management," by M. Powis Bale.

DESIGN FOR A BLOTTING-BOOK IN FRETWORK.

BY J. W. GLEESON-WHITE.

It is a curious fact that on comparing the record of the virtues and vices, the latter show by far the longest pedigree. Most, if not all, modern vices are practically identical with those that roused the passions of the oldest cave-men; but of the virtues, some are yet so modern that if we cannot identify their inventor, we can at least discover periods when they were absolutely unthought of, much less practised. The supremely feminine virtue Tidiness (if it be indeed a virtue at all) may be fairly considered as a late development in the scale of virtues that belong to humanity, for we find it in no great request among nomadic races or man-eating savage tribes. Of course those primitive societies knew nothing of the thousand-and-one odds and ends that distract, while they delight the highly artificial routine of to-day. But Tidiness, although held by its admirers to be a branch of the great law of order (of which the first word was spoken in Paradise itself), is yet (speaking entirely from the blind and foolish standpoint of the head of the household) a specious pretender at the best. For the vice of Tidiness—I beg its pardon: I should say the virtue—has little sympathy with that routine order which distinguishes the male worker. When the most skilful mixing machine ever invented—the common or parlour-housemaid—tidies my papers (the personal case is too deeply felt to project an imaginary one), there is no hint of order in

Design for Cover of Blotting-Book, to be cut in Fretwork.

her mad manipulation of them. When the fatal disease yclept "spring-cleaning" tidies away my pamphlets, sketches, unanswered letters, and the rest of the elaborate chaos of my writing table, the masculine belief in the sacred law of order (that, like the mystic word OM of the Buddhists, can only be grasped to the full of its pregnant meaning by fellow mystics) tempts one to utter brave, swelling words of righteous indignation at the petty tidiness that has made havoc of what, in spite of all appearances to the contrary, was not *really* out of order, but at most — well — untidy.

Probably many readers of Work suffer or enjoy a similar kindly despotism, that in a well-intentioned whirlwind sweeps away the last number of their beloved journal, never to be seen again until some cataclysmal disorganisation, such as moving house, ejects the hidden thing from its concealment.

Therefore both reading cases and blotting-books may be pleaded as evidence of man's inherent law of order, as opposed to woman's passion for the worthless imitation called Tidiness.

Having said my say, as the phrase goes, and avenged myself to a certain extent on my especial belongings in the shape of woman for her merciless onslaughts on what she is pleased to call the dirt and disorder of my sanctum, much to the disgust of utilitarian readers of the Gradgrind school, to whom social sermonettes such as the above are about as unpalatable as holy water is said to be to a grim personality whom I will not name, I will make at once for the end of this matter and release all such from any further necessity.

Though history does and may repeat itself, I may not; so for the modes and methods that can be followed in making the blotting-case, which is shown *sans margin* in the accompanying illustration, I am compelled to refer my readers to page 8 of this volume, where I have said everything for their guidance that it is absolutely necessary to say.

It may be as well to remind readers who are fond of fret cutting, but do not wish to cut a cover for a book or for a blotting-case, that the design can be utilised as a panel in fretwork, or even as a panel in carved work in low relief. The words "blotting-book" on the vase being omitted, and the vase itself left plain, the design may also be used for glass painting.

HOW TO MAKE A TOWEL-HORSE.

BY L. IVOR POOLE.

A towel-horse, rail, or airer—for the article forming the subject of this paper is known indifferently by any of these names—may seem such a commonplace piece of furniture that no directions about its construction can be needed. I venture, however, to think that few amateurs if they were asked would be able to give an answer off-hand how to make a convenient and serviceable towel-horse. No doubt they could contrive something which would answer the purpose, but lots of little unexpected difficulties would crop up—questions about the substance of the wood, dimensions, and so on—before arriving at a satisfactory decision. If you doubt this assertion, just try—without taking the trouble to step into a bedroom to get a few hints from the thing itself—to formulate a plan with all the necessary measurements. But you may, perhaps, be inclined to ask: Are all towel-airers made of the same size or even pattern, from which no variation may be attempted? To imagine uniformity in them any more than in any other piece of furniture as being compulsory is of course absurd, but still convenience must be consulted, and a towel-rail which has stood the test of experience may very well be taken as our model. The design given in Fig. 1 probably will not please every one, but it is a good all-round pattern, that is to say, it will not look out of place with most of the styles of ordinary bedroom furniture which are usually met with. It will go equally well with the round-cornered wardrobe and ugly toilets of twenty years ago, or their more sensible counterparts of the present day, without being obviously out of harmony with any of them. Naturally, modification of detail may be made to render it more in accord with the furniture it is to go with. For example, if the edges of this are stop-chamfered, the edges of the ends into which the rails are fixed may be finished in the same way instead of being left square. The rails themselves may also be octagonal instead of round, and the top piece of the ends be straight instead of curved. Thus, by slightly altering details, a towel-airer constructed on the lines laid down may be made to match in general character the remainder of the furniture. Perhaps, before going any further, it may be as well just to enumerate the principal features of a useful towel-horse by way of suggesting to the novice in furniture work what principles to apply in designing, or let us say rather setting out, not only a towel-horse, but anything else he may wish to make. It must be adapted for the purpose to which it is intended, so utility must be studied as it is of primary consideration. To be useful it must have accommodation for more than one towel, then it must be of a convenient height and length. We don't want a thing five or six feet long in an ordinary bedroom, nor would it be pleasant to pull a towel down from a great height, or to stoop to pick one up. For various reasons which there can be no occasion to mention, the airer should not occupy too much space, but it must be sufficiently wide at the base to stand firmly on the ground, and last, but not least, the various parts should be so put together that they will stand fair wear and tear. As we proceed the reader will be able to see how far these conditions are complied with in our present example, the size of which is about as follows:—Length, 2 ft. 2 in.; height, 3 ft.; width at upper part, 7 in.; and at bottom, 1 ft.

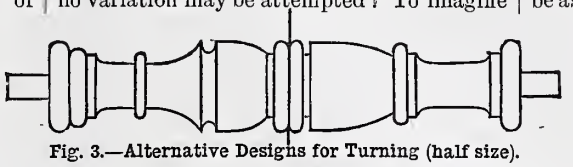


Fig. 3.—Alternative Designs for Turning (half size).

Fig. 1.—Towel-Horse. (Scale, about 1 in. to 1 ft.)

Any departures which it may be deemed advisable to make from these will probably be in length or height. Of both it may be said that an increase or decrease of 6 in. would make either an unusually large or an unusually small airer, though it may happen that in exceptional cases something either greater or less is required. If so, I would merely remark that measurements in furniture are not like the laws of the Medes and Persians.

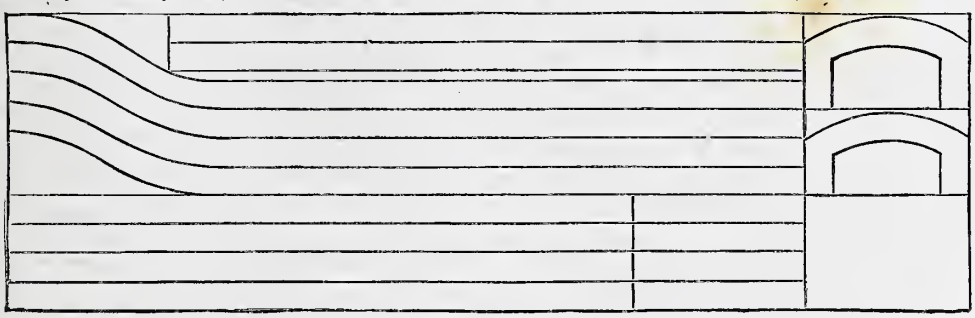


Fig. 2.—Board set out for Pieces. (Scale, $1\frac{1}{2}$ in. to 1 ft.)

The kind of wood will naturally depend on that of the more important furniture of the room, so nothing need be said about it, beyond reiterating the caution that it must be sound and dry, and as free from knots as possible. Indeed, it may be said that no part of the airer should have a knot in it. Even if there are any in the wood from which the pieces are cut, they can easily be avoided by a little care in setting out.

Fig. 2 shows how all the pieces may be got out of a plank not over 3 ft. 6 in. long by 1 ft. wide, but of course it would be too much to say that they must necessarily be cut from one board. If there are odd lengths and widths from which they may be prepared, by all means use them, only it should not be forgotten that it is false economy to cut to waste when it is avoidable. For instance, the shaped end pieces can be got much more economically from a single piece than from four pieces. In the latter case we require four pieces, each $3\frac{3}{4}$ in. wide, being the

spread of the foot end and the width of the straight part, making fifteen inches of width altogether as against eight inches in the former. Certainly the superfluous wood taken from four pieces may come in for something else, but, as a rule, these "short ends" have a tendency to accumulate, and it is better, when practicable, to have but few of them remaining over from any given piece of work. However, this may seem a digression from our immediate subject, so without further delay, let it be said that all the wood required will be a piece of full 1-in. stuff, measuring 3 ft. 6 in. by 1 ft., which, so far as the end of the rail is concerned, should be capable of being cleaned up as little under ⅞ in. as possible. A thin piece of wood should be shaped to the curve of the foot to serve as a guide in setting out these parts of the ends. As there is no taper in these, *i.e.*, they are of the same width and thickness throughout, it will be unnecessary to shape more than one edge of this mould or template. The straight lines need no directions about marking them. As the width of the pieces forming the ends is to be a little over an inch, the lines should be drawn say 1¼ in. distant from each other, which will allow plenty for the saw kerf and cleaning up. The arched top pieces should also be set out from a template, keeping the straight portions an inch or so long on the inner side. This will be better than cutting them off flush at the finish of the curve, although the cross grain in continuation of the uprights may not appear quite the thing. Still the weakness caused by this construction is more apparent than real, as the dowel pin which connects these portions runs through the cross grain piece, and consequently adds to its strength. And as a further justification, if any be needed, of having the top pieces made as directed, it may be said that in this form of tower-rail it is the best construction, as space must be given for the insertion of the ends of the two top rails. Whether theoretically the construction is the best possible for towel-airers is another matter altogether, but as I have said it answers well, and can be justified from experience, we need not trouble ourselves just now about theory. In addition to the parts already referred to, there are six bars or rails connecting the ends, and four short pieces to act as stays or braces between the two main parts of the ends. These will be seen in Fig. 2, and their positions in the completed article will easily be recognised in Fig. 1. The cutting of the straight lines on the board will require no remark, beyond stating that they will, of course, be done with the ripping or band saw, but possibly the curves may seem a difficulty to novices. They may be sawn with the band saw, but as this is hardly likely to form part of the outfit, let it be said that the work may be done with the ordinary hand frame or with a good fret machine. If this be used, however, it must not be expected that the ordinary saw blades will do, for they are not strong enough. Specially large and strong blades, such as those prepared by the Britannia Company of Colchester, for use with their No. 8 fret machine, will be required. In case the distance from saw to arm may seem an obstacle to cutting such long pieces, let me say that I don't think it is sufficiently well understood by amateur fret workers that the cutting edge of the saw can be made to face in any direction in the machine above referred to, as well as in some others, consequently it is only necessary to arrange the saw so that it may cut material fed to it from either right or left, as may be most convenient, instead of from the front only. The short ornamental end rails will, of course, be turned in the lathe, but those who do not possess one, may either leave them square or simply round them. For those who want a suggestion for the pattern of the turning, Fig. 3, showing two designs, is given. The ends must in any case be worked down to a pin as shown, some ½ in. long for insertion in the uprights, and, of course, the length between the shoulders must be just equal to the width of the opening in the arched top. A very easy way of enriching the appearance of the horse will no doubt suggest itself, viz., by means of an increased number of the ornamental turned rails, which, whether few or many, are fixed by means of glue into the uprights. If only two are used, appropriate heights for them from the ground will be for the bottom one about fourteen inches, and for the upper one about double that distance. While alluding to them it may be well to direct attention to the position of the longer bars, being about a couple of inches above the short rail. The arched top pieces can be put on after the uprights have been connected. They are fastened by short pins one at each joint, let into both pieces and glued. Before gluing, it will, however, be as well in this instance, as in more important furniture, to fit the parts together "dry" in order that any inaccuracy may be seen and rectified before finally fixing up. We may now suppose that both ends are ready, and it merely remains to connect them by the six rails, which should be turned down to a pin at the end and fixed in precisely the same way as the shorter or stay rails. A word of caution may be advisable to the beginner about the absolute necessity of having all the long rails of exactly the same length, otherwise the parts cannot be properly fitted together. The pins should also fit very tightly into the holes for them; and naturally, though as it hardly comes under the head of "making," and need not therefore be enlarged on, polishing of some kind will be required before the job can be considered finished. To prevent disappointment it may, however, be said that wax polishing is quite unsuited for such a thing as a towel-horse on account of it not resisting damp. French polish either bright or dull should be preferred to varnish, which, if the rail, so far as joinery is concerned, is well finished, will quite spoil the work in the eyes of any one who happens to know the difference between the two.

With these remarks, the directions how to make a good though plain towel-horse must be concluded, leaving other and perhaps more ornate varieties for consideration in the sweet by-and-by. I may, however, before I bring my paper to a close, say that I have been led to write this article on account of the demand that exists among many of our readers for instructions on the manufacture of plain strong articles of furniture for use and home. Ornamental wall cabinets and sideboards involving a good deal of careful and elaborate work are all very well, they say, and, indeed, much to be desired; but it is also desirable to have diagrams and working drawings, together with hints on the method of going to work in order to turn out some strong and well-made articles of household furniture of creditable appearance. So in this I have given a sample paper in this direction, and I shall follow it very quickly, the Editor permitting, with one on the kitchen dresser.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

7.—Some Useful Technical Books.

I am sorry to say that the exigencies of space have compelled me to keep several useful technical books waiting for a notice for some time. I will do my best to introduce some of them to my readers on the present occasion, and I will promise to make mention of those that may remain unacknowledged at the first available opportunity.

"Slöjd" (Cassell & Company, Limited; 6d.).—What Slöjd may be is still, I fear, a mystery to many people in the United Kingdom who are possessed of a good all-round knowledge of things in general. It is a Swedish term, implying the training of artistic, skilful capacity, or general dexterity, and the training, briefly and broadly speaking, is imparted by causing the children to give their attention to some simple operations in carpentry by which certain models are placed before them with scrupulous care, neatness, and exactness. For further acquaintance with the principles of Slöjd (pronounced Sloyd) as a means of teaching the essential elements of education, I must refer all who are interested in it to the clear and well-written pamphlet (so-called) from the pen of Miss Emily Lord.

"Forty Lessons in Carpentry Workshop Practice" (Cassell & Company, Limited; 1s.).—A most excellent volume, exhibiting most clearly, by illustration and precept, the method of performing most of the operations in carpentry involved in preparing and putting stuff together, and the mode of making various appliances, such as the carpenter's bench, mitre box, etc. To the apprentice and amateur it is simply invaluable. It forms one of the capital "Polytechnic Series" of technical works recently commenced by the firm, and is written by Mr. Charles F. Mitchell, Lecturer on Carpentry and Joinery, Polytechnic Institute, 309, Regent Street, W.; and revised by Mr. George Campion Pope, Teacher of Practical Carpentry, Handrail, and Staircase Work at the same institution.

"Practical Plane and Solid Geometry, including Graphic Arithmetic" (Cassell & Company, Limited; 3s.).—This is another volume of the "Polytechnic Series," written by Prof. Henry J. Spooner, C.E., F.G.S., Director of the Polytechnic School of Civil and Mechanical Engineering, etc. It has reached a third edition in the present issue. It deals exhaustively and intelligibly with every department of plane and solid geometry, and takes up and thoroughly explains a species of arithmetic known as "graphic" arithmetic, because the abstract arithmetical processes — addition, subtraction, multiplication, division, involution, and evolution—are, by its means, worked graphically or by geometry. The great charm of this volume lies in the combined brevity and lucidity of the text, and the excellence of the diagrams, with which the text is abundantly illustrated.

"Forty Lessons in Engineering Workshop Practice" (Cassell & Company, Limited; 1s. 6d.). — This is the third volume of the "Polytechnic Series," in which precisely the same is done for the young engineer as was done for the young carpenter in "Carpentry Workshop Practice." Its authors—Messrs. C. F. Mitchell and Mr. E. G. Davey, of the Polytechnic Day Schools—have given a clear description of the various operations that are performed by beginners in engineering, and the mode of making many of the tools that it falls to their lot to use.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Upholstering in Leather. — CAB HAMMER (*Cork*).—Ere this appears you will have seen that your former letter, which you assume has been overlooked, was being replied to in due course. Rest assured that every question for these columns receives prompt attention, but, from the necessity of going to press some time before publication, answers cannot possibly appear immediately.—D. A.

Polishing Doors.—J. T. P. (*Ledbury*).—The process you have adopted is that known as wax polishing. You are more likely to get a good appearance with it than with French polishing, as you are not accustomed to this kind of work. In experienced hands, French polishing is capable of greater brilliancy being imparted to it, otherwise wax polishing is better. I am glad to hear you have taken in WORK since its commencement, but what a pity you do not read it, as you would then have seen fairly full directions in "Shop" for polishing mahogany.—D. A.

Transparent Glue.—J. B. (*Poole*).—Any good glue properly prepared in a clean pot is transparent. If it is opaque, the glue is either of an inferior quality or it has been melted in a dirty vessel. Possibly you may mean colourless glue, but for such work as you allude to—mitres of frames and open situations—there is no advantage in using it, even for the sake of appearance, and it is not as a rule so strong. You must be aware, if you have read all our back numbers, especially those containing the articles on jointing-up, that the line between two boards glued together is all but imperceptible in good work, to which you specially refer. If the glue shows at all, then you must consider that the work is defective, either from the joint not fitting closely at all parts, or that the glue has not been sufficiently pressed out.—D. A.

Small Cornish Boiler.—AMATEUR (*Bermondsey*).—I cannot recommend boiler making for amateurs. It is often dangerous for professionals, but if you are bent upon it then I would advise you to make it all of copper, about 6 in. diameter, and 20 to 24 in. long. You could make the shell of a piece of copper pipe and the flue also of about 12 gauge. The ends might be slightly thicker. The flue should be about 2¾ in. diameter. The ends must be flanged or dished outwards for riveting to shell and inwards for riveting to flue. The flue and ends must first be riveted together and afterwards the shell. All the joints should be tinned before riveting, and well sweated with solder afterwards. The pressure should not exceed 20 or 25 lbs., and a good safety valve and pressure gauge should be fitted. Shall be pleased to help you further, but advise you if you are not a coppersmith or brass finisher to get a coppersmith to do it for you and test it before steaming. It should be tested to twice your working pressure.—OLLA PODRIDA.

Reversing Valves.—J. E. J. (*Middlesboro'*).—With regard to the reversing valves you ask about, please say if your cylinders are single or double acting. If the former, then all you have to do is to change the direction of the steam and exhaust. If you have the cylinders by you it would simplify matters if you gave me a rough sketch of one of them showing the arrangement of steam ports. I could then help you with more facility.—OLLA PODRIDA.

Steel Surface and Steel Etching.—W. E. M. asks (1) "for a receipt for a solution which, applied cold by means of a brush or dipping into the bath of solution, will turn the surface of highly polished steel a nice permanent brass colour." (2) "The proper method of etching names on cutlery as it is done in Sheffield." I have had no experience in either of these matters, but I have secured information from what I believe to be valuable sources, and trust it will meet W. E. M.'s requirements. Lacquer for steel work:—Two gallons spirits of wine, 1 lb. of fine pale shellac, 3 ozs. Cape aloes, cut small, and 1 oz. of gamboge, cut small, will make a fine pale brass lacquer. As different depths of colour may be required it will be best to prepare the several ingredients in separate bottles and mix for the colour required. Etching on steel.—Print the design on unglazed and unsized paper with a composition of beeswax and resin. The article is made warm and the paper adheres to it. The paper is then damped with acid, which eats into the metal. When sufficiently bitten into wash the paper off. It will be necessary to have the design engraved in copper and then transfer it to the paper as ordinary copperplate printing.—O. B.

Electrotype Stripping.—SILVIO (*Greenwich*).—Silvio's bath may be in proper working order, but his battery may be wrong, or it may be too strong for the work, or too weak for the work. Like most of the questioners who write to WORK, SILVIO tells us absolutely nothing, asks us to guess from vague premises what is the matter, and to give a cure. Correspondents should remember that we are not omniscient, and give us every detail, however apparently unimportant, to enable us to give useful advice, as any misconception by us of the true state of affairs renders our counsel valueless. If the battery is too acid and the deposit of copper too quickly given off, the copper is hard and "strippy," but a similar effect may be caused when the bath gets too quickly exhausted of its metallic base. SILVIO should first ascertain what is the cause, and then it can be corrected by making the battery (he does not say what battery he uses) right, or by suspending a plate of pure copper opposite to his moulds, so that if the bath solution has parted with too much copper, the pure copper may be chemically absorbed and again given off as required according to the speed of decomposition which the strength of the battery determines. If SILVIO cannot succeed with the necessarily imperfect advice we give, let him write a fully detailed case upon which we can definitely reply.—J. W. H.

Transferring Wood.—KESSIE (*Bristol*).—(1) If KESSIE will look up our reply to a YOUNG CABINET MAKER (see page 781, Vol. I.), he will find the process of transferring lithographs to wood fully explained. (2) Veneers are usually cut from the very best timber and are not intended to be stained; if they must be stained black, such portions should be stained first, before the glue has closed the pores of the wood. The cellular tissue ought to be filled in with the colouring matter, "to go right through," as you express it. I should select the pieces with as little "figure" as possible, and use ordinary writing ink, dipping it and drying it a few times till the black becomes quite dense. There are several recipes in our replies to correspondents for ebony stains, but we find this to be the simplest and most permanent. Then glue the veneer into its place, whether as an inlay or solid all over, clean off, set in oil, and polish.—J. W. H.

Slide Valve Engine.—G. N. (*Maidstone*).—I do not know of any book bearing specially on the horizontal engine. There is one published by Lockwood, entitled, "The Model Engineer's Handy Book," by P. N. Hasluck, which should be of assistance to you. You should send to Stevens' Model Dockyard, 22, Aldgate, London; R. A. Lee, 76a, High Holborn, London, W.C.; Messrs. Cannon and Weld, 155, Fenchurch Street, London, E.C.; or Bateman, Strand, for lists and prices. The first named publishes a book of instructions which might be useful to you, and any of them would be pleased to allow you to examine their goods, which in itself would prove a most instructive lesson. — OLLA PODRIDA.

Boiler for Engine.—SHOPITE (*Ditton*).—A vertical boiler would be most suitable for your purpose, as it would occupy little space and cost nothing for setting. You would require one about 20 in. in diameter and 30 in. to 36 in. high, not any smaller. If you could get a larger one, say 22 in. diameter, and same height, so much the better. The cost will depend upon pressure and make. You might get a second-hand one for about £12 or £15, or perhaps less, but it would be better to get a new one. Write to C. D. Philips, Engineer, Newport, Mon., and enclose six stamps for his Machinery Register, asking at same time if he has a boiler on his hands likely to suit. A small second-hand launch boiler would do very well, but in any case make sure that you are getting your money's worth. Boilers are hard bargains as a rule.—OLLA PODRIDA.

Model Locomotive. — W. S. W. (*Wigan*).—Kindly say whether you intend your cylinders to be outside or inside, as the arrangement you require will differ greatly for each case. I may say that the inside arrangement will be best and snuggest if it will suit your intentions.—OLLA PODRIDA.

Size of Boiler.—JACK OF ALL TRADES.—A boiler about 7 in. diameter by 15 in. long or high, as the case may be, would meet your needs. The safety valve might be made about ⅜ of an inch in diameter and loaded with a dead weight if the pressure at which you intend working the boiler is not high, say about 20 or 30 lbs. on the square inch; this is the simplest form of valve to make and set, but you should also fit a steam gauge on the boiler for safety.—OLLA PODRIDA.

Imitation Ivory.—R. F. W.—It will not answer your purpose to make this for inlaying. Ivorine is the best substitute. It can be bought from the Xylonite Company or from any of the principal dealers, such as Harger Bros., in fretwork materials. When inlaid it is scarcely distinguishable from ivory. White holly is sometimes used instead of ivory.—D. A.

Inlaying.—R. N. (*Grays*).—Only one letter has been received from you. I do not think you can do better than get "The Amateur" from H. Zilles and Co., as you are fond of fretwork, or there is my own book, "The Art of Fret Sawing and Marquetry Cutting," published by Ward, Lock, & Co. Inlaying as done by professional marquetry cutters will be described in WORK later on.—D. A.

Upholstering Hints.—W. E. (*Howden*).—You do not give any idea of the shape or description of the couch you are making, so that I am unable to do more than give a general outline of how you should proceed. The webbing, which is the foundation of the upholstery, must be thoroughly stretched and securely fastened. Springs are sewn to this. Above the springs a cover is tacked to the frame. On this cover the stuffing is laid, and finally the outer covering. To give all the details necessary to enable any one unacquainted with upholstery to form a correct idea of the work is out of the question in the limited space of "Shop." The subject is a large one, and could not be treated adequately without taking up several pages of the magazine. Articles on upholstery will be given from time to time. It is quite impossible for this answer to appear by the date you name. You ask us to publish it within eleven days from the date of your letter.—D. A.

Polishing Hatstand.—J. T. (*Dulwich*).—I do not know what the stuff which you call "French varnish" is, but as you have had some experience in French polishing, and know what polish looks like, I suppose the liquids are very much alike in appearance. If they had not been you would probably have discovered that you had got hold of the wrong stuff sooner than you did. If I am right in my assumption, the French varnish is very likely spirit varnish. This as used by French polishers is much the same thing as French polish, but with a little more body in it. Perhaps you now see that the varnish can be removed by washing with spirit, and consequently redissolving the lac. This, however, is both a tedious and somewhat expensive method which need only be resorted to in mouldings and other work which cannot very well be cleaned by scraping. There are also other liquids which will remove the varnish, but I refrain from naming them as I do not know the wood of which your hatstand is made. By using some solvents you might stain the wood, which would be a pity. The methylated spirit being neutral will not effect the colour, so that it may be used on any wood. As there is generally a good deal of plain flat surface on a hall stand you may be able to remove most of the varnish by scraping, and if you can do so it will save your time. An ordinary scraper will do very well. If I knew the design of your stand more definite directions might be given, though you will not go far wrong by availing yourself of these hints. I must repeat what I have previously said, viz., that it is almost impossible to answer any questions connected with polishing or staining satisfactorily unless inquirers will state the kind of wood. If you don't find sufficient information in the above to enable you to do what you want, kindly write again with fuller details.—D. A.

Sideboard Material.—TIMBER (*Birmingham*).—If you buy the wood well and of medium quality, it should not cost you over £3. Choice varieties would be considerably more expensive. I am glad to hear you are wishing to become a worker, but surely you do not intend to make your first attempt at cabinet making with a sideboard. If this has been your idea, take *Punch's* advice—"Don't." Begin with something easy, for unless you are fairly well up in wood-working, your sideboard when finished will be anything but satisfactory. I am almost inclined to say it never will be finished, for you will soon find unsuspected difficulties crop up, and get disgusted with the work. I hope you will not take this advice amiss, as it is meant to prevent discouragement and waste of money on wood which will be spoilt.—D. A.

Pattern Makers' Tools.—E. R. (*Halifax*).—A pattern maker is an omnivorous animal, laying many tools under contribution in the pursuit of the varied tasks which he is called upon to perform. He employs the tools of the carpenter, joiner, cabinet maker, turner, fitter, and draughtsman. I will, however, give you a simple list of such as should constitute the equipment of an apprentice: Jack, trying, and smoothing planes, two skew mouth rebate planes, half a dozen rounds, a couple of small iron planes, and a couple of spokeshaves, one hand saw, one tenon saw, one dovetail saw, a large and a small screwdriver, a couple of working gauges, a pair of wing compasses, a pair of spring dividers, two pairs of callipers, one internal the other external; half a dozen assorted gimlets, the same number of bradawls, a hatchet, a brace and set of bits numbering from thirty to thirty-six, a pair of pincers, a bench hammer, a contraction rule, two feet long, a Charnley Forest hone, a couple of Charnley Forest gouge slips, two or three trying squares of different sizes, and a bevel. For edged tools select half a dozen each of paring chisels and paring gouges, each ranging from a quarter inch to inch and a half in width—the gouges must be selected of different sweeps, embracing the flat, the middle flat, and quick curves; half a dozen assorted firmer chisels and gouges will be required, two or three turning-gouges, and as many turning chisels, a couple of round-nosed tools, and a diamond point. Additions will be made to these in the course of time until this list may become doubled or trebled. But there are plenty of pattern makers who work with a list not more extensive than this; the cost of such a set will differ very considerably according to the quality of tools selected, but you may average it at about £6.—J.

Reed Boards. — REGULAR SUBSCRIBER.—Reed boards fitted with reeds can be obtained from the American Organ Agency, 2, Oseney Crescent, N.W. The cost per five octave set is 10s. 6d. unvoiced, and they can be had already voiced for about 7s. 6d. more.

Any other fittings pertaining to reed instruments, American organs, harmoniums, etc., may be had there, and by sending a drawing of any special kind of keys or coupling mechanism, a free estimate of the cost of making such will be given.—G. N.

Plumbing and Electric Lighting.—EAGER (*Hammersmith*).—Both these subjects will be treated in WORK, but it is impossible to say exactly when the papers will appear.—ED.

Bamboo Fastening.—W. S. (*Bolton*).—Joints in bamboo work are very simple, and pending more detailed description in forthcoming articles on the construction of bamboo furniture, I think the following hints will enable you to do what you want. When you want to join two pieces together as in your first sketch, a hole must be bored through one side of the piece, either to admit the end of the other, if it is of small enough size, or a dowel stuck into the hollow end. This dowel should fit tightly into both pieces. In one of them it may be fastened with glue or a wire nail. In the other you will see that the latter must be used. In the case of the triplicate joint, you must to a great extent be guided by the remainder of the design, with stretchers connecting the pieces at top and bottom; no joinery is needed at the centre. If everything depends on the joint, here notch the pieces and connect with wire. That such little trifles are not usually very strongly put together I daresay you know. Tying with a piece of fancy cord is sometimes considered sufficient.—D. A.

Spring Mattress.—M. DE R. (*Bolton*).—It can scarcely be said that either the woven wire or spiral spring mattress is best, for each has merits of its own to recommend it for use. For purposes of home construction, however, there is no comparison between the two, as the woven wire mattresses are not at all suitable for amateur craftsmen to make. You are correct in supposing that the construction of a spiral spring mattress is not very difficult, especially in the ordinary or box form, still it requires an aptitude for a knowledge of upholstery besides a little joinery. To give minute directions in "Shop" is of course impossible, but at some future date I hope to describe the construction in detail. There are many different methods of making up and finishing, but briefly the constituents of a box spring mattress are a frame to which the laths supporting the springs are fastened at the bottom, some stuffing above the springs, and an outer covering of ticking. There is no fixed rule for springs, as before these can be determined on various points such as cost have to be considered. For your purpose I should recommend 10-in. springs, of any of the ordinary gauges, distributed equally within the frame at the rate of one for every 1½ ft. super of the mattress.—D. A.

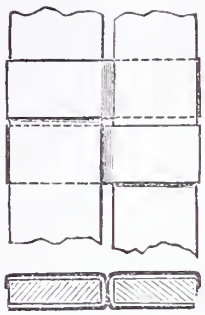
Chair Inlaying, etc.—S. S. (*Salford*).—Kindly repeat your inquiry about inlaying chairs, for in the form you have put it I am sorry to say I am so obtuse as not to understand clearly what you want to know. Are you in a difficulty with regard to the inlaying or the polishing of an inlaid chair? The colours to be used with the brush, in other words, staining new work to match old, depends a good deal on circumstances. Some artists use a great many colours, while others use only a few to get similar results in a picture, and the same applies to polishing. For the woods you name, burr, walnut, and pollard oak, I do not think you can use as a base for matching up anything better than gas black and red polish. It is not so much, however, on what is used as how it is applied that the appearance depends. All the processes to which you refer will be considered in due course, for to omit most of them would be like *Hamlet* without the title rôle.—D. A.

Brass Castings.—AMATEUR (*London, S.W.*).—You can melt brass in small quantities in an ordinary kitchen fire, provided the grate is tolerably large. You must first get a piece of sheet iron and place in front of the upper bars, so that all the draught shall pass through the lower bars, make up a good fire of coke, and place the crucible containing the metal right down into the centre, and heap fresh coke well over it. Unless the grate is of ample area you will find it necessary to use bellows or a blower. The best crucibles, as I think, are those of "Salamander" brand, sold by the Morgan Crucible Company, Battersea. The sands used in different districts vary, and your only plan is to go and beg a bucketful at the nearest brass founder, for which he will only charge you a few pence. But under any circumstances the making of brass castings at home is a tedious and costly process, considerably more costly than purchasing them at a foundry.—J.

Books on Joinery.—G. H. (*Burton-on-Trent*).—There are few trades on which more books have been written than on joinery, so that the difficulty is not to find, but to select suitable books out of some dozens; you may make selection from the following:—"Joints in Woodwork," by H. Adams, published by Spon, 1s.; "Elementary Carpentry and Joinery," published by Ward & Lock; "Carpentry," by R. S. Burn, two vols., one text the other plates, published by Collins, 6s. 6d.; "Drawing for Carpenters and Joiners," published by Cassell and Co., 3s. 6d., "Treatise on Handrailing," by Collins, published by Lockwood, 1s. 6d.; "Circular Work in Carpentry and Joinery," published by Lockwood, 2s. 6d.; "Handrailing and Staircasing" by Cresswell, published by Cassell & Co., 3s. 6d.; "Carpenters' and Joiners' Assistant," by Newlands, published by Blackie, in twenty parts at 2s. each; and there is Peter Nicholson's old work, which you can frequently pick up second-hand, or which you can buy new of Lockwood for 21s. Trübner, of Ludgate Hill, publishes several excellent works also.—J.

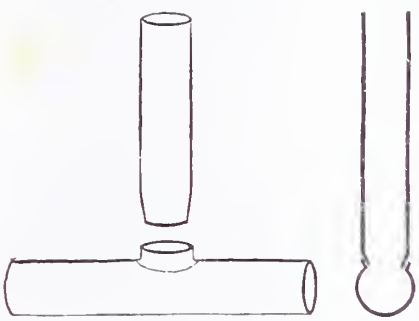
Hygienic Folding Chair.—M. H. (*Bristol*).—This chair, for which you desire instructions and dimensions, is a patented article, and it would scarcely be fair to the inventor to assist any one to infringe his protected design. Mr. J. T. Moore, Macclesfield, is the manufacturer of these chairs, but they can be procured through any upholsterer, and I think your best plan would be to purchase, and give up the idea of making. I do not know the prices asked, but a note to the inventor will bring you particulars of the "Hygienic," and also of the "Waverley," another chair of a similar character.—G. LE B.

Hingeing for Screen.—T. H. (*Leeds*).—Undoubtedly the best arrangement for allowing screens to be folded in any direction is the double-acting screen hinge. These hinges are now to be bought at a very much lower price than was the case a few years ago. Melhuish sells them at a very reasonable figure, but if you want something cheaper why not attach the folds with pieces of webbing? If you have a folding clothes horse for airing linen on you will see exactly what is wanted, as it is probably made to fold either way. In case, however, you have not, I think the illustration will make everything clear. You will see each hinge is formed of two pieces of web which cross each other. They should be strongly fastened with tacks to the inner edges of the frames. In case you do not like this arrangement, there is another one which you can make yourself, though for some reasons it is not so good. It may be sufficiently explained by saying that it consists of hinges fastened on or let into the top and bottom edges of the frame. Hinges of this sort can be bought, but something answering the same purpose can be easily made.—D. D.



Hingeing for Screen.

T-Joint.—D. M. J. (*Portsmouth*).—I am not offended at criticism when in such kindly and courteous terms as yours. I like your idea of the T-joint, and reproduce it for the benefit of readers. Bore a small hole in the horizontal pipe with the end of the pliers, or a taper tool; work the metal away at the sides, forming a kind of T in the pipe itself. If it only comes up ⅛ it will be sufficient, but a little more will be better. The upright pipe is then prepared the same as for any other joint, etc. The advantages are a full way in the pipe and a stronger joint. The diagram will explain clearly what is meant.—R. A.



T-Joint.

Frame Tools.—PHONO (*Nelson*).—The subject of picture-frame making is one which comes within the scope of WORK, so that you and others interested may rely on its receiving due attention. With regard to your inquiry about wholesale dealers, I can only repeat what has been said before in these pages, viz., that wholesale houses do not care as a rule to supply retail consumers, and that when they do so it is generally entirely as a matter of personal favour or at prices equal to those of a retailer. I can understand your desire to purchase at as low figures as you can, but you would save little or nothing by going to wholesale firms. Of course, if you are a retail tradesman in the articles you name you will know without any aid from me who to deal with, and I cannot undertake to name one or more firms to the exclusion of others equally good, perhaps, though unknown to me.—D. A.

Scales for Organ Pipes.—AMATEUR ORGAN BUILDER (*Arundel*).—The only book I know of giving scales, etc., for organ pipes, suitable for amateurs is "Organ Building for Amateurs" (Ward, Lock & Co., London), price 3s. 6d. There are many hints on the subject in the back volumes of the *English Mechanic*. As regards the 8 ft. stop on the pedals, a violoncello would, I think, suit your purpose. Scale about 2½ in. or 2⅔ in. for longest pipe.—M. W.

Westinghouse Brake, etc.—F. W. R. (*Norfolk*).—(1) The brake story is probably inaccurate. The individual may have projected an air-brake, but the Westinghouse brake has only been perfected after years of experience. If you are interested in the matter and have the man's address, why not apply to him direct? (2) If the spokes are broken in below the surface you will have to drill them out. (3) Copal varnish will suit your purpose. If you want a very fine finish lay it on, coat after coat, until you have a good thickness (1/12th of an inch about), then when it has got perfectly hard throughout rub the surface down with fine pumice stone and water, and then polish with putty powder and chamois skin. To prepare the varnish, dissolve 1 oz. camphor in one quart alcohol and add 8 ozs. copal in small pieces and at a moderate heat until solution is complete; the heat should not be greater than that which will allow the bubbles to be counted as they rise from the bottom.—F. C.

American Organ Bass-Notes.—W. F. (*New Ross*).—To soften the bass of your American organ each reed tongue must be curved, so that its vibrating point may dip into the frame, while the curve given to it is sufficient, at two-thirds of its length from the rivet, to allow the blade of a penknife to be passed between it and the frame. The curve must also be twisted in such a way, that on looking at the point of the tongue endways, the left-hand corner is dipping into the frame, while the right-hand corner is cocked up. The curve must be less pronounced towards the treble, and should disappear entirely about an octave from the top in the eight feet set. This bending is done with a small pair of flat-nosed pliers, the jaws of which should be filed smooth, in order that the reed may not be damaged. It is not by any means an easy matter for an amateur to voice reeds satisfactorily, but I hope to devote a special paper to that subject in my series of articles on American reed organ making. The pipe-like tone of the American organ depends almost entirely on this process of curving the reeds. The size of the wind chest, the construction of the swell shutters, and the weight of spring in the "exhauster" are of course points which help to produce a good tone, but they are useless unless the reeds are properly voiced. I have never heard an American organ in which the harmonics were so pronounced as to produce an unpleasant effect. Organ pipes have been adapted to reed organs with more or less success, but so far as the trade is concerned they are considered unsatisfactory. If you wish to adapt them, choose a soft-voiced Dulciana for a metal stop, or a Clarabella for a wood stop, as these would go better with the free reeds. There are many makers of organ pipes who lay claim to being the best, so that it would be difficult for me to answer this last query of yours with any degree of certainty. Write to Willis, organ builders, in the Minories, E.C., for a price list of organ pipes. I believe their work is fairly good.—G. N.

Organ Tuning Cones and Cups.—ORGAN BUILDER.—I am afraid you will experience some difficulty in getting a second-hand set of turning cones and cups, and if you did happen to come across a set, they would most probably fetch a good price, unless the seller was ignorant of their worth. Why not buy a new set; they can hardly be considered expensive, when one set will last a man's lifetime. There is a Mr. Newman, of 78, Augustus Street, Regent's Park, London, who is a maker of these tools; you would be able to get them from him at first cost. I think he charges something like 26s. for a set consisting of three cones and two cups; these would be quite sufficient for all ordinary work. If you write to him, ask if he has a second-hand set by him, and mention the name of the firm of organ builders with which you are connected.—G. N.

House Painting.—N. F. (*Wolverhampton*).—Your desire for assistance is one that has the fullest sympathy of WORK, especially in the good cause you mention. Concerning the promised articles, they can only appear at intervals. When completed, however, you will find them most useful for practical work or reference. The elementary part now in hand will commend itself to your requirements especially. The late Charles Reade, in *It's Never too Late to Mend*, makes the reformed Tom Robinson to accomplish some remarkable achievements in graining, when this character wanted to raise some money honestly in Bathurst. That famed novelist was far from being alone in such mistaken notions of the process and practice of painting. In no other craft can so much show be made with only a superficial knowledge, whilst on the other hand the painter has never done learning, and each job or undertaking brings something fresh or new to him. The articles in WORK are written not only for reading, such as the above, for instance, but chiefly for working from, and therefore the writers aim at a workmanlike system of explanation and direction. A complete answer to your questions can only be gathered by the course pointed out—patient study, and by mastering the entire sets of papers. By the time this appears, much that concerns you will have been published, but I hope the subjoined will considerably aid you. I take it that your first query refers to new or unpapered walls. If having colouring on them, you must wash or scrape it off, and, when dry, coat with glue size or patent size, used warm and of good strength. For making paste, heat up the flour with cold water in a suitable vessel, so that no lumps are in, and it is in the form of a stiff batter; then pour in quickly boiling water, stirring meanwhile until it turns. A little piece of alum—about 1 oz. to a gallon—put into the saucepan of water keeps the paste when made from souring. If properly made, this should be, when cold, so stiff that it could be

put up in paper, being thinned for ordinary use with cold water. "What colours harmonise?" is a question entirely outside consideration herein. It would present a good test subject for a professional essay. Harmony of colour is as intricate a matter to explain as harmony of music, and is to some extent analogous. For your ordinary requirements, confine yourself to greys, buffs, and soft greens. Your two last questions are altogether too vague and general for "Shop," space in which, compared to the demands made upon it, is very limited. The preparation of walls and woodwork will shortly be considered in a proper and useful manner, in order that the worker may understand his task, and use brains as well as fingers. The present time is certainly one in which "tips" and "scraps" are much written and affected; but, when 'tis a question of competence and utility, careful and painstaking directions are absolutely necessary, and experience advises us to confine "scrappy" literature to its more rational sphere of fiction and pastime. Several answers to queries concerning mixing paint, colouring, etc., have recently appeared since the receipt of your letter; these will be useful to you. We shall be pleased to assist you in any particular item, and to hear of your success in the future, through the medium of "Shop."—F. P.

Regilding Frames. — ECONOMIST (*Birmingham*).—During the interval between the receipt of your letter and the appearance of these few lines, several queries similar to yours will have been fully answered. In justice to readers and staff alike, it is necessary to avoid, where possible, any such repetition. In this case I believe the answers alluded to will fully meet your wants. All gilders' tools and material can be purchased at a dealer in painters' brushes and material. Gilding will be fully treated later on. Write again, giving more definite questions, if you require aid beyond this.—F. P.

Eccentric Fixing. — STEAM. — To obtain the maximum of power, fix the eccentric so that the valve shall open the port to its full width to steam. When the piston rod is right out, the eccentric ought to be 90° in advance of the crank pin, plus the amount of lap and lead. Size and power of boiler depend on type. But a very small one would answer, say one equivalent to ¼ h.p. It is always best to have ample boiler power, so that I should not have one less than 1 ft. diameter.—J.

Lathe Cutting Tools.—N. C. (*Homerton*).—You ask what kind of cutting tools are used for lathes, and how and where to obtain them. There is *no end* to the different tools used. Begin with wood, go to a large ironmonger and ask for turners' chisels and gouges, pick out two chisels, say one ¾ in. and one ¼ in. wide, also two gouges of about the same size, which four tools will, I suppose, cost you about 4s. This is all you want to begin with; till you have had some practice with these it is of no use to go further. A fret saw requires firmly fixing into the clamps at each end, which is always done with a screw and not with a spring.—F. A. M.

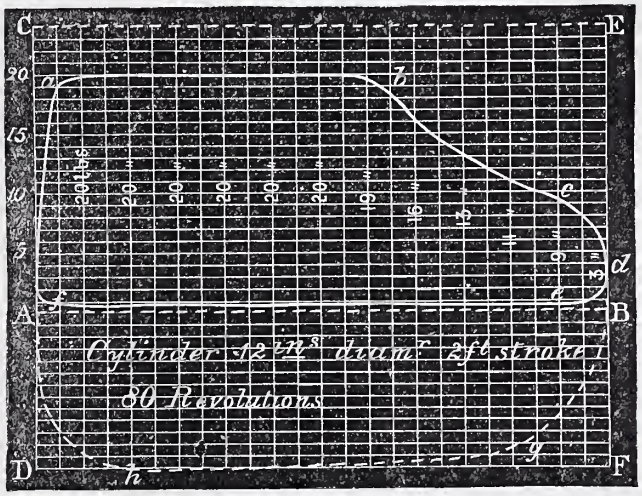
Colouring Photo Slides.—H. A. N. R. (*Bishopstown*).—There is no preliminary application required. Transparent oil colours being used, as sold for this special purpose, they are practically coloured varnishes that lie well and dry rapidly. If water colours are used, any slight greasiness that repels the tint may be got rid of by brushing a little oxgall and water over the plate and letting it dry, or the admixture of a little oxgall with the colour, completing the process by giving the whole a coat of white varnish.—E. D.

Tempering Brass Wire. — BRASSEY (*Glasgow*).—The only tempering which brass wire receives is that imparted in drawing. Soft wire is that which is annealed several times during the process of drawing, perhaps six, eight, or ten times, according to the number of times which it is drawn through the plates; hard wire is that which is either annealed fewer times, or not at all. To case-harden iron you must put it in an iron pot enclosed, and covered over with a quantity of nitrogenous matters, such as bones, horns, hoofs, leather cuttings, and such like; and lute on a cover, and expose it to the heat of a reverberatory or other suitable furnace for the space of from twelve to thirty-six hours, after which the contents will be withdrawn and thrown into water. The depth to which the case-hardening will reach will extend from about $\frac{1}{16}$ of an inch in the first period named, to $\frac{1}{16}$ or $\frac{3}{32}$ in the second period, the latter being amply deep enough for most purposes; the deeper the case-hardening, it must be remembered, the more liable is the forging to become warped. For a mere surface hardening whose depth will be no thicker than that of a piece of writing paper, it is sufficient to heat the iron red hot and roll it in powdered yellow prussiate of potash.—J.

Sailcloth Watertight.—R. C. (*Glasgow*).—I do not think there is any waterproof that would do for sailcloth that would not crack, and I am not aware of any better mode of joining than seaming.—BING.

Merits on an Idea.—A. W. (*Newcastle-on-Tyne*).—If you will submit your ideas I will endeavour to get you an opinion thereupon in the manner you wish. Send a stamped addressed envelope.—ED.

The Engine Indicator.—W. F. (*Belvedere*).—I fear it would be difficult to give you the information you require in the "Shop" column. The subject is a large one. The book I used is "Description of Richard's Improved Steam Engine Indicator," published by Longmans, at 5s., in 1868. The indicator was invented by Watt. It measures and records the pressure in the cylinder at every part of the stroke. Suppose you drilled a hole into the cover of an engine cylinder, so as to communicate with the inside, and into this hole you screwed a steam gauge. Now, as the engine worked, the finger of the gauge would move according to the varying pressure within. For instance, at the beginning of the stroke, at the moment when the slide-valve admitted the steam, the finger would suddenly jerk up to, say, 40 lbs., or nearly boiler pressure; it would continue there till the slide or expansion valve began to cut off the steam, when it would sink down, etc. Evidently, however, the movements of the finger or index of the gauge would be useless, unless some method of recording them were contrived, and this is what is done in the indicator. Instead of the steam gauge there is



The Engine Indicator.

screwed into the engine cylinder a small cylinder, having a diameter of about ⅝ in., fitted with a piston made lightly, and having no packing, so that it can move with perfect freedom; above the piston there is a spring so regulated that for every lb. per square inch that comes upon the piston it will rise some definite distance such as $\frac{1}{16}$ in. If, then, there be fixed to the rod of this small piston a pencil, then, as the engine moves, the point of the pencil will rise and fall $\frac{1}{16}$ in. for every pound per square inch of pressure on the small piston, which being connected with the inside of the main cylinder will indicate the varying pressures in the engine at every part of the stroke. To obtain a register of the movements of the pencil, we have only to place in front of the point a piece of paper which shall move to and fro with the movement of the piston of the engine. It is not necessary that the paper should move as far—that is, should have as long a stroke as the engine piston; the engine may have a stroke of 2 ft., for instance, whilst the movement of the paper might be 3 in., we could still divide the 3 in. into twenty-four equal parts to find the pressure at every inch of the stroke. Looking at the figure, we see a piece of paper ruled by cross lines; this represents the indicator card, which moves in front of the pencil point, being drawn to and fro by the motion of the piston. Let us first suppose that the indicator piston is not open to the cylinder, but only communicates with the air; the little piston, then, will remain stationary while the card moves to right and left, and a straight line, A B, will be traced on the paper or card. Now, suppose the connection between the card and the piston of the engine be broken so that it will no longer move to and fro, but that the connection between the engine cylinder and the indicator piston be reopened; the card, therefore, will remain still, whilst the pencil moves up and down; it will now trace such a line as A C or B D. Having then traced the effect of each of these movements separately, we shall be able to follow the two whilst they move simultaneously. Whilst the card is moving to and fro by the action of the engine, the pencil tracing and retracing the line, A B, and the indicator piston being open to the air, at the moment the pencil reaches A, open the indicator tap to connect it with the cylinder; the pencil will instantly shoot up to a position, *a*, rising almost vertically, then, as the card moves to the left, it will maintain its position till it reaches the point *b*, where the cut-off begins; it rounds down here because the valve does not shut suddenly. From *b* to *c* no more enters, but the steam expands in the cylinder and continues to drive forward the piston, though with lessening force, till the point c is reached, when the fall is rapid, owing to the opening of the exhaust, which occurs before the card reaches the end of its movement at *d*. From this point, *d*, the card returns backwards, as does the engine piston, and the line, *d e f*, shows the path of the pencil whilst the return stroke is being made; the height of this line above the first line, A B, representing the back pressure in the exhaust pipe, which in this case appears as one pound. Were the engine fitted with a condenser, this line would fall below the atmospheric line, as dotted at *d g h*. The indicator diagram being traced, we take off the card, and since the distance, A B, represents the 2 ft. stroke, we may, if we like, divide that into 24. Since every $\frac{1}{16}$ of vertical height represents 1 lb., we draw upon the card parallel lines $\frac{1}{16}$ apart, beginning from the atmospheric line, A B, upwards only, if the engine is high pressure only, and downwards also, if it is condensing. The dotted line, C E, is added to represent the boiler pressure as read from the steam gauge, which we have supposed to be 21 lb., showing a loss of pressure in the steam passages and throttle valve of 4 lb. To complete the card we write on it the particulars of the engine, thus:—Cylinder, 12 in. diameter; 2 ft. stroke; 80 revolutions per minute. Then from the card the mean pressure can be obtained by taking the average height of the vertical lines, or of every other one, as written upon the figure; except that 1 lb. must be deducted for back pressure 19, 19, 19, 19, 19, 19, 18, 15, 12, 10, 8, 2; twelve figures, which added together give 179; dividing this by 12 to find the average, we get 16 as the mean pressure throughout the stroke. Now if the diameter of the piston be 12 in., its area is 113 square in., which multiplied by 16 gives 1,808 lb. for the pressure on the piston. A 2 ft. stroke at 80 revolutions per minute makes 320 ft. per minute for the speed of the piston, and this multiplied by 1,808 gives 578,560 foot-lbs. per minute for the power of the engine. Dividing this by 33,000 we get 17 as the indicated horse-power of the engine.—F. A. M.

The Clock Jobbers' Handy Book: Where to get it.—READER.—Order the book you name of the nearest bookseller, and tell him it is published by Messrs. Crosby Lockwood & Co., and that its price is 2s. This is all he will want to know, and the book will soon be in your possession.

Photographic Developer.—A. V. J. (*Brinham*).—The following will be found an excellent developer for wet plates (negatives) for ordinary work: proto-sulphate of iron, ¼ ounce; glacial acetic acid, ¼ ounce; alcohol, ½ ounce; pure water, 8 ounces; dissolve. For positives the following modification is required: sulphate of iron, 1½ ounces; nitrate of baryta, 1 ounce; alcohol, 1 ounce; nitric acid, 40 drops; water, 1 pint; dissolve and filter. With regard to the deposit in the toning bath, it proceeds from the gold being reduced to a metallic state, the solution consequently becoming useless for toning purposes. Why use lead compounds at all? Try the following: gold chloride, 1 grain; acetate of soda, 30 grains; boiling water, 8 ounces. Let this stand in the dark for a day or two before use; add a drop or two of chloride of gold solution (of a strength of 1 grain gold chloride to 1 drachm of water) if it tones too slowly, also add one drachm of the gold solution for every sheet of paper toned. Well wash the prints before toning. It is a good plan to pass the ready sensitised paper through a bath containing about an ounce of carbonate of soda to the gallon of water, washing out the carbonate of soda before putting the prints in the toning bath. Be careful not to overtone. As a guide tear a print in two pieces, tone one piece, and keep the other at hand for comparison untoned. You will then easily see how far the process has gone; all prints dry up darker in colour than they appear when wet. Iodized collodium usually contains bromide as well as iodide. A pint of collodium may be properly iodized by the addition of forty grains each of iodide of ammonium and cadmium with twenty grains of bromide of cadmium. These salts are to be dissolved in a portion of the alcohol and ether, and added to the rest in which pyroxyline has been dissolved. Shake them well together and allow the preparation to stand undisturbed until perfectly bright and clear, then pour off the clear portion for use.—E. D.

Spiriting off Burr Walnut.—J. P. (*Hackney*).—As you refer only to your difficulty in getting a permanent bright polish on burr walnut it may be assumed that you can French polish the ordinary run of stuff, and that you understand generally how to do the spiriting off. The dulness which your polished burr shows after a week or two may arise from a variety of causes, the precise reasons being difficult to tell by any one who has neither seen the work nor yet your mode of manipulation. I can therefore only hint at a few of the more probable. First of all you may have used too much oil and not sufficiently got rid of it when applying the polish. In this case the remedy is obvious. Then you may have spirited off too much, though this seems in your case hardly likely. I am almost inclined to attribute the defect to the bodying in being imperfectly done. Suppose you were to do this more carefully in your next job and not content yourself with one bodying up. The polish sinks so much in burr that the dull surface may be from this cause, so go over it two or three times with your polish rubber after intervals of a day or two before spiriting. Of course

you must be careful not to get too thick a coating of the shellac (or polish), for this should be kept as thin as possible. Are you sure that your polish is good? If you are in doubt try Fordham's (Curtain Road), or any other maker of established repute. There are one or two text books on the subject, but there is none that I would care to unreservedly recommend. The best, perhaps, is that published by Wyman & Sons, Long Acre. Articles on polishing are in hand and will appear, but I cannot say definitely when. In the meantime, when you meet with any difficulty you can always write to "Shop" and have your own needs specially commented on. I do not know whether I need remind you that burr walnut requires more skill in polishing than many other woods, and that a man must be well up in the work before he can get the best results. No doubt you think you are troubling too much. The very object of "Shop" is to assist workers in any branch of manual operations, and none of the staff, from Editor downwards, regard inquiries coming within our scope with any other feeling than that of sympathy and a desire to remove difficulties or suggest improved methods.—D. A.

Patent.—INVENTOR (*Liverpool*).—Respecting the prior provisional protection you refer to, it is not necessary that you take cognisance of it, though the purchaser of your protection rights may run some risks. When the prior provisional protection is "completed," you will be able to take objection if any points are included in the complete specification which were not foreshadowed in the provisional specification. In your own interest you should ascertain when the complete patent is accepted for the prior invention, and when this acceptation is notified you should at once inspect the specifications at the Patent Office, Southampton Buildings, London, where you will be able, any time within two months, to lodge an objection to the grant of the patent, upon the forms specially arranged for this purpose. In the event of the earlier provisional specification not being completed, the matter may be considered void.—R. & C.

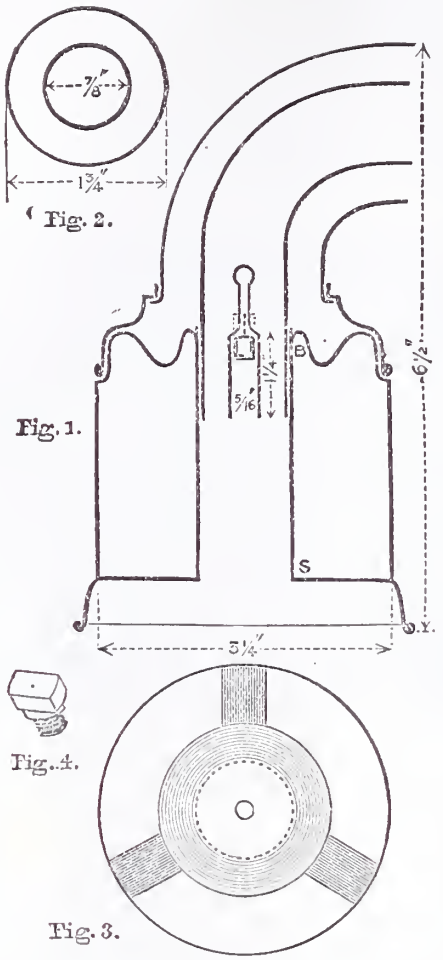
Apprenticeship.—'PRENTICE.—There is no doubt that to become a competent marine engineer you must go through the shops of some marine engine works; but I doubt, unless you have friendly influence, your getting into any works on the terms you mention. Your best plan will be to apply direct to some firm of marine engine builders, when you will doubtless get all information.—F. C.

Photo Telescopes.—A. S. H. (*Yorks*).—Your question arises from a misapprehension of the matter. Telescopes may be applied to photography in several ways, as, for instance, in photographing astronomical subjects. In this case a camera is adopted to the telescope, the sensitive plate taking the place of the eyepiece. In this manner different nebulæ have been photographed. At this time, extensive operations are in progress, making star charts of the southern hemisphere. Many leading astronomers in various parts of the world adopt this method of securing records of the heavens. Another adaptation of the telescope to photography is to have a telescopic arrangement attached to cameras, in order to ascertain the proper focus of an object at sea, where no guides exist that enable the distance to be correctly estimated.—E. D.

Firing Glass Facias.—The firing of glass facias and lettered glass is undertaken by James, 78, High Street, Camden Town, who has some of the largest kilns in London, capable of holding very large sheets. He also undertakes the firing of china plates, vases, tea cups, etc. The cheapest and best kiln for firing glass is Thompson's patent gas kiln (Leeds). The heat is under control, and it is possible to have a gas kiln fixed up in a shop, whereas, the old coke kilns require to be in a separate building. The query as to building kilns has been answered (see page 46, Vol. II.). Unless you have a good deal of work to fire, we strongly advise you to go to a professional kilnman to get it done, as you will save both money and trouble by so doing. "Glass Painting," in Wyman's "Technical Series," can be consulted on the subject; also "Pottery Painting," in the same series.—F. M.

Gongs.—W. E. W. (*London, W.C.*) has seen thin plates of metal suspended by two cords to be struck and used as bells or gongs, and asks in reference thereto what size the several plates should be, with the thickness, and also the kind of metal—bell metal or otherwise—to produce an octavo of tones. If W. E. W. has seen the plates, has he no idea from the colour what is the probable kind of metal? I am sorry I can give no direct answer to these queries. The nearest approach to the article that I have seen is a set of steel tubes which was exhibited at the "Inventions;" they gave a magnificent tone, and occupied but little space; the largest was, perhaps, about 5 ft. long and 8 in. in diameter; the tone was exceedingly deep and rich. Bars of steel are also used instead of bells, and these produce a fine effect, and can be more readily tuned than bells, but plates I have not seen or heard of before. Venturing an opinion, I should say weight for weight steel will give the deeper tone. I am afraid that on such a subject the exact diameter and thickness can only be determined either by measuring existing plates or experimenting. One thing I think will be seen: that with a decrease in size there must be a decrease in thickness.—O. B.

Paquelin Lamp.—F. L. W. (*Salford*), JACK (*London*), and others.—In reply to your inquiries, I send herewith some sketches, dimensions, and particulars of the Paquelin lamp. Body of sheet brass 22 or 24 wire gauge wired round the bottom, with 9 $\frac{3}{16}$ holes punched round close to the wire for admitting air. This is in one piece in the original, but you could not make it like that. Central tube is brass, of a diameter to allow the inner bent tube to fit nicely in it. This is brazed round where I have marked B in the sketch and soldered at the bottom, S. Inner bent tube: $\frac{7}{8}$ brass with a slot of sufficient width to enable it to slip over a hollow cross-bar of oblong section, $\frac{3}{16}$ by $\frac{1}{4}$; this cross-bar is fixed $\frac{3}{16}$ below the top edge of central tube, which said tube must



Paquelin Lamp. Fig. 1.—Longitudinal Section of Lamp. Fig. 2.—Plan of inner and outer Tubes. Fig. 3.—Triangle under bottom. Fig. 4.—Nipple (full size).

of course have two holes made in it, before fixing in the body. A nipple (Fig. 4) is screwed into this cross-piece with a very fine hole, and the drilling of this hole will, I expect, be the crux for you; it is as fine as the hair of your head, and if it is made too large the thing will not go. This hole gets choked sometimes in using, and the best thing I can clear it with is the fine point of a thin shred of tin such as a tinman trims off a bottom that is a shade large. Outer bent tube: thin sheet iron riveted to the brass ogee moulded top, which has fifteen $\frac{3}{16}$ holes round it, and two bayonet notches cut in it to fasten on two little studs on the sides of the body. The bottom is soldered in, and so is the triangle underneath the bottom. The filling screw is soldered in and the handle also. The interior, as far as I can see, consists only of a piece of lamp wick bound round the central tube. You will soon see which are the vital parts of the affair, and what parts you can modify to make it easier. For instance, instead of the two bent tubes you might make them to an angle, taking care that it was sufficiently obtuse, so that the outer tube would take off and on when the inner one is in position. I hope this, with the drawing already given, will make all clear.—R. A.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—S. C. & SONS (*Salop*); H. B. S.; J. M. (*Manchester*); J. R. (*Huntley*); J. H. M. (*Beau Pare*); H. B. (*Jarrow*); W. W. NELSON; GLESCA NOKEL; NIGER; ENQUIRER (*Jersey*); B. H. T. (*Liverpool*); FURNITURE; ENQUIRER (*Herne Hill*); A. N. F. C. (*Christchurch*); T. M. & SONS (*Glasgow*); CONSTANT READER; W. H. (*St. Leonards-on-Sea*); J. O. (*Manchester*); VERITAS (*Reading*); READER (*Blackburn*); H. J. (*Southampton*); T. W. (*Brighton*); F. W. C. (*Stratford*); F. C. (*Cardiff*); J. J. A. (*British Guana*); MEDICAL (*Hampstead*); A DISAPPOINTED READER; E. L. R. (*Oxford*); EUONOMY; AMATEUR; B. J. T. (*Stafford*); YOUNG SHIPWRIGHT; H. W. D. (*Lincoln*); ENQUIRER (*Walton-on-Thames*); G. B. (*Accrington*); KING BRUCE; READER; J. H. (*Leicester*); P. P. (*Walerford*); F. R. (*Streatham Hill*); PHOTOGRAPHER; S. W. (*Bristol*); GALA; G. P. (*Elgin*); B. S. (*Reading*); G. K. (*Glasgow*); A. R. (*Scorrier Saw Mills*); WINDMILL; C. L. F. (*Brighton*); W. D. E. (*Perth*); R. H. (*Accrington*); CARBOX.

Trade Note.

MESSRS. STEVEN & STRUTHERS, brass founders, Glasgow, have successfully completed the first of several phosphor-bronze castings, which are interesting in view of their size and weight. It will be remembered that it was decided by the Admiralty to have several of the second-class cruisers recently ordered wood sheathed and copper-bottomed. As the copper would result in the corrosion of steel by galvanic action, it is necessary to make the stem and stern posts of phosphor bronze. The London and Glasgow Company are building at Govan three of the wood-sheathed cruisers, and three others are being built by Messrs. Palmer, on the Tyne, and for these Messrs. Steven & Struthers are supplying the castings. The stem of one of the vessels has been completed. It weighs over 10 tons, and from the connection with the built keel to the point of the ram the measurement is 23 ft. 6 in., while the height from the ram to the top of the stem is 20 ft., making the length from tip to tip 43 ft. 6 in. The stiffening bracket in connection with the ram forms part of the casting, and is not, as is usually the case, separate and bolted to the stem. At its broadest part the stem is 3 ft., and is scarped for the steel plates and teak planking. The principal casting of the stern framing, the first of which is now in progress, will weigh 12 tons 5 cwt. To it are fixed two brackets for the propeller shafting tubes, each bracket being 4 tons 10 cwt; while the rudder, on the balance principle, will be 10 tons, making in all 31 tons 5 cwt. The larger casting in connection with the stern post measures, from point to point, 35 ft. 6 in. The rudder is cast in frame, and plated with bronze sheeting $\frac{3}{8}$ in. thick. It may be added that the metal is composed of 90 per cent. copper, 9·5 per cent. tin, and 5 per cent. phosphor. The castings for each ship will cost about £2,200.

WORK.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [6 R

Complete Fount of Rubber Type.—Two alphabets, to form any word or name, box, pad, ink, and holder, post free, 1s. 6d.; extra alphabets, 6d. per set; figures, 3d. Business, address, and pocket stamps equally cheap.—W. C. PRESTRIDGE, Manufacturer, Cumberland Street, Bristol. Established 1870. [2 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [3 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

"Roll Call" Pipes.—Healthful, Luxurious, THIRSTLESS Anti-nicotines. Briars. Post free, 1s. 8d.—ALLEN DEWSNAP, 65, Pikes Lane, Glossop. [5 R

Notice.—We take in Exchange Lathes and various tools for better. Catalogue, 6 stamps. List of Second-hand, 2d.—Britannia Co., Colchester.

Largest Stock of Engineers' and Mechanics' Lathes, Shapers, etc. Stocks and Dies. Forges, etc.—Britannia Co., 100, Houndsditch, London.

Call and select from our stock at 100, Houndsditch; but all letters addressed Britannia Tool Factory, Colchester.

Britannia Co. supply Gas or Steam Engines, and fit up workshops complete. Terms, Cash or easy terms. [8 R

Bird Stuffing for Amateurs, with 70 Diagrams and Illustrations. Best cheap work published. 7d. free. "Egg Collecting," 3½d. "How to Rear Lepidoptera," 4d. Illustrated catalogue Naturalists' requisites, 2d. Egg Drills and Blowpipe, 1s.—Messrs. DAVIS, Naturalists, etc., Dartford. [9 R

Powerful Miniature Shocking Coil and Battery.—Carried in waistcoat pocket. Complete Instructions for making, 9d.—BELDAIR, 25, Livingstone Road, Bath. [10 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [2 S

Violin for Sale.—Splendid instrument, beautiful tone, perfect condition, baize lined case and mounted bow. Must sell. Only 17s. 6d., post free. Rare bargain. Cannot fail to please.—WOODBRIDGE, 34, Hill St., Ipswich. [3 S

SITUATION WANTED.

London Agency wanted by an inventor with business experience. References. Mechanical sundries preferred.—I. D. L., c/o W. LYE, Engineer, 25, Artillery Lane, London, E.C. [1 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.

SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

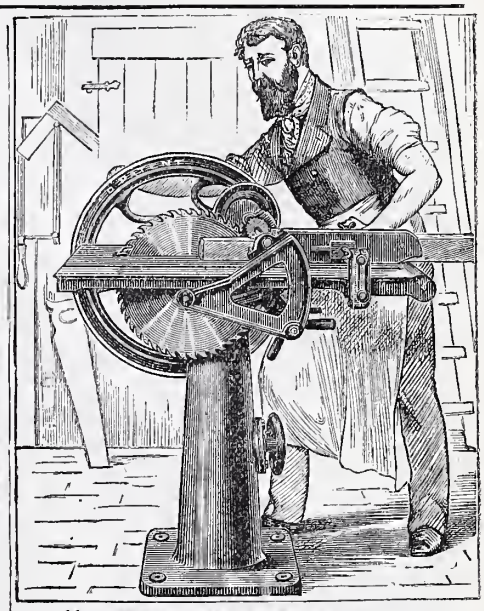
PRICE, TALBOT & CO., LIMITED,
LATE DALE & CO.,
26, LUDGATE HILL, LONDON, E.C.

WATERPROOF FLUID GLUE.

(Patent.)

By post, 1s. 3d. *and* 8d.

WATERPROOF GLUE CO.,
62, Dale Street,
LIVERPOOL.



"THE LEYTON"

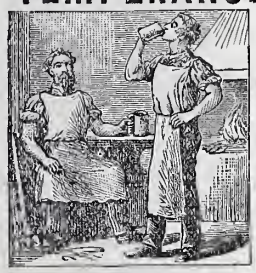
New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

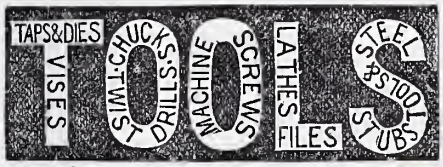
AGENTS WANTED.

NEWBALL & MASON, Nottingham.

RD. MELHUISH & SONS,

FETTER LANE, LONDON, E.C.

Gold Medal for Excellence of



For all Workers in Metals, also Joiners, Wood Carvers, etc.

WE HOLD THE MOST COMPLETE STOCK IN THIS COUNTRY,

And all Orders have Immediate Dispatch.

Orders for Hardware and Tools over 10s. in Value, Carriage Free.

RUBBER STAMPS.

H. SAVAGE, Manufacturer and Patentee.

Rubber Stamps, Rubber-faced Type. The "Climax" and other Dating Stamps. Patent Ink Pads, &c. &c.

Makers of Boxes, Mounts, Presses, Vulcanizing and Moulding Machines, Brass Turned Ovals and other Shapes.

MATERIAL and all Supplies for the Trade. State your requirements to

H. SAVAGE, 33, CHEAPSIDE, LONDON.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.
37, CHANCERY LANE, LONDON, E.C.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

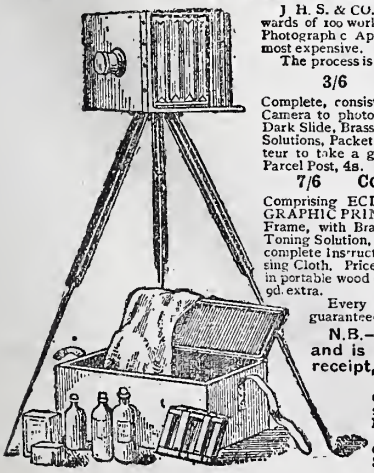
Monthly.] **CASSELL'S TIME TABLES.** [*Price 4d.*

J. H. SKINNER & CO., EAST DEREHAM, NORFOLK,

MANUFACTURERS AND IMPORTERS OF

PHOTOGRAPHIC APPARATUS AND FRETWORK MATERIALS.

Timber Yards, Sawing and Planing Mills covering about Two Acres near Railway Station.



J. H. S. & CO. have now a large Factory with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description, from the cheapest to the most expensive.

The process is simplicity itself. Full Instructions supplied with each set.

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

Every Set is carefully examined before being sent out, and guaranteed to be in working order.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase money.

Better Sets, 10s. 6d., 21s., 42s., 100s., and upwards. Complete Catalogue of Photographic Apparatus, one stamp. J. H. SKINNER & CO., EAST DEREHAM, NORFOLK.

Wholesale Agent for London—J. MOTHERSILL, 60, Holloway Road, N., and 6, Southampton Row, where Samples may be seen.

J. H. S. & CO. keep regularly in stock about **120,000 FEET OF FRETWOOD,** solid and 3-ply, veneers, &c., besides a very large quantity of Logs, Planks, and Boards, Carving and Turning Wood, &c., and **200,000 FULL-SIZE DESIGNS for Fretwork, Wood Carving, &c.,** besides an immense Stock of Joiners' Tool Chests, Fretwork Outfits, Drills, Saw Frames, Hand and Treadle Machines, Saw Blades, &c. &c.

Specialities for 1888 & 1889.—Books of New Designs. FRETWORK No. 1, containing 12 Large Sheets, price 1s. No. 2, containing 20 Sheets of larger and more elaborate Patterns, 2s. 6d. Book of Wood Carving Designs, containing 14 Patterns, price 1s.; these are all New Patterns, not sold in any other form, and would, if sold separately, cost three or four times the amount charged. Fretworker's Handbook and Workshop Guide, price 1s. New Designs. All Patterns greatly reduced in price.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, 48 Saws, Awl, File, 4 Designs (with sufficient planed Wood, gratis), and 1s. Handbook on Fretwork, price 3s. 6d., carriage paid. 12 feet Assorted Planed Fretwood, 3s. 6d.

☞ Special Fretwork Design, in commemoration of Her Majesty's Jubilee, size, 36 in. by 26 in., price 2s. 6d.

JUST PUBLISHED, NEW CATALOGUE of Machines, Saws, Designs, Wood, &c., 56 pages, 600 Illustrations, with Instructions, 4d., post free. Good Fret Saws, 1s. 4d. per gross; best ditto, 1s. 9d. per gross.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

MELLIN'S FOOD

FOR INFANTS AND INVALIDS.

MISS BARBER.
Age 15 Months.

"96, Brixton Hill, London, S.W.
"4th March, 1889.

MRS. E. BARBER writes:—"I beg to forward photo. of my little girl, brought up entirely on your Food."

G. Barber.

Samples, Pamphlet, and Prospectus Post Free on Application to

G. MELLIN,
Marlboro' Works, PECKHAM, S.E.

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

STERN'S PUMILINE LINIMENT

NEVER FAILS to give immediate Relief and finally to Cure all cases of *Muscular* and *Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,* etc. Also most efficacious in *Bronchitis* and *Throat* and *Chest Affections.*

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes: "Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

From all Chemists, 1s. 1½d. *and* 2s. 9d. *per Bottle, or* 3*d. extra for postage, from*
G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.
A Work on the "Home Use of Pumiline" sent free on application.

NOTE.—Our New Illustrated 200-Page Catalogue is now ready, containing 700 Illustrations, of all the Latest Improved Tools for Carpenters, Joiners, Engineers, and all Metal Workers, Carvers, Fretworkers, &c. By post, **6d.** The Polytechnic List of Tools for Students on application.

UNIVERSAL HAND BEADER.

Iron Stock, with Seven Steel Cutters, **5s.** each.
Free by Post.

For Beading, Reeding, or Fluting, straight or irregular surfaces, and for all kinds of light Routering, this Tool is invaluable to Wood-workers. Seven superior Steel Cutters go with each Tool. Both ends are sharpened, thus embracing Six ordinary Sizes of Beads, Four Sets of Reeds, Two Fluters, and a Double Router Iron (⅛ and ¼ inch). The Cutter is firmly clamped to the Stock. A Gauge with long straight bearing surfaces is used in ordinary work; and a Gauge with oval bearing surfaces is used for curved or irregular forms of work. Either Gauge can be shifted from one side of the Cutter to the other, without separating it from the Stock, and can be rigidly set at any required distance from either side of the Cutter.

Note the Address—**MOSELEY & SON, 323, High Holborn, W.C.**

ENGRAVERS' AND ETCHERS' PLATES, TOOLS, AND MATERIALS.
OF BEST MATERIAL AND WORKMANSHIP.

COPPER PLATES from ½d. per square inch; STEEL PLATES from 1d. per square inch; GRAVERS, 3s. doz.; GRAVER HANDLES, 3s. 6d. doz.; THREADED GRAVERS, 1s. each; PLAIN, FLAT, OR ROUND GRAVERS, Set of 10, 2s.; ETCHING POINTS, 1s. and 2s. each; MEZZOTINT SCRAPERS, 7s. doz.; THREE SQUARE SCRAPERS OR BURNISHERS, in Handle, 2s. and 3s. each, and all kinds of Tools and Materials. Lists Free.

JOHN SELLERS & SONS,
151, ARUNDEL STREET, SHEFFIELD.
London Agents: J. DONNISON & SON, 20, Wormwood Street, City.

FRETWORK AND CARVING.

Highest Award—Gold Medal for Tools and Patterns.

NO. 731

OCCASIONAL TABLE. SIZE 26½ X 15 INS.

Machines, Designs, Tools, Wood, Mirrors, Hinges and Fittings, Varnish, etc.

T. N. writes:—"I got a First Prize from one of your Designs."

R. W. A.:—"Received your Catalogue today, and consider it the best I have seen."

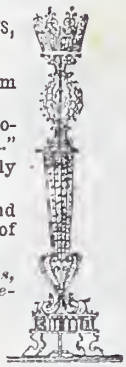
R. B. M.:—"Machine to hand, am highly pleased with it."

J. A. S.:—"I have taken Eight First and One Second Prize with various patterns of yours."

Illustrated Catalogue of all Tools, Wood, etc., and 500 Miniature Designs, free for Six Stamps.

Harger Brothers,
SETTLE, YORKS.

NO. 730.



FLOWER OR LAMP STAND. SIZE 44 X 12 INS.

Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.
SOLD EVERYWHERE.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

A Four Page Supplement is issued Gratis with this Number.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

Vol. II.—No. 58.] SATURDAY, APRIL 26, 1890. [Price One Penny.

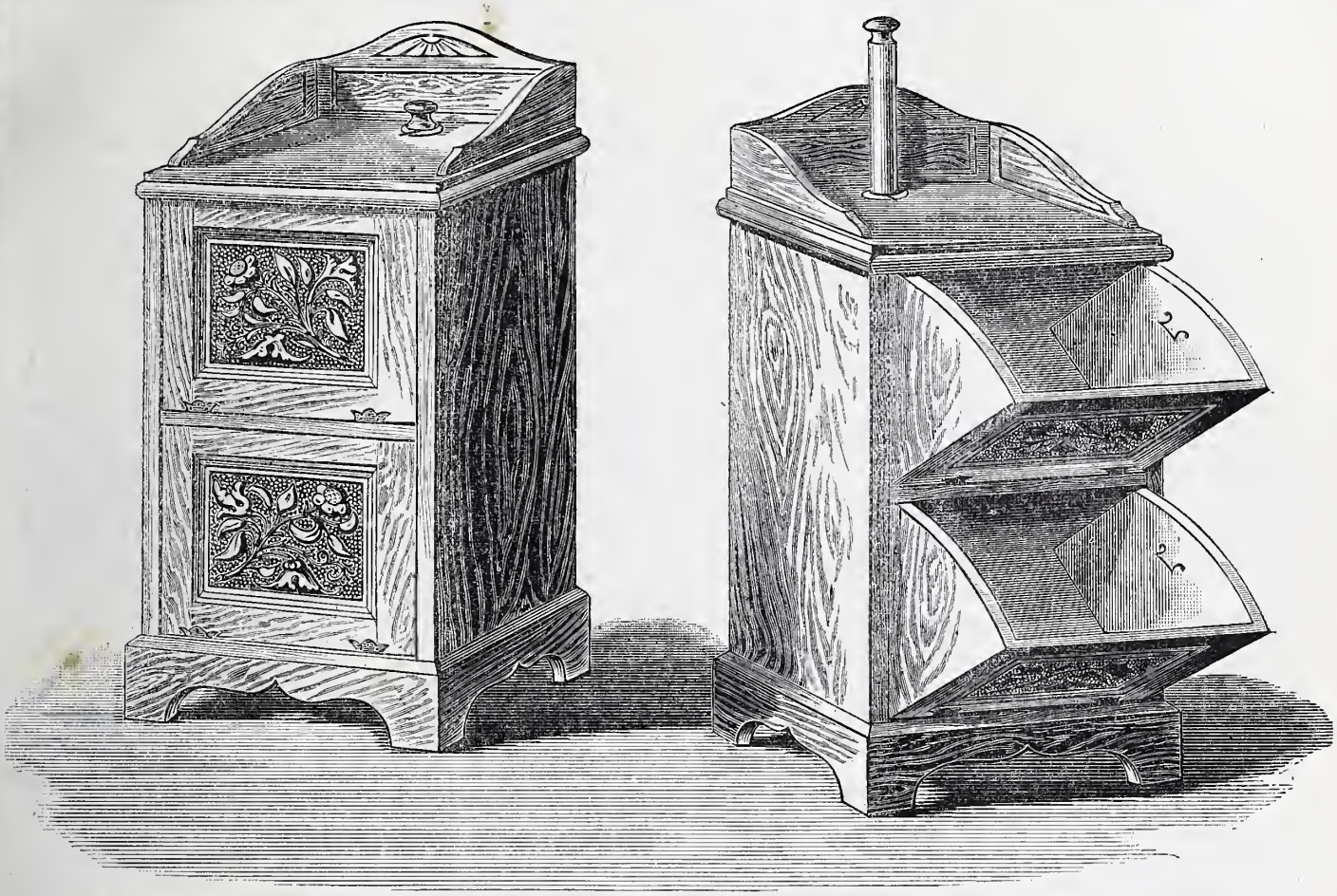


Fig. 1.—Coal and Coke Box closed. A NOVEL COAL AND COKE BOX. Fig. 2.—Coal and Coke Box open.

A NOVEL COAL AND COKE BOX.

BY JAS. SCOTT.

How seldom one sees a coal box (grandiloquently called vase) in any of the homes one may chance to visit! What is the reason for this? Certainly not on account of the cost of such articles, for they can be bought cheaply; and just as certainly not because they are useless, for in the winter time they are among the most useful things for an apartment. I will leave the answer to be arrived at by someone more philosophical than myself. Very few houses have coal cupboards in all the different rooms; and the inhabitant of either of them has, perhaps, to leave the warm apartment to gather sufficient "diamonds" in a shovel with which to replenish the dying fire.

I am very far from inclined to encourage idleness, but I think that by having to leave the room for such a purpose a less number of times the fire would burn the brighter, and many little squabbles between man and wife, as to whether "I" or "you" shall fetch the coals, be prevented.

"But why," it may be asked, "have I designed this article to have *two* compartments?" Well then, for answer, I may say that coals in one, and coke or wood and paper in the other, will utilise it as I intended it to be. It may be considered better still, however, to have one compartment filled with coals and the other reserved for ashes, for it will very often be found convenient, when a shovelful of coals are put on the fire, to take up some of the ashes previously raked out.

It will doubtless have been observed that *both* boxes open and shut together with the same movement of the hand—that of pulling up and pushing down the column at the back. A compartment may be added on top; another wing (as shown in plan at Fig. 12) added, with one or two boxes in each wing; or even two or three wings added to it—all to work with the same movement. I mention this as some reader may find the idea of use to him, other than by utilising it in a coal-box, where it would be a decided advantage to open several compartments at once. Nothing more, then, but particulars as to construction need be said.

This one is intended to be about 30 in. high to the top board, 15 in. wide, and 16 in. from back to front. We shall not want much wood for it. The carcase consists of a backboard 23½ in. long and 14 in. wide; two sides each 23½ in. long and 15 in. wide; a bottom board 15 in. long and 14 in. wide; a top board 16 in. long and 15 in. wide; and a shelf in the middle (which must not come into contact with the backboard) 15 in. long and about 8 in. wide. The top and the bottom boards must have a hole at the back part to allow the pillar and tube to penetrate them. To the bottom board is screwed a plinth, similarly constructed to the one in Figs. 5 and 6. The boards for this plinth will be two 16 in. long and 6¼ in. wide, and two 15 in. long and 6¼ in. wide, with

the inside framing of any size. The top edges of it should be canted towards the outside, while inside a little depth is allowed for the insertion of the bottom of the carcase. If the plinth is shaped as I show in Figs. 1 and 2, something after the arrangement in Fig. 6 must be attached, on the bottom of which will rest the tube; but if it is made quite plain, only a board at the extreme bottom will be necessary.

The boxes *must* be a quadrant of a circle in shape—Fig. 7 shows one of them. As ornament, the fronts might be panelled and carved. A circular board, 22 in. in diameter, cut into quarters, will give us the sides for them. Each will have a front and bottom board 13 in. long and 11 in. wide. A metal box, similar to that in Fig. 8, with two handles, and painted black inside, will fit into the wooden ones, and can be taken out and refilled without necessarily moving the whole article. To keep the metal box within the wooden one, it will be necessary to have a narrow strip of wood along the back of the latter, as in Fig. 7. One thing in particular concerning the boxes must not be lost sight of: I have allowed them to be opened more than half-way so that the metal boxes can be taken out; but some reader may reduce the length of the pieces connecting the boxes with the pillar, to prevent the boxes opening quite so far. If this is done it will be impossible to extract the metal boxes.

The pillar, etc., now claims attention. A metal or wooden tube, about 3 in. in diameter, is fitted at the back, the top of it coming flush with the top of the job. Along the whole distance of the front of this tube, and at the back for a distance of about 12 in. from the top, are grooves, in which work two small bayonet catches, which catches prevent the boxes falling either backwards or forwards when they are opened, so that the hand is not obliged to be on the article at all during that time. The front groove is also necessary on account of the connecting rails (B in Figs. 10 and 11) which are attached to the column. When the pillar is pulled up the proper height it can be turned, when one catch will come *above* the top board and one *under* it. The pillar, with the small black squares indicating the bayonet catches, can be seen in Figs. 3 and 4. The extreme length of it is 32 in. or 33 in. long, and it is made to work freely up and down the tube. Two rings, as A in Fig. 9, are placed, *not joined*, to the pillar, and each is kept in position by a pair of rings (B B in the same diagram), which *are* joined to the pillar. On to the fronts of the rings, A A, are hinged the connecting rails shown in Figs. 10 and 11, which are 5½ in. long, and about 1 in. wide by ½ in. thick, and should be very strong. The other end of each of these rails is connected with the back of a box. It will be found necessary to cut a small piece away from the back of the bottom of each box, in order to hinge the connecting rails to them. In Figs. 10 and 11, A represents the back of the boxes, B the connecting rails, C the tube, D the movable rings (A in Fig. 9), E the pillar, and F the fixed rings (B B in Fig. 9).

A small pediment, with a fluted panel, and two side pieces, will give a better effect to the article, which I think will look best in dark wood, as light wood will be liable to show smears, etc.

In the sizes I have given, I have allowed quite sufficient for the various joints. The top board I have intended to be ¾ in. thick, the remaining boards ½ in. thick.

Perhaps I ought to say a few words with regard to the hingeing. Hinge together the boxes, connecting rails, and pillar first; then fix the front hinges to the shelf and bottom board; and finally hinge the boxes to them. Ornamental hinges should be used for this latter part, as one half of them will show on the fronts of the boxes.

If the connecting rails are inverted, they will work in a similar manner. It would not necessitate having so deep a plinth as we are obliged to have in the present case, but it would be found that they would cause some trouble, and in the end be far from as convenient and useful as the present ones.

If any reader should consider that too much space is lost by having the metal boxes the shape of Fig. 8, he can utilise the whole space by carrying out the following instructions. Have the complete front of the wooden boxes detached from the circular parts, and hinged in front in precisely the same manner as in the present case. The metal boxes will then be the *same* shape as the wooden ones. When required to be refilled, the front of the wooden ones can be lowered and the inner ones taken out. To keep the fronts and the other parts firmly together when required, a hook might be attached to each side of each box, to secure the front, in the thickness of which a pin has previously been driven. It will be necessary to cut away a small portion of the sides of each box to allow for the thickness of the hooks, but this need not disfigure the fronts of the boxes, as the pins for the hooks can be driven into the back part of the thickness; if this method is adopted, it will be better to have a much thicker board for the front of each box than I have mentioned above. The bottom board will not be attached to the front one, but the connecting rails and the side hooks will prevent it falling out of its place.

This idea admits of several modes of adoption, and of several improvements, but I will leave both—should he not approve of my design—to the reader's ingenuity.

[Figs. 3-12 are placed on the opposite page, a position which is more convenient for the reader when reading the paper and referring to cuts.]

CLEANING AND LACQUERING OPTICAL BRASSWORK.

BY CHAS. A. PARKER.

LACQUERING—LACQUER BRUSH—HOW TO MAKE THE LACQUER—OPTICAL DEAD BLACK, VARNISH, AND CHEMICALS.

HAVING described the various methods of finishing and preparing the brasswork, we will now turn our attention to the process of

Lacquering.—The article should first be heated by being placed on a stove, or, if not possessed of a stove, it may be laid on an iron plate and held over a clear charcoal fire or any other source of heat, provided it is protected from the naked flame, care being taken not to touch the bright surface with anything that would be likely to stain it. It must now be heated until just too hot for the hand to bear, and yet not sufficiently hot to bubble the lacquer, or, in other words, as near the temperature of boiling water as possible. If the article is allowed to get too hot it will be apt to burn the lacquer, and if it is too cold it will not set. When the brass has been heated to the correct temperature a flat ¾-in. brush (which should be clipped and trimmed if necessary) is dipped into the pot containing the lacquer, and scraped against the side to get rid of the excess of lacquer, or it may be wiped across a string stretched over the top of the pot. The brush should now be laid on the work as light as possible, with a slightly curved motion at the beginning of the stroke, in order that it may miss the sharp edges, which would otherwise cause too much lacquer to be pressed out of the brush and thus spoil the surface. The brush should be drawn rapidly, but not hurriedly, over the surface of the brass, and lifted off the instant that it reaches the other edge, and it must always pass over the metal in one steady sweep, never being allowed to go over the same spot a second time while the surface is moist. When lacquering flat irregular surfaces the great danger to be avoided is the lacquer collecting around the edges or spreading in irregular quantities. In order to avoid the mishap, some workmen first coat the work with alcohol or very thin lacquer. If the brush is passed a second time over a spot where the lacquer has only partially set, it will result in an unpleasant brown stain; but if the lacquer has been laid on too thin, the article may be heated again and the process repeated with fresh lacquer until a good even body has been laid on, it being simply a matter of practice to lay one coat over another without dragging the previous one off. Should the surface become spoiled by any mishap the lacquer may be cleaned off by boiling it in a lye of potash, as before described. Screws are lacquered by being arranged in rows along a strip of wood. It should be remembered that small thin articles part with a considerable amount of their heat in laying on the lacquer, whereas bulky work remains apparently unaffected. It will thus be seen that it is necessary to make small articles somewhat hotter than larger articles previously to lacquering, *experientia docet.* When the work has been satisfactorily lacquered it should be exposed to a gentle heat for a short time, in order to evaporate the alcohol and harden the lacquer, causing any slight unevenness of the surface to disappear and greatly improve the appearance of the lacquer. A small cooking stove will be found very useful for heating the work, care being taken that the heat shall never exceed the temperature of boiling water, otherwise the lacquer will be apt to get burned.

In lacquering tolerably broad surfaces a brush the same width as the work should be used; but for very large work, or when there are a great many screw-holes, an ordinary brush is unsuitable, the best kind of brush for the work being made in the following manner: Cut a strip of wood just a trifle broader than the surface to be lacquered, and shape it to the form of Fig. 5 (see page 36), afterwards sawing a slit with a thick saw through the edge of the wider portion. Now take a strip of clean flannel about a couple of inches wide, and of the same length as the width of the wood, and fold it lengthwise; then fold a strip of white nankeen cloth over the flannel, afterwards wedging them both into the slit in the wood with the folded edge outwards, securing them in position by means of some small screws driven through the side of the wood. Before screwing them up tight it will be found advisable to put a piece of straight wire through the bow of the folded cloth, in order that it may be pulled tight, and thus be left smooth and straight. This brush must not be dipped into the lacquer, but should be fed by means of an ordinary brush, with which the lacquer is dabbed on

o the nankeen. The woollen cloth holds he lacquer and the nankeen prevents it rom flowing too freely, and also presents a smooth surface to the article to be lacquered, preventing any particles of wool from coming in contact with the lacquered surface. With a brush of this kind it is a simple matter to successfully lacquer large surfaces.

It will not, as a rule, be found an economical plan for residents in large towns to make their own lacquer, as it can generally be purchased cheaper, and sometimes better, than it can be made in small quantities at home; but for the convenience of those of our readers who may wish to make their own lacquers, directions are here given for the preparation of a golden lacquer: Take of ground turmeric, ½ oz.; saffron and Spanish annatto, of each ½ drachm. Mix these in a bottle containing 5 oz. of highly rectified spirits of wine, and put it in a warm place, with occasional shaking, for about a week; then strain it through clean, coarse linen into a clean bottle, and add ¼ oz. of coarsely powdered seed lac, putting it again in some warm corner, and shaking it frequently the same as before, for about a fortnight, or until the lac has entirely dissolved, when it may be again strained and put in a clean bottle ready for use. It is not wise to use more seed lac than the quantity given above, as it has a tendency to prevent the lacquer from laying as evenly as it should.

Sufficient having been said to enable the reader to lacquer equal to an optician after a little practice, it only remains to conclude by giving directions for the production of the optical dead black with which to provide the interior of a lens tube, the hood, and cap, etc. For ordinary common work or the interior of lens tubes, a dead black composed of spirit varnish and vegetable black will be found to answer very well. Obtain from an oilman a pennyworth of vegetable black, or lampblack, and twopennyworth of ordinary spirit varnish. Mix some of the varnish with methylated spirit, and then add a small quantity of the black, grinding it up with a stick of wood in a small saucer, carefully breaking all the lumps, and adding sufficient black to form a varnish as thick as cream. If a brushful is now tried on a piece of bright brass it can be ascertained whether it is fit to use, as it will dry in a few moments. If it dries shiny, a little more black or spirit must be added; and if it is too thick, a small quantity more spirit and varnish. To apply this varnish to the interior of a lens tube, pour a small quantity inside the tube, and then quickly turn the latter round, in order that it may completely cover the surface, the superfluous black being poured back into the saucer. If properly mixed and applied, a splendid dead black can be obtained by the above simple plan, which is hard, quick drying, and not liable to rub off with a little friction. A good chemical dead black for the lens cells, stops, etc., may be made in the following manner: Pour ½ oz. of nitric acid into a wide-mouthed bottle, and into this drop as many strips of copper wire as the acid is capable of dissolving, placing the bottle out in the open air in order to avoid the fumes of the gas. When the acid refuses to dissolve any more copper, carefully pick out the remaining portions by means of a forked stick, and then add another ½ oz. of acid and 1½ oz. of clean water. To use this solution hold the article to be blackened on a hook of brass or copper wire and plunge it into the nitric acid solution, which should previously be poured into a saucer or similar suitable receptacle. The article is allowed to remain in this solution for about a quarter of a minute, when it should be taken out and held over the flame from a Bunsen burner, or over a charcoal fire, until the colour changes from green to a good dead black. The brass first becomes coated with a thin green film of nitrate of copper, but this changes by prolonged heating to black oxide of copper. When the article is cold the surface black may be brushed off with a blacklead brush. When required, the liquid may be applied to the surface of the brass by means of a camel-hair brush with equal success.

The following are two more chemical dead blacks which may be employed in place of the above, if desired:—(1) Make a couple of strong solutions of the nitrates of silver and copper, mix them together, and dip the article in this mixture, afterwards heating it over a gas flame until the required degree of dead blackness is obtained. (2) Prepare the following mixture:—

Sulphate of iron	1 part.
White arsenic	1 ,,
Hydrochloric acid	12 ,,

Immerse the article in this solution until

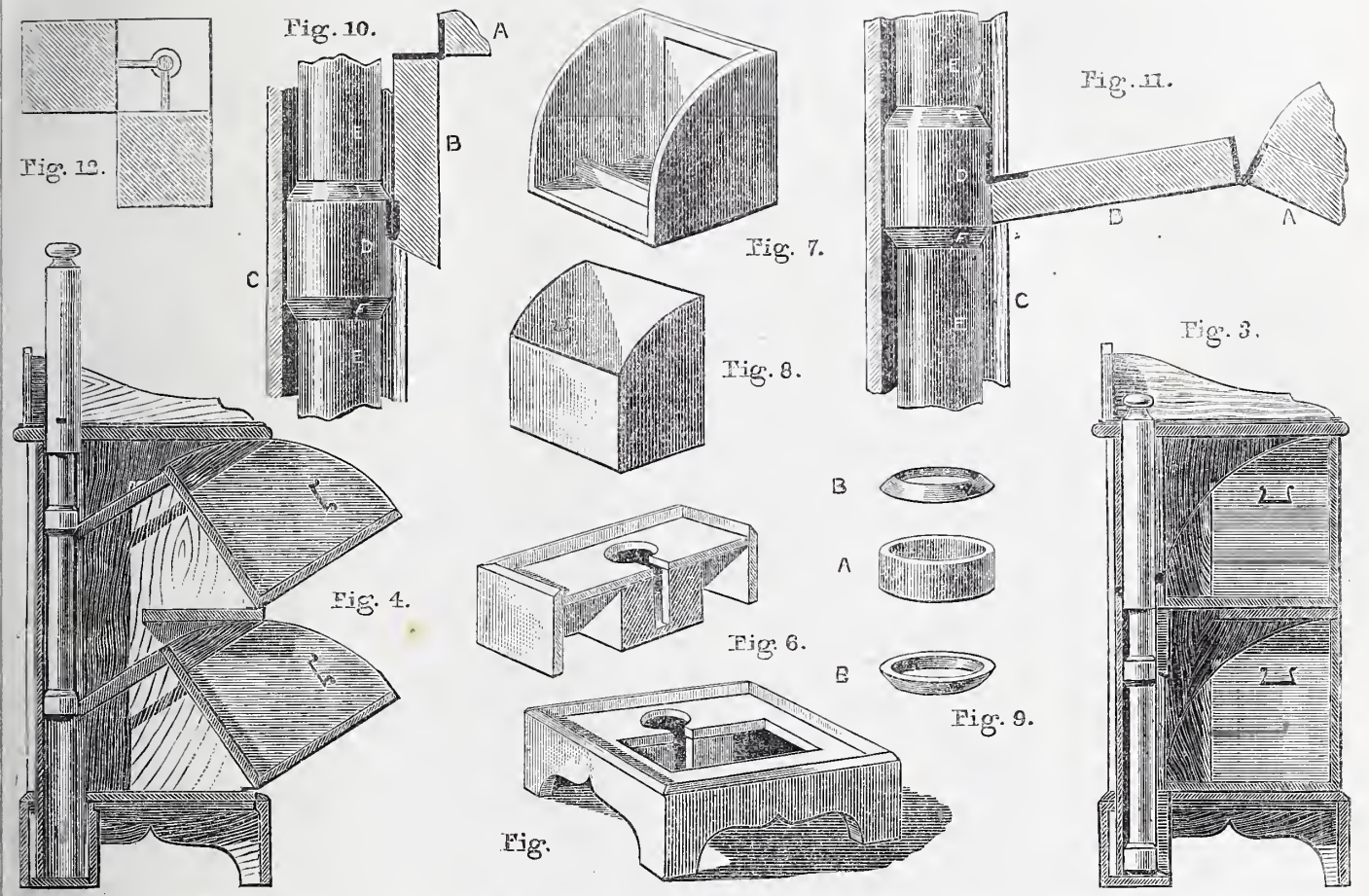


Fig. 3.—Section of Boxes closed. Fig. 4.—Section of Boxes open. Fig. 5.—Plinth. Fig. 6.—Back Part of Plinth, so made in order to receive Bottom End of Back Tube and Pillar. Fig. 7.—One of the Boxes. Fig. 8.—Metal Box to fit into Fig. 7. Fig. 9.—Rings (any thickness) to fit on to Pillar (Figs. 10 and 11). Figs. 10 and 11.—Diagram showing Pillar and Connecting Rod when Boxes are open and shut. Fig. 12.—Plan of Corner Box.

it turns black, then remove, and rinse thoroughly with clean water, afterwards drying it in sawdust and polishing the surface with blacklead.

CANOE BUILDING IN WOOD.

BY AN OLD OARSMAN.

STOCKS—KEEL—STEM AND STERN POSTS—PLANKING—GARBOARD STRAKE—MARKING PLACES OF TIMBERS—ROOVING-IRONS—RIVETING NAILS—FITTING AND NAILING TIMBERS—CROSS TIERS—DECK BEAMS—STRINGERS—STEP AND TRUNK FOR MAST.

THE first thing in proceeding to build a canoe is to make the stocks on which to build. The usual manner of doing this is to place a plank on edge, some 14 to 16 ft. long, 9 in. to 1 foot deep, and 2 in. thick. This must be fastened to the floor by struts, which are driven into the earth if the floor is unpaved, and screwed or nailed to the planks if of wooden flooring. The top edge of the stocks should be about 18 in. above the floor, as shown at Fig. 1; the keel formed of red pine, oak, mahogany, American elm, or other suitable wood, about 2½ in. deep, 2½ in. wide, and 12 ft. long, carefully selected, so as to be free from shakes and knots. This is cut away on each side until a section in the middle would be as in Fig. 2. It is worked in this shape to form a hold for the nails when the garboard strakes are nailed to it, as in Fig. 3. But a groove or rabbet should be cut into the keel on either side, as in Fig. 4, to let the edge of the garboard strake enter and get a firm hold in it. This rabbet is continued along the keel up both stem and stern posts. The keel, stem, and stern posts are fastened in two ways, as shown at Fig. 5: by making a long scarf and nailing them together with strong copper nails, or a wedge-shaped joint, as in Fig. 6, a small tenon being cut in the stem, which enters the keel, and prevents any inclination to twisting. The joint is covered by a piece of oak or other strong wood, which is nailed or screwed into both the stem or stern post and keel, forming a strong solid piece of work, fit to take the endless bumps and blows certain to be met with in a canoe journey. The keel and posts being fitted together, the keel is nailed with three nails to the upper edge of the plank or stocks, taking care that the posts are perfectly perpendicular (they can be tested by a bradawl being driven into the top of the post and a plumb-line attached to it), and they are kept in their places by pieces of wood nailed to them and any beams above or at the side, and a long straight piece of wood or plank, a couple of inches wide and an inch thick, is nailed to the top of stem and stern post, along the centre of the boat. This is also useful to hold the moulds in place, and enable any strut to rest against and thrust out a plank to any desired position.

In drawing the midship section of your canoe to the proper scale, arrange how many planks should be on each side; you make an exact mould or template of what the midship section will be when finished, and prick down its sides the width of each plank, and the same thing must be done on stem and stern post, also on any other moulds or sections fore or aft of the midship one. The next step is to cut out and prepare the planking, beginning with the garboard strake. The way is to mark the intended breadth in the middle and at either end, and then, having drawn a line graduating from the centre to the other end, you proceed to saw out the plank, and then surface it with the plane. Should your plank not be long enough, it should be cut out in two pieces and neatly scarfed by cutting in a scarfing machine, the nails being roughed on the *inside*, only the heads being *outside*. When finished, if this has been properly done, the plank will be quite as strong as if cut from a single piece of wood. After the garboard strake has been put on, the following planks are cut in a curve, by holding the plank to be cut against the edge of the garboard—or, better still, pinning it with bradawls to the mould, stem, and stern posts—and marking on it where the plank will be when nailed in place. The keel has the T form in which it is cut graduated fore and aft from amidships, the effect being that the form of the canoe fines or narrows as the floor springs; the garboard strake, from being nearly flat amidships, gradually rises on its outer edges until the two ends come flat against the stem and stern posts, and their ends, being nearly perpendicular (from the planks being twisted), the ends are chamfered off, so as to fit close and quite watertight into the rabbet or groove cut in the stem to receive them, when they are neatly and firmly nailed with copper nails about half an inch apart. The planks in most canoes are made of six cut stuff worked (if of spruce)—*i.e.*, a deal cut into six planks and then planed on both sides, the outside being finished with a smoothing plane. It is always better if the garboard strake is a little thicker than the other planks—say ⅛ in.—as, from being the bottom plank next the keel, it may have more rubbing and bumping, and so should be a little stronger than the rest of the skin. The garboard strakes having been fixed in their places, the edges on the outside of the plank should be chamfered off with a plane, so as to form the angle at which the next plank will be when nailed along the edge (as in Figs. 7 and 7A), and so on, plank after plank, to the upper strake. The first thing, when the garboard strakes are nailed or screwed to the keel, etc., the intended places of the timbers should be marked with chalk on the inside of the plank, and continued up to the gunwale as each plank is fixed in place. The most correct way of doing this is by taking a line and fixing it with a nail to the centre of the top of the stem, then, holding a piece of chalk between thumb and finger, and holding the line firmly in the hand, a mark is made on the planks on one side, and then, immediately opposite, on the other, then by shifting the hand along the line to the next place selected for the position of a timber. If this is done with care, the timbers will come into place exactly opposite each other and at the proper distances along the boat. In nailing the planks together, the nails are usually placed about two inches apart, and the holes for them having been made with a bradawl, the copper nails are driven through from the outside with a moderately heavy hammer, all being kept steady by holding a roughing-iron against it. There are various sizes of these roughing or rooving-irons used. They are steel-faced tools, about six inches long, having a flat end to hold against the plank, timber, or other part whilst driving a nail; and the other, or conical, end is furnished with a small hole large enough to admit the end of a nail, as in Fig. 8. This is for the purpose of driving on the roughs or rooves, which are put on as soon as the nails have been driven all along the plank. The roughs are small round or square pieces of copper, rather less in size than the top of an ordinary pencil, with a hole in the centre (see Fig. 9). In making this hole the metal rises in the centre like the holes in a pepper-box or nutmeg-grater. The nail having been driven home from the outside, a rough is placed on the point of the nail, the cup part on the point, and the roughing-iron being placed on it, the hole ready to receive the nail, and held with a firm pressure, a smart blow being at the same time given with the hammer on the head of the nail, the rough is forced along the nail close down to the plank. This done, the projecting part of the nail is seized with a pair of pincers and twisted off close above the rough, leaving an end somewhat rough and jagged. The roughing-iron is now held with its flat end against the head of the nail outside, and the hammer is used with a smart tapping action on the projecting rough end of the nail, riveting the end of the nail over the rough. This makes a remarkably strong holdfast as shown in Fig. 10. This roughing is so secure that it rarely gives. Sometimes nails are used without rooves, the end being cut off and turned down, as in Fig. 11.

The planks being now fitted and nailed or screwed in place, you proceed to fit and nail in the timbers. Great attention must be paid to the proper fitting of the timbers, as, if they do not fit correctly against the planks, they will be drawn out of shape, causing the outside of the canoe to look wavy and uneven, probably influencing her progress through the water, and causing her to steer badly.

To fit in the timbers, a piece of oak or other timber, about half an inch thick, is cut to the curve of the canoe side, and whilst it is held firmly against the planks, a pair of compasses, fixed with a screw at a distance of about half an inch to an inch from point to point, is drawn along the timber, one point resting against the plank, and the other marking a line along the timber at an exactly equal distance from the plank, showing the precise angles at which the timber must be cut to fit close to each plank.

It is usual to commence by placing the cross tiers or timbers which cross the keel, and fix or tie the first two or three planks on each side (Fig. 12). Before fixing, these cross timbers have a small piece cut out of them close on each side of the keel. This is done to let the water flow easily from end to end when the level of the canoe is altered by any one getting on board, or from any other cause. (See Figs. 12 and 13.) The rest of the timbers generally start from the centre of the garboard strake across all the planks up to the gunwale, being cut off at a slant, so that the deck may rest on them and thus have a support. A small piece of one corner of each timber is cut out next the plank (Fig. 14), so that when the canoe is turned upside down, any water in her may flow easily to the lower end, whichever may be in that position. To the tops of these timbers it is usual to attach the deck beams, by some termed carlines, but incorrectly so, as carlines are the fore and aft pieces which are fitted between the deck beams to support the deck fore and aft. These deck beams (Figs. 15 and 15A)—which are usually from forward and from aft of the well, with the longitudinal beams let into them, that part where the mast-hole comes being wider, to admit of the hole being cut, and to be stronger, so as to take the strain of the mast when under sail; the fore and aft beams which bound the well

are made of oak, and are deeper and stronger than the others, so that the inner edge may be chamfered away, to give room for one's legs when the feet are placed under the decks—must be perfectly shaped, as on them the deck comes and takes its shape. The curves must be correct, and so graduated that their centres can be touched all along by a straight edge from stem to well, and from aft side of well to stern post. The beams are nailed or screwed to the timbers, the nail or screw being driven from the upper side right down into the timber, and then another nail is driven from the outside of the gunwale into the beam (Fig. 16). The upper plank is strengthened by a stringer, which is a piece of thin planking about one inch and a half wide, running the whole length of the boat, being nailed along its upper side to the plank. This adds wonderfully to the strength of the canoe. To this stringer the deck is usually screwed or nailed. When this stringer is nailed in place and all the timbers secured, the bow and stern are strengthened by a fork or mast-hook made of oak (see Fig. 17), being screwed or nailed inside, abutting on the stem and stern post. This keeps the gunwale in shape at either end, and obviates the danger of the planks or deck being started by any sudden and severe shock, such as running against any barge, boat, or quay wall. When all is ready for the deck to be put on, the step for the mast must be put in place. This is made of oak or other suitable wood, cut to fit over the keelson and on the planks on each side, and is firmly nailed to the keel and garboard strake, a hole or step being cut in the centre for the lower end of the mast to enter and be held firmly when sailing, etc. (see Fig. 18). A trunk, made of wood or metal, down which the mast must pass, should be nailed or fixed firmly from deck beam to step. This prevents the mast getting out of the step and bursting up the deck, and possibly causing an upset, a danger which has occurred. This trunk should, in all cases, be square, and the edge on deck finished with a brass ferrule or plate, fixed by screws to the deck and under beams.

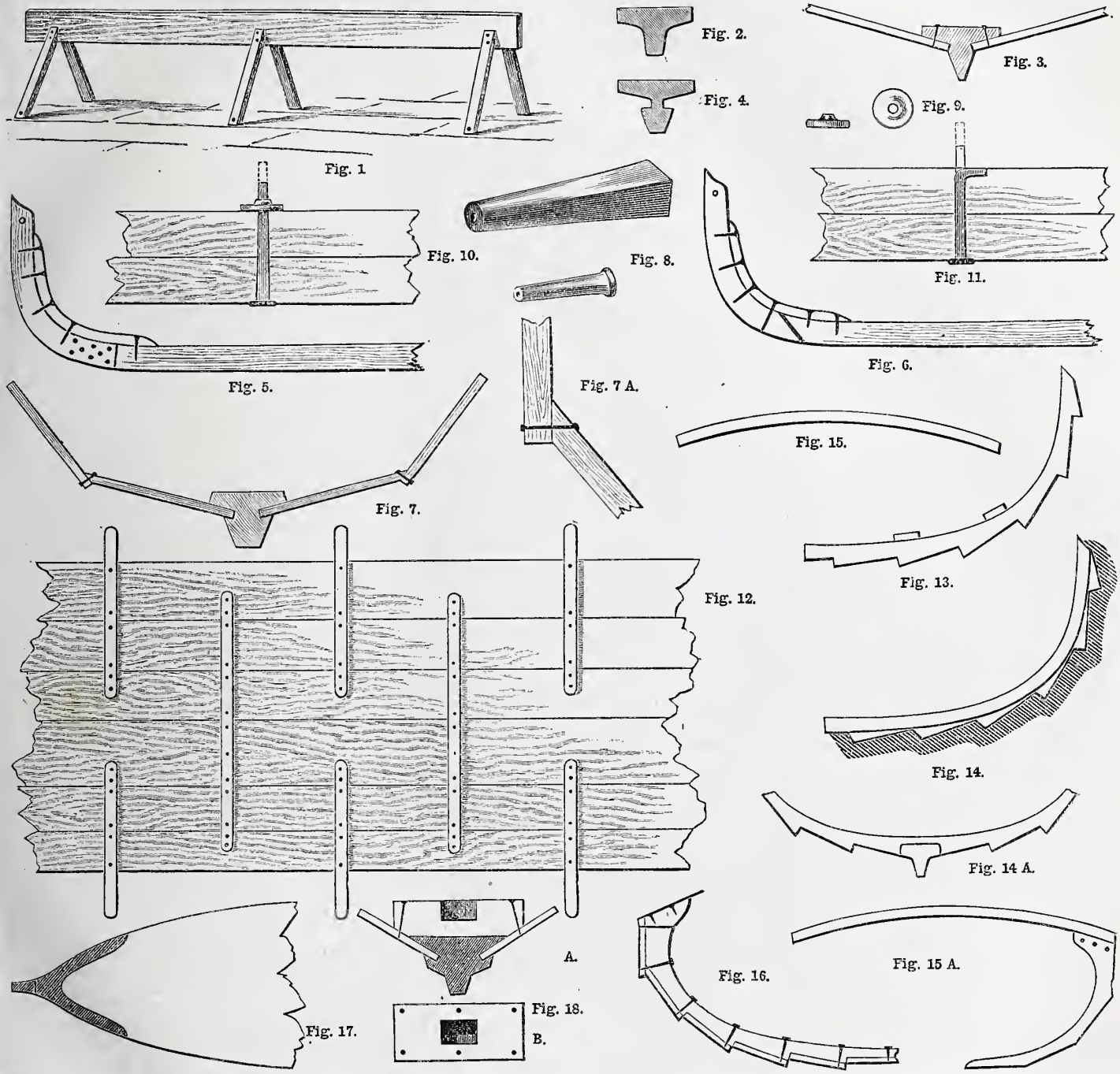


Fig. 1.—Stocks. Fig. 2.—Section of Keel. Fig. 3.—Garboard fixed to Keel. Fig. 4.—Rebate for Garboard. Fig. 5.—Scarf for Keel and Stem. Fig. 6.—Scarf or Sloping Joint for Keel and Stem. Fig. 7.—Chamfer at Edge of Planks. Fig. 7 A.—Chamfer of Plank on larger scale. Fig. 8.—Rooving-Iron or Anvil. Fig. 9.—Burr or Roove. Fig. 10.—Nail with Roove on. Fig. 11.—Nail without Roove. Fig. 12.—Diagram showing how Timbers and Ties should be put in Canoe. Fig. 13.—Timber shaped to Planks. Fig. 14.—Timber ready for Marking. Fig. 14 A.—Timber cut on each side of Keel for Drainage. Fig. 15.—Deck Beam. Fig. 15 A.—Deck Beam fastened to Top of Timber. Fig. 16.—Timber cut to fit Deck. Fig. 17.—Fork or Crutch at Stem. Fig. 18.—Step of Mast and how to fasten it, shown in Section (A) and Plan (B).

THE ART OF GRAINING.

PRACTICAL PAPERS ON PAINTED IMITATIONS OF WOODS.

BY A LONDON DECORATOR.

Graining Oak in Oil Colour.

In the preceding paper upon this subject I considered the necessary qualities of both "grounding paint" and "graining colour," and also briefly indicated the preparatory work required to new woodwork which is intended to be grained. The main working principle embodied in the art of graining—namely, the manipulation of a transparent graining colour over an opaque and solid surface of paint, whereby two distinct processes are used to obtain one complete colour-effect—was also therein explained to the reader; whilst the possession of good samples of the woods to be imitated was urged upon the student as a matter of the most primary importance.

The tools required for graining oak in oil colour were shown in the illustration accompanying the previous introductory paper. I do not purpose herein to occupy ourselves with the whole of the brushes represented in the above, lest the quantity and variety should confuse the learner, but prefer to make the student familiar with the tools as the occasion shall arise for their use. Assuming, therefore, that the practically inclined one has procured a good specimen of English oak, and also a suitable piece of painted deal or pine upon which to practise, we will turn back to the engraving of grainers' tools, and I will particularise those required for present needs, and further, briefly advise as to their size and cost.

A variety of *steel combs* is indispensable to graining oak, and these can be purchased either separately or in a set of different sizes and degrees of coarseness. They are sold singly, by the inch, in sizes from one to four inches in width, and are made with six, nine, twelve, and fifteen teeth to the inch. The sets, as usually retailed, consist of three combs of one, two, three, and four inches, and each size is made up by coarse, medium, and fine combs. They are retailed in a shut-up tin case at 3s. 6d. and 4s.; whilst 1½d. and 2d. per inch, in width, is charged for loose combs. As a good set of steel combs will last a lifetime, I advise the purchase of such in its entirety; where, however, the cost stands in the way, let the learner invest in four-inch combs of three varieties and a couple of small sizes. The second description of comb I have depicted is of leather; these also can be obtained in varying sizes and degrees of coarseness. India-rubber, gutta-percha, and even suitable pieces of cork, can be utilised for cutting graining combs; but, although all of these materials have special characteristics which an experienced grainer can readily turn to practical account, the learner is advised to content himself with machine-made steel combs and two or three coarse leather ones. These latter can be purchased at any large dealer's, and the price is about the same as for the steel kinds. Comb Fig. 3 takes a more familiar shape, and although not absolutely indispensable to graining oak, it is advisable to invest 4d. or 6d. in this article. They are purposely made for dividing the long hair of a thin overgrainer (Fig. 13), when charged with water colour, into separate fine divisions. Turning to the brushes, one of the most expensive of the grainer's tools, the *badger hair softener*—or "badger" it is usually termed—must be noticed. Like a good set of combs in the hands of a careful worker, this brush will also last, if not exactly one's lifetime, a great number of years. This is a serious item of expense, and one which cannot be substituted by a cheaper article. A 3½ or 4 in. badger of the *finest* quality costs from 12s. to 15s., and the cheapest reliable quality of a good maker's badger is marked from 6s. 6d. to 7s. 6d. for the above sizes. The latter sum should procure a sufficiently good article for his purpose if the learner is careful to purchase from a good firm, such as G. B. Kent & Co., Hamilton & Co., or Crowden & Garrod. One word of warning here: do not be tempted by a retailer of German rubbish into buying so-called badgers, the stocks of which are ebonised, and with a thin ornamental plate of white bone next the hair. These goods are sold at about half the cost of a good badger-brush. The hair in them, which is comparatively little, has scarcely any "spring," is of varying length, and they are practically useless for "softening" graining work. Whatever they are made for, there is one purpose they fulfil capitally—I personally recommend them to lady clients for dusting the *bric-à-brac* of their drawing-rooms. A couple of *overgrainers* of three or four inches in width, as shown with Figs. 13 and 15 in illustration (see page 40), will be a further very useful present investment; and a *thin hog-hair mottler* (Fig. 17), about two inches wide, will complete the equipment of graining brushes proper. The careful cultivation of the thumb-nail of the right hand has nowadays been substituted by a piece of thin bone of similar shape, termed a *thumb-piece* (Fig. 7). This, when covered by a piece of soft linen rag, is far more pleasant than one's nail to work with, and the "lights," as the cross-markings of the oak figure are called, can be wiped out as naturally and cleanly with the thumb-piece as by the earlier and more primitive method. The cost of the overgrainers will be from 1s. 6d. to 2s. each, the thickest kind (Fig. 15) being the most useful for oak. Fig. 17, the thin, or *chisel-edge mottler*, which will be very useful later on for graining mahogany and satin wood, will make a call for another 1s., or thereabouts. The "thumb-pieces" are made in several sizes, costing but 2d. or 3d. each. Besides grainers' tools, the student will require a brush to spread his oil graining colour. A medium size English paint tool will answer best for the practice-board; but a nicely worn-in paint brush and tool are necessary when any quantity of work has to be covered.

The mixing of "graining colour," and the nature and proportion of its constituent parts, will here require some consideration; and as this portion of my paper will bear equally upon mixing all shades and colours of graining paint, it requires the learner's careful attention and study. The pigments, or material colours, used with fluids in compounding oil graining colour are of a transparent or semi-transparent nature, the chief of which are known as *Terra-di-Sienna*, or *Raw Sienna*, *Burnt Sienna*, *Raw* and *Burnt Turkey Umber*, and *Vandyke Brown*. These colours are prepared, finely ground, in linseed oil, and can be purchased at any colour shop. Linseed oil and oil of turpentine are mixed with the pigments, and the addition of a drying agent—used in proportion to the natural drying qualities of the pigment and the circumstances of the work—completes the process.

The megilphing of oil graining colour is a matter here requiring some attention. Any person who knows the meaning of the word "graining" is also aware that the combs I have previously described are used for imitating the grain, or pores, of the wood. Now, to ensure that when the work is combed the effect thereby obtained shall be permanent, some means must be adopted to counteract the spreading nature of the linseed oil. Notwithstanding such a recommendation may be bad from a theoretical point of view, I may say that the action of a drying agent alone, used in excess of the amount required to *dry* the mixture, is sufficient for the purpose of megilphing graining colour. This is the plan adopted with the bulk of all ordinary and cheap oak graining. Thirty years ago, when a journeyman painter's wage was about a guinea a week, a couple of hours spent in mixing a pot of graining colour—preparing and dissolving beeswax, mixing lime-water, soft soap, or such like articles—was not considered "unnecessarily long"; but to-day the worker is expected to "knock it up" as quickly as a pot of white paint. Mr. Ruskin's tirade notwithstanding, there are still occasions when a thoroughly good and enduring piece of oak graining is demanded, such as may be required to stand for half a century, and in the execution of which neither pains, time, or material need be grudged. In such an instance the addition of a proper megilph is a decided advantage. No assistance would accrue to the student were I to detail herein the many different preparations which have been used for this purpose. That which is generally acknowledged to be most convenient and satisfactory is a preparation of beeswax. A few ounces of the genuine wax—not the paraffin-adulterated article—should be scraped into shreds and thoroughly dissolved and mixed, by the application of heat, in linseed oil. This quantity will be ample for five or six pounds of graining colour, or, as the mixture is more a fluid than of a solid nature, the subjoined *proportions* may be most conveniently stated:—Add to the dissolved beeswax one pint of each linseed oil and oil of turpentine, about one gill of "terebine"—liquid drier—and the pigments, ready-ground in oil, which are required to stain the mixture the desired colour. When wax is used for this purpose, the worker must take every care to thoroughly mix it with the fluid, otherwise, excess of wax on any portions may prevent it properly drying. It should always be remembered that the province of this substance is not to dry the mixture, but solely to make it more amenable to the dividing and wiping-out action of the combs. Patent, paste or liquid, drier must still be added for oxidising the linseed oil, and where Vandyke brown is used a *double* proportion of drier to that given above should be taken, since this pigment is a very slow—or, as it is termed, "bad"—drier. The best umbers, on the other hand, are good drying pigments, and require less drying agents, whilst the siennas require the full proportion I have given.

Graining colour for ordinary purposes is best made with about equal parts of oil and turps, one-eighth, of the whole bulk, of paste driers, and the addition of pigments; burnt umber usually suffices to obtain the desired depth and tone of colour. In a subsequent paper I hope to give instructions for mixing "grounds" and "graining paint" for every *colour and shade* of oak. The above are considerations applying chiefly to the *nature* and mixing of all oil graining paint; whilst, when describing the imitation of the many varieties of oak *colour* now in use, it will be necessary to notice more fully the pigments previously enumerated.

The reader being now, to an equal extent, familiar with the tools required and the preparation of the "ground" and "graining paints," we will turn our attention to a definite description of imitating the grain and figure.

To Grain Light or Wainscot Oak—a specimen of which, it is presumed, the student, as well as the writer, has before him—we require a light buff or cream-colour grounding paint. The only pigment necessary for staining our white lead paint to the desired tint is *yellow ochre*, ground in oil, sufficient of which is added to make the paint a *decided* cream colour. Some half a dozen distinct depths of light oak can be well imitated upon grounds made from white lead and yellow ochre alone; but beyond a certain range of colour, the ochre gives somewhat raw and crude effects. The best pigment for staining the graining mixture we are going to use over our light oak ground is *raw Turkey umber*. If the raw umber cannot conveniently be obtained, ordinary burnt umber will do. The former gives results nearer in colour to the new-looking oak, for which burnt umber is usually too "warm." Having prepared our colour according to the previous directions, and using plenty of driers therein instead of megilphing it, it is necessary now to well "work in" the paint tool we use for spreading—that is, by stirring and scraping across a knife, to get the colour properly into the brush. As our graining colour, if properly mixed, is scarcely thicker than a "wash," very little is necessary to cover the practice-board—which we will suppose is about 24 in. by 11 in. The tool is therefore well scraped out, and then our panel is spread. Care should be taken to rub the colour out comparatively *bare*, and the learner should rather try how little he can use of his colour to "rub in" the board, as it is termed, than *vice versâ*. Graining colour is always "laid off" the way of the grain, and it naturally follows that when a door is being covered the figure and grain should always be in keeping with the constructive divisions, and therefore such as we should find in a good solid oak door. Although careful and even spreading and proper "laying off" with the paint brush is sufficient for all ordinary work, it is often advisable to get the colour more perfectly distributed by finishing with the "stippling" process. As the student must *aim* at first-class work only, we will stipple the practice-board with the "badger," and obtain a coating free from any brush marks. But here, a few words of theory.

In all branches of imitative work, and notwithstanding *perfect* imitation is thereby implied, a certain degree of conventionalism is usually apparent even in the best examples. This is the case with graining, since a "master in the art" will often execute a grained door the *figure* and *arrangement* of which may exhibit more symmetry and balance in its entirety than many doors of the solid wood will show. There is no pretence of "teaching Dame Nature her business" thereby, but simply this: the grainer produces an imitation of that which, as he has learned by studying and copying the natural principles of the tree's growth, *may* be found in reality. The worker in wood, however, although he appreciates the beauty of its grain and figure, cannot sacrifice every other consideration to that, and use only those portions of a tree which will make an ideal door—hence, although perfect in construction, it may be, as suggested, inferior in some respects to the imitation. My reason for this digression is to impress upon the student that a solid oak door is not *always* the ideal to work up to, but that, whilst we are imitating, let such imitation contain as much beauty of growth and balance of parts as may be found in the best specimens. This will further explain matters should the learner fail to see the exact interpretation in his own specimen of my written instructions; the natural characteristics of both sources will, however, be identical.

To return to the practice-board, and which we will treat as a door panel, now ready for "combing" and "figuring." A little study of the real wood will show that there are two features to be copied: the grain which runs lengthways and the figure, or "lights" of oak, as it is termed, which crosses the former. A little more observation will teach us that the "grain" consists of an arrangement of dark pores of the wood, some finer and closer, and others long and coarse, and that where the figure is there are no dark pores, but a very fine grain, which seems to underlay the whole effect. A good panel of real oak will show according to its growth a coarse grain upon the one side, which graduates into a finer and then into the figured portion. To imitate this, we take a 3-in. coarse comb, preferably leather, and placing the edge against the left-hand side, draw it firmly once down the panel. A medium steel comb is then used next to that we have already wiped out, and this is carried about half-way across the width. If carefully done, we have now a graduated series of regular lines from which the graining colour has been drawn off. But this is not much like the grain at present. We now take a fine or medium wide steel comb, and starting at the same edge, we cut the lines into "pores," as it were, by either of two methods: we may draw the comb at a slight angle regularly across the coarse combing, or we may, and very successfully with practice, make the comb execute a cross, "wavy" action, and obtain a similar effect. Having cut the first combing up into pores, or grain—hence "graining"—we carry the fine combing across the panel, but keep it, upon the right-hand portion, quite subdued in effect. This completes the "grain," a few hints concerning which must be given here. Combing must always be cleanly and carefully done: the work must start right at the top and be carried quite to the bottom—simple enough on the practice-board, but not so easy on a moulding-framed panel. Wipe the combs, as they are used, in a piece of old rag, free from "fluff," and practise to get a full and regular pressure over the wide comb, which will ensure clean combing.

Now for the *figure*. We take a piece of old linen rag and double into several thicknesses; our thumb-piece is now put within it and then under our right hand thumb—projecting from it sufficiently to occupy the place of a long thumb-nail. With the left hand the ends of the rag are held away from the panel, and this also serves to steady and guide the right hand. Starting from the top, we wipe out the figure, putting in its coarsest markings and broadest lights nearest the right-hand edge of the panel, as it would be in reality. From this side the figure is imitated in varying degrees of coarseness, until its markings, gradually getting smaller and closer, are intermingled with the strong combing of the left-hand side of the panel. No attempt is here made to describe the figure, but rather to accentuate its chief points. The real oak panel or a nicely grained specimen alone can teach the growth of the "lights" of oak. To wipe them out naturally and cleanly is, I believe, the most difficult process the learner of graining must master. In manipulating the thumb-piece and rag, the broad top of the former enables us to take out the thick and "set" lights, and with the thin edge to make the small ones; whilst all the irregular veins of varying shape are made by a combined action of both. In a good panel of oak the strongest figure is never crowded, but nicely balanced throughout. When the figure is completed to this extent, we have to put in "half-tones" of colour, found between the veins. To effect this, a clean piece of rag is made into a pad about two inches long, and the graining colour surrounding the figure is carefully, but not cleanly, wiped or softened out. This process must never be worked close up to the "lights." The desired effect is this: by wiping away a portion of the colour to obtain a more transparent appearance, and whilst "softening" the figured part of the panel, we still further help the contrast of the clean-wiped lights by the shade portion surrounding it. It is only advisable to put "half-tones" between the most prominent "lights." Both in wiping out the lights and the half-tones, the surface of the rag is, of course, continually changed; clean wiping is very dependent upon *clean rag* as well as the practice of the worker. We now, finally, take the *thin hog-hair mottler*, and slightly soften off the veins with a downward touch; this, if successfully done, will give a delicate "woody" appearance to the "lights," and assist them by strengthening the under shadow. The work is now allowed to dry ere it receives the subsequent "overgraining" process. In my next paper I hope to "grain a door," and will endeavour to assist this subject by an illustration of working methods of graining oak in oil.

A SIMPLE WRITING CABINET.

BY R. F. HILL.

In the accompanying sketch will be seen a very effective, useful, and simple writing cabinet, suitable to stand on any side or occasional table. So simple, in fact, is the construction, that it is impossible for any amateur, reading instructions and carefully following sketches at the same time, to make any mistake.

The first thing will be to find out, or rather for me to tell you, how much wood and brass work will be required.

There will be, of course, four uprights, D, each to be $\frac{3}{4}$ in. square by 15 in. long. Four pieces for the doors and back, 15 in. by 10 in., $\frac{1}{2}$ in. stuff; two 15 in. by 5 in. for the side flaps of writing fall—these also to be $\frac{1}{2}$ in. thick. The bottom board, C, will be 1 in. stuff, 12 in. by 12 in. The top, B, 12 in. by 12 in.—this only $\frac{1}{4}$ in. thick. For the moulding, about 8 ft. 6 in. of 1 in., pattern as shown at A; that to go round front fall, as shown at Fig. 1, with $\frac{3}{8}$ in. astragal moulding. Then there will be wanted a board of 9 cut or $\frac{1}{8}$ in. full stuff; this will be for the stationery boxes, F, and pen rack, G, etc.

The brass work:—Five pairs of $1\frac{1}{4}$ in. butts, one small lever lock of the ordinary drawer pattern, two small flush bolts for the side doors, one catch and eye to fasten side flaps of writing fall when closed.

Having got, cut, and cleaned up to the

sizes given, you will be ready to start fitting and fixing same as follows :—

The bottom board, C, to be laid on the bench if you have one ; if not, wish you had. Don't let this discourage you—use the kitchen table ; it won't be the first time, no doubt, it has been used for a similar job. In my case it has been used more often than the bench, being minus that commodity myself. But this is not getting to work. The top, B, to be laid on this; the edges being got exactly square, fix them with two or three brads so that they shall not shift. Then take one of the uprights, D, and stand on one corner of boards, exactly quarter of an inch from either edge, as shown at H, and mark round with pencil. Having done this at all four corners, you will find there will be ten inches between each square, being the space required for doors, front fall, and back. Keep the top and bottom together ; bore with your $\frac{1}{4}$ in. bit a hole right through the two, exactly in the centre of each square, as shown at H. The uprights, D, will also require to have a hole bored in either end about $1\frac{1}{2}$ in. deep (with the same bit) to receive dowel pin; this should be slightly over the $\frac{1}{4}$ in. Having well glued dowels, force them into the holes in uprights, leaving about $1\frac{1}{2}$ in. out, as shown at E. While the glue is setting, take the top and bottom apart and well glue the holes in the latter, in which the dowels in uprights should be forced. The ends (about $\frac{1}{2}$ in.) that show through should be sawn off, and if dowels do not fit tightly, a wedge driven in before the glue has set will be the best thing. Treat the top, B, in exactly the same manner, putting three or so brads through into uprights to keep same square and strong, as there is a pretty good strain on them when the side doors are hung. Now take the piece selected for back, glue all round edges, fit in and fix through top and bottom with brads ; this when set will keep all secure for the next job—that is, cutting in and screwing butts on to doors, and side flaps for fall, the lock on top of front fall, and the flush bolts on side doors. The catch and eye can be left until everything else is fitted. The tray shown in Fig. 2, and again in the section as I, will be cut through to receive ink bottles (the shape depends whether you happen to have any by you, or on what you are able to get), and also to form a tray for pens, etc. This will be made from the 9 cut, and ought to be cut large enough that when fixed on the side doors shut against it. The stationery boxes, F, should be 5 in. wide, 2 in. deep back to front, and 8 in. high; this will be found a very convenient size for note paper, envelopes, cards, etc. This, like the pen rack, G, should be made of the 9 cut. The moulding on top will be mitred round, and glued on, thus forming a 1 in. gallery all round.

The bottom board, C, having the edges left exactly square, the moulding (same as that used at top) can be mitred round and glued on; a brad or two will not hurt in this case, as it is apt to get a knock now and again. The astragal moulding for the front fall should be cut and glued on about $1\frac{1}{2}$ in. from the edge all round. The side flaps having been hinged on to fall, if you are going to line same, you will have to run a slip of veneer $1\frac{1}{2}$ in. all round, thus leaving a sunk space deep enough to receive leather, plush, or whatever you may fancy. The stationery boxes being screwed on the side doors, these may be hinged on and the holes made for flush bolts. The screws for fixing front fall to bottom board should be as long (say $\frac{7}{8}$ in.) as you can get, and yet thin enough to go through holes in hinges. Having these, and fixed on same, cut in the hole and fitted on plate to receive catch of lock, your task (let's hope it has been a pleasant, and not a weary one) is done.

In commencing my paper, some of my readers doubtless noticed that I made no mention of the sort of wood to be used. Mine is in American whitewood enamelled, as this one was really an experiment that, for a wonder, turned out a success. But should I ever make another, it would be in American walnut, this being a wood that always does you justice, if you take a little trouble in the finishing. Nevertheless, in materials there is always great scope for choice, and it may be desirable to make choice of a wood which would harmonise either with the material or colour of the surroundings. Another effective mode of treatment would be to overlay the front panel and the sides and back with fretwork cut in thin wood, either in the same or a different wood. This would impart the effect of carved or iniaid work with little trouble. Again, the surface ornamentation known as "chip carving" might be applied with good effect to the enrichment of the cabinet, or the front and sides might be painted with light and pretty floral designs in the Japanese style.

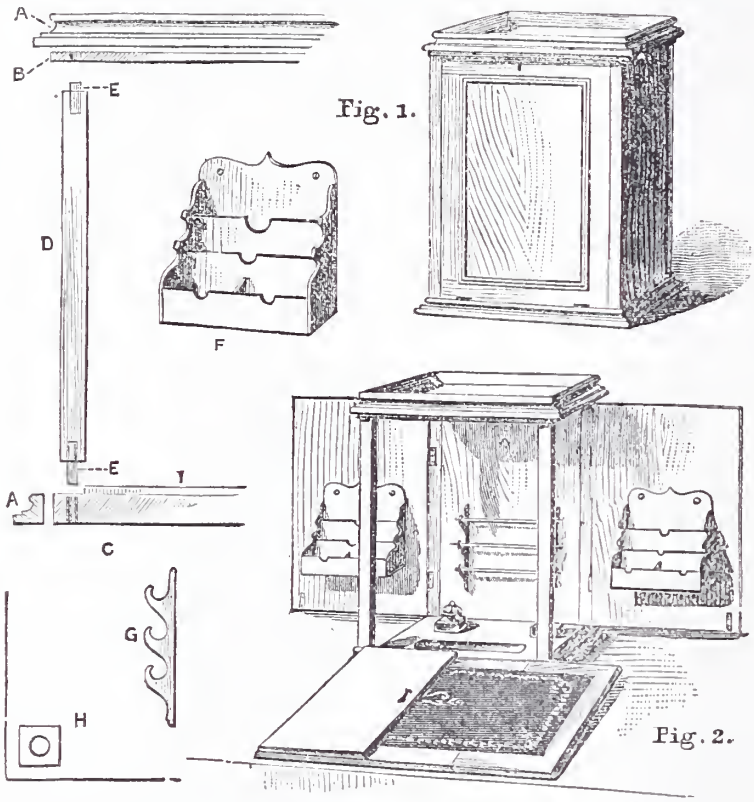


Fig. 1.—Simple Writing Cabinet, closed. Fig. 2.—Cabinet open—A, Moulding ; B, Top Board ; C, Bottom Board ; D, Upright ; E, Dowel Pin ; F, Stationery Box ; G, Pen Rack ; H, Plan of Sockets for Dowel Pins.

A NOVEL USE FOR JAPANESE FANS.

BY OMADAUN.

From the straw bottle-cover upwards there is nothing which in these days is too insignificant to be adorned with art draperies or enamel paint, and so utilised for wall decorations, and we can almost imagine the disgust of the old family china when it finds itself in such company, and can fancy the willow pattern plate casting a contemptuous glance at the wooden spoon which it finds at its side, gaily decked with ribbons, and give an involuntary shudder.

But the Japanese fan stands higher in the social scale of art decoration, and could hardly be objected to by even the most fastidious piece of old Dresden ; it is in itself always a pretty and effective decoration, and the addition of a bracket, upon which a vase or other small ornament can be placed, adds greatly to its artistic effect, and is, moreover, a novelty, I think.

The general effect of these Japanese fan-brackets, as they may be called, will be seen from the sketches given. Almost any of the flat fans (not the folding ones) may be used, though some adapt themselves for the purpose more readily than others ; and there is such a very large choice, that individual taste must be left to decide upon a suitable pattern and design.

Fig. 1 is an ordinary fan having a cream or white ground, and the shaded part being either in red or blue. The bird was not painted on this fan, but stuck on separately, so that with a little care it could be removed and was replaced to suit the position of the bracket.

Fig. 2 shows another pattern often seen. A small bracket can be placed as shown, and adds greatly to its effect.

Fig. 3, having a suitable design, was utilised as a frame for a carte de visite photograph as well as for a bracket, and when done had a very pretty effect. This fan had a pale blue ground, the design was executed chiefly in black and white, which was lightened with a little water-colour paint, the apple blossom being touched up with pink and gold given to the centres, the bird also being touched up with the same colours, a little gold being given to the wings and head, and the tail painted red instead of black. The gold used was ordinary leaf, being put on with gold size ; but bronze powder would no doubt answer the purpose, though it would not perhaps look as bright. A suitable vase for bracket on Fig. 3 is shown at Fig. 3A, which for economy of space is placed within the containing lines of Fig. 6.

In Fig. 4 a suggestion is given for the arrangement of two brackets on one fan, which in that case would have to be rather larger than the single ones, and the back should be a little stouter, so as to admit of larger and heavier ornaments being used.

With these suggestions any one will be able, I think, to select a suitable fan to work upon ; so we will now proceed to the construction.

A piece of thin wood (the backing used for picture-frames will do, though it is best to have it a little stouter) must first be cut out the size and shape of the fan it is intended to use. This back must be covered with some plain white or coloured paper, which can be done best with a little paste and glue mixed; but ordinary paste will do, and care must be taken to cover the edge—that is to say, the paper must be cut larger than the wood, and turned over the edge all round. The back is then firmly glued to the fan, and the whole placed under pressure so as to get well set. We can now proceed to make our bracket. This may be of any suitable size or shape, and should be of about ¼ in. in thickness, or rather less, as they must not be made too heavy; but the thickness will of course vary with the size. The shelf and support of the bracket must be either glued or fixed together by fine gimp-pins, and the whole painted to suit the colour of the fan upon which it is to be placed. When the paint and glue have set, the bracket can be fixed in its place. This is easily done by means of three or four fine gimp-pins put in from the back, and through the fan. The position in which

Fig. 1.—Plain Fan with Bracket affixed.

the bracket should be placed will depend very much upon the shape and design of the fan used. If it has no definite design upon it (as in Figs. 1 and 4), it is not very material where the bracket is placed; but in Fig. 3, for instance, the obvious place is at the foot of the tree, as shown in the sketch. The bracket having been fixed in the position decided upon, we have only to provide a means of hanging it up, and our task is completed. For this purpose we cannot do better than screw into the edge of the back two small rings such as are used for hanging up pictures, and here will be seen the advantage of having the back made sufficiently stout to admit of this being done without splitting. The two rings must be screwed in such a position that when hung up the *bracket* may be level, although the fan may not hang perpendicular, as in Figs. 1, 2, and 4.

We have now finished our work so far as a simple bracket is concerned; but if we can find a fan suitable, and desire to utilise it as a photograph-frame (as shown in Fig. 3), we must treat it a little differently. The position of the photograph having been decided upon, the first thing to do will be to cut a piece out of the fan so as to form a mount; this must be carefully done with a sharp penknife. In the fan shown in Fig. 3 an oval was cut, as adapting itself best to the design; but if the design admits of it, any other shaped mount might be cut.

Having done this, a back (of thin wood) must be made as before stated; but there must be a piece cut out of this to allow of the insertion of the photograph. Figs. 5 and 6 will show how this should be done—Fig. 5 being the fan, and Fig. 6 the back.

Fig. 3. — Fan and Bracket, also used for Carte de Visite Photograph.

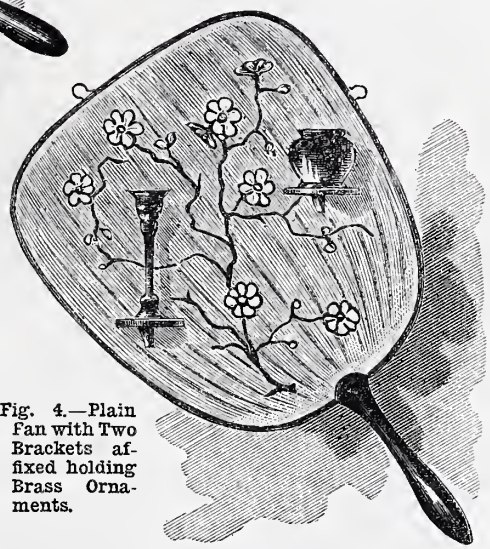


Fig. 4.—Plain Fan with Two Brackets affixed holding Brass Ornaments.

The piece cut out is shown at A, so that when placed at the back of Fig. 5, a rebate is formed (as shown by the dotted lines in Fig. 5), in which a photograph and glass can be fixed in the ordinary way.

The back is now ready to be covered and glued to the fan, and the bracket is fixed in the same way as before directed. The edge of the mount must be gilt—either by using gilt paper, or a little gold-leaf or powder.

The fans can be touched up, if it be

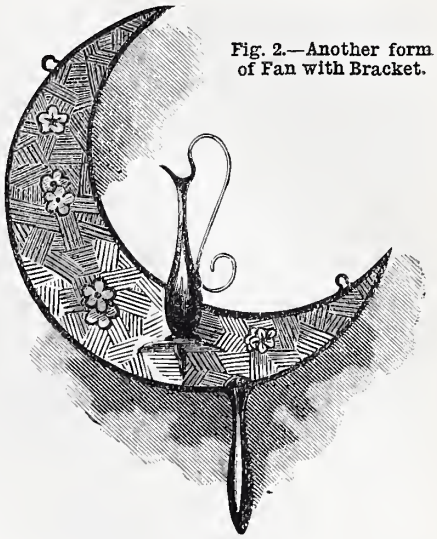


Fig. 2.—Another form of Fan with Bracket.

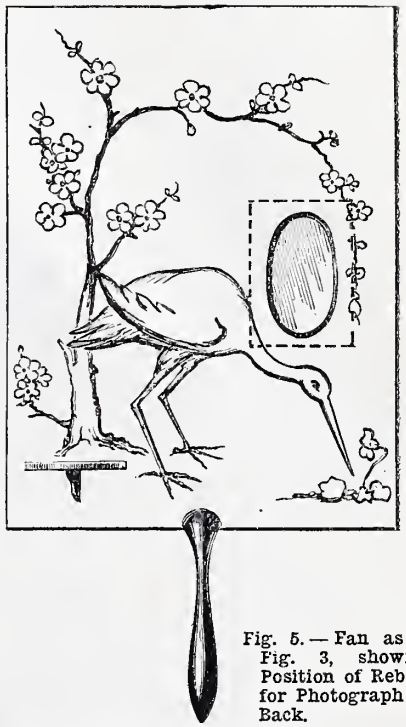


Fig. 5. — Fan as in Fig. 3, showing Position of Rebate for Photograph in Back.

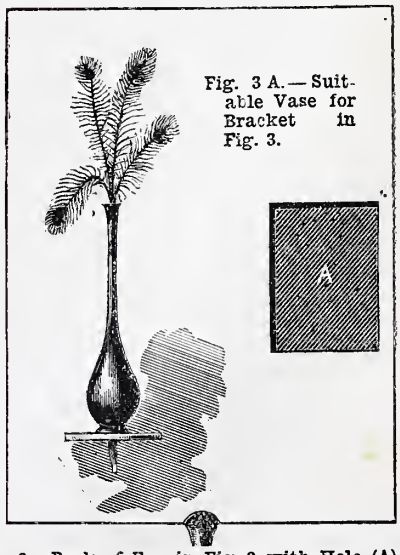


Fig. 3 A.— Suitable Vase for Bracket in Fig. 3.

Fig. 6.—Back of Fan in Fig. 3, with Hole (A) for Photo.

thought necessary, with a little water-colour paint; but this must be done carefully, as it is rather apt to run.

The sketches are given only as guides to those who may wish to make some of these little articles, and with the number of different fans now obtainable can be varied to an almost unlimited extent.

And now we have finished our work. Our little bracket is not very pretentious, but it has the merit of simplicity, and forms a very pleasing little decoration. It is easily made, and will amply repay the worker for the little time expended. The sketches shown in Figs. 1 and 3 have been taken from some which the writer has made himself, very successfully; and if any reader should find a difficulty in following these directions, he will be pleased to render any assistance in his power through the columns of "Shop."

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

8.—Hand Power Mortising and Boring Machine.

In building, cabinet making, joinery, etc., the old plan of cutting mortises with a mallet and chisel has been almost entirely abandoned in favour of hand or steam power machines. In Fig. 1 a representation is given of a very powerful Hand Power Mortising and Boring Machine, designed and constructed by Messrs. M. Powis Bale & Co., the well-known saw-mill engineers, of Appold Street, Finsbury, London, E.C., of which I am told that a very great number—amounting, in fact, to thousands—have been sold since its first introduction. The operation of the machine, which is made entirely of iron and steel, will be readily understood from Fig. 1. A reciprocating motion is communicated to the chisel through the medium of the hand lever, which is attached to the chisel spindle by means of links and a cross-head, and to the standard of the machine by a pin. The standard is slotted at the back, and, by slackening a nut, can be raised or lowered to suit the depth of the wood to be mortised. The wood is secured by means of a cramp on a compound table, which is arranged with horizontal and transverse movements, effected by the agency of a rack and pinion worked by the large hand wheel, and by a screw and nut worked by the smaller wheel. By this arrangement the wood can be brought under the action of the chisel at any desired point. It is claimed for the machine that, with ordinary attention, it is impossible to make a mortise out of truth. In fixing the chisel to start work, it should be pressed lightly up into its socket as near square as can be judged, and a light cut made; then reverse the chisel, and see that it falls exactly between the gauge strokes. If it does not do so at the first essay, it must be adjusted until it does. For wedging, it is simply necessary to raise one end of the wood and make the wedge cut before removing the wood from the machine. For boring, the chisel is replaced by an auger, to which a rotary motion is given by a pair of bevel wheels worked by the handle shown in the illustration.

9.—Handy Mitreing Machine.

In Fig. 2 is represented a handy mitreing machine, also manufactured and sold by Messrs. M. Powis Bale & Co. Its action will be readily understood from the illustration, and therefore no lengthened explanation need be given. It is a machine of what may be termed the "guillotine" class, and will cut mitres in wood up to 3 in. in width by $2\frac{1}{2}$ in. in depth.

10.—Some More Useful Books.

Lockwood's Builders' Price Book for 1890.—This is a new and most carefully prepared edition of a well-known and highly-valued price book designed for the use of builders, architects, contractors, and engineers, and forming a comprehensive handbook of the latest prices of every kind of material and labour in trades connected with building. This edition for 1890 has been rewritten in great part, remodelled, and considerably enlarged, and has been edited by Mr. Francis T. W. Miller, Associate of the Royal Institute of British Architects. It is published by Messrs. Crosby Lockwood & Co., and containing, as it does, 600 crown 8vo pages, supplied free by post for 4s., it must be regarded as a very cheap book. Its varied contents have been brought up to date throughout, and much useful information has been supplied with reference to electric lighting, ventilation, and sanitary appliances, with recent improved methods of construction and every special feature of modern building. It is claimed, as a manifest proof of its utility and importance to those engaged in the building trades, that every price given has been carefully and thoroughly revised, those for measured work having been calculated entirely afresh. The tables and memoranda relating to each trade will be found most useful, and in the Appendix are given the principal provisions of Acts of Parliament relating to building and sanitary matters, and the various rules and regulations issued by the London County Council, the Corporation of the City of London, and other public bodies. As a reference book in all cases of legal disputes, no book, perhaps, will be found so useful as this.

Reid's Patent Indexed Ready Reckoner.—This is a very handy and useful form of ready reckoner, showing the value of 1 to 50,000 articles at any given rate from $\frac{1}{16}$d. to £1, published by Messrs. Andrew Reid Sons & Co., Newcastle-upon-Tyne. Its value—and I think I may say its uniqueness—lies in the fact that its margin is graduated after the manner of a ledger index, so that any one who has occasion to make use of it can open the book at once at the table dealing with the price he requires, without the trouble and annoyance of turning over page after page in vain. Nothing can be better calculated for constant use on the tradesman's desk.

Turning Lathes.—This useful and well-written manual, well suited for technical schools and apprentices, and forming an excellent and handy guide to turning, screw cutting, metal spinning, etc., has now reached its third edition, and the publishers—the Britannia Company, Colchester—have been so encouraged by the favourable reception of the first and second editions that they have caused this, the third edition, to consist of 6,000 volumes. It is edited by the Rev. James Lukin, B.A. As I have already noticed its contents in WORK, I need only add that the work is now rendered all the more complete by the addition of a very complete list of engineers' tools.

Trade Catalogues and Price Lists.—I have to acknowledge the receipt of Tylar's "Practical Hints and Photographic Calendar, 1890," published by Mr. W. Tylar, 57, High Street, Aston, Birmingham, post free, 4d., a most useful hand book and *vade mecum* for all who are interested in photography; and the Trade Catalogue of Messrs. H. Binko & Co., Electric Light and Telegraph Engineers, 34, Leadenhall Street, London, E.C., which is equally desirable as a guide and price list for all who are interested in electric lighting and locomotion and telegraphy.

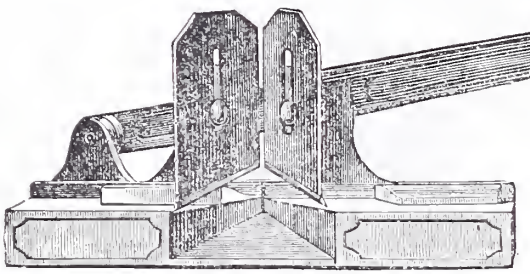


Fig. 2.—Mitreing Machine.

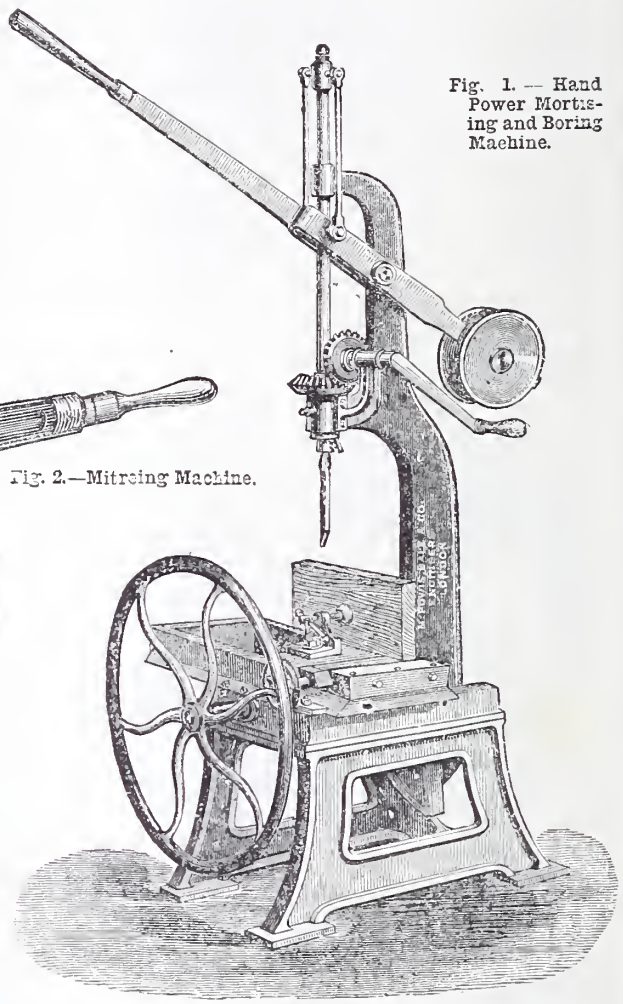


Fig. 1.—Hand Power Mortising and Boring Machine.

11.—Walker's Turning Patterns—Second Series.

I have very much pleasure in calling attention to the Second Series of Turning Patterns that have been issued by Mr. F. J. Walker, 41, St. Helen's Street, Ipswich. The Series, price 1s. 7d., post free, comprises four sheets and about thirty designs of different kinds, such as knobs for drawers, candlesticks, vases, tazzas, twine boxes, etc. Among them I may specially mention a series of spice boxes of pyramidal form, so to speak, in which each box, excepting the topmost one of the set, forms the cover of, and fits into, the one immediately below it. Any young turner who wishes to have some really good patterns at his command cannot do better than purchase Walker's Turning Patterns.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

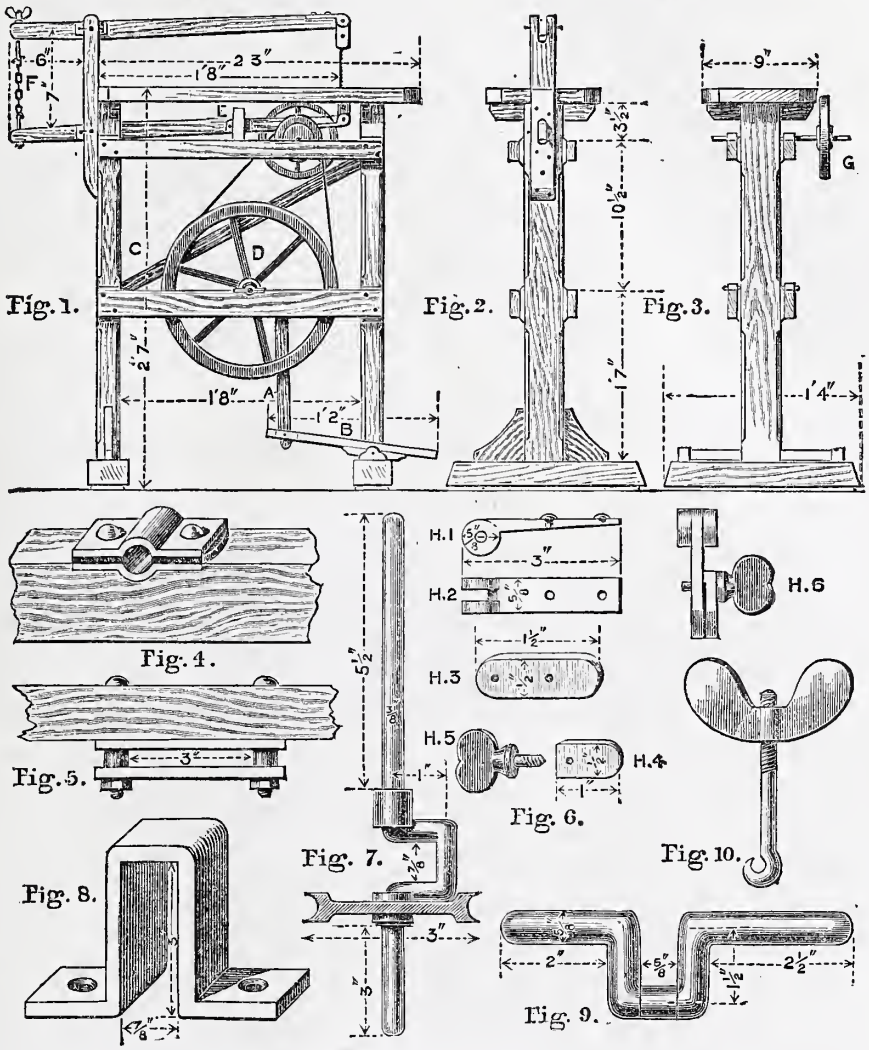
*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

TO OUR READERS.

In consequence of the very heavy demand upon the "Shop" columns of Work, *and* in order to accelerate as far as possible the speedier publication of answers to questions in "Shop," *the publishers of* Work *have decided to issue periodically,* and free of charge, *to our subscribers a Four-page Supplement, devoted entirely to "Shop." The first of these supplements is given with the present number.*

I.—Letters from Correspondents.

Fret Machine.—North Jack writes:—"I send a few rough drawings of a fret-sawing machine, hoping they will be of use to some of the readers of Work. I think Fig. 1 will be understood. At A is shown spear rod; B, treadle; C, diagonal stay; D, driving wheel; E, guide; F, tension chain. Fig. 2 will explain itself. Fig. 3 is the end at which the sawyer sits and works the treadle with both feet; G is fly wheel, to be placed on right side: it is handy to start machine going, and should be about 2 lb. in weight. Fig. 4 illustrates bearings for top and bottom cranks: may be made of sheet brass, cut to the width first and then bent to the required shape and size in vice and between blocks of wood, and may be put on the machine with stout screws, or, better still, small bolts, with pieces of leather between them to allow for reducing when journals wear too small. Fig. 5 is the top crank slide, to be bolted under side bottom arm; it may either be made of iron or brass, with two short pieces of tube to hold them to the distance to suit thickness of crank pin. Fig. 6 shows parts of clamps for holding saws: the top part is shown in H 1 and H 2, the long jaw in H 3, the short jaw in H 4, the thumb screw in H 5; the end view of clamp complete is shown in drawing H 6; two of these clamps will be required. I should advise those that require them to buy a pair ready-made from any of the fretwork importers advertised in Work. Fig. 7 shows top crank with section of small pulley, also showing a piece of tube to serve the purpose of collar to prevent shaft from playing sideways. On the long end a fly wheel, as shown at G, Fig. 3, which will serve to throw crank over centre. Fig. 8 represents a guide for bottom arm to run in, to keep it on crank when in motion. Two brass plates to be let in each side of bottom arm, to run in slide, as shown at E, Fig. 1. The crank is shown in drawing, Fig. 9, to carry a 12-in. driving wheel, and to be made of ⅜ in. iron. Fig. 10 is a thumb screw for giving the proper tension to saw when in working order. The whole of the timber work of frame I sized and stained walnut colour. If there is anything which cannot be understood, I shall only be too pleased to explain through 'Shop.' The following is a list of timber required to construct the machine:—2 deals, 2 ft. 8 in. long, 2¾ in. wide, 2 in. thick, for uprights; 2 deals, 1 ft. 4 in. long, 2¾ in. wide, 2 in. thick, for feet; 1 pine, 2 ft. long, 9 in. wide, 1 in. thick, for table-board; 2 oaks, 1 ft. 8 in. long, 2 in. wide, ⅞ in. thick, for driving-wheel bearers; 2 oaks, 1 ft. 8 in. long, 1½ in. wide, ⅞ in. thick, for fly-wheel bearers; 2 oaks, 2 ft. 2 in. long, 1½ in. wide, ⅞ in. thick, for arms; 1 oak, 1 ft. 2 in. long, 2½ in. wide, 1 in. thick, for arm piece; 1 oak, 1 ft. 11 in. long, 1 in. wide, ¾ in. thick, for diagonal stay; 4 oaks, 4 in. long, 2 in. wide, ½ in. thick, liners for bearers; 4 oaks, 3½ in. long, 2 in. wide, ½ in thick, liners for top bearers; 2 oaks, 1 ft. 2 in. long, 5 in. wide, 1 in. thick, for treadles; 2 oaks, 9 in. long, 2 in. wide, ¾ in. thick, for table supports."



Fret-Saw Machine and Parts.

II.—Questions Answered by Editor and Staff.

Brazing Bicycle Frames.—L. W. (*Manchester*). The most economical method of brazing bicycle frame is with charcoal fire. The blowpipe makes a cleaner job but requires to be large, and have a good force of gas, not less than ½ in. pipe inside diameter. I always use the charcoal fire with a small fan and foot lever for driving it. Borax and spelter, or soft brass wire, or both, are all the materials required for brazing. Bend bits of brass wire about ⅛ in. thick round the joints to be brazed; put some spelter inside the tube along with some moistened borax, letting them run down the tube to the place wanted; heat the joint over the clear fire for a little, then apply some of the moistened borax round it at the wire; then place the job on the centre of the fire and keep up a steady blast, and apply now and then a little *dry* borax to the joint, and keep a piece of wood burning on top, allowing the flame of the wood to descend on to the wired joint. When the metal gets up to a red heat, the wire will dissolve, also the spelter inside. When this takes place remove gently from the fire, throw on a little more borax, afterwards some common salt, and scrape off any cinder or scale with a bit of iron, then leave it aside to cool. If there are any bored holes or screwed holes near the joints to be brazed, fill them with clay; this will preserve them uninjured by the fire. I am not aware of any work on brazing large work such as bicycles.—A. S. P.

Model Making and Tools.—J. W. R. (*Cockermouth*).—(1) Taking your questions *seriatim*, you can begin with a very few tools, because you can commence with very elementary tasks. As you develop skill you will find your tools increase, without involving any great single outlay. Model work involves the use of both wood and metal, and therefore tools suitable for each. I will enumerate some of the principal, which you can get one after the other, as you choose: a work bench; and for your lathe, prong and face chucks for wood, point centres, and a slotted face chuck or a dog chuck for metal, and drill chucks; to which you may add a cone plate, an angle plate, and an emery wheel or two; then you will get a few turning tools both for wood and for metal, some drills, and some files; you will want a vice, a cold chisel, a hack saw, a square, callipers, a bevel, scribing block, a scrape, and emery powder and cloth. Then there will be taps and dies, besides a few common wood-worker's tools. (2) To describe the making of a single action oscillating cylinder with its pattern, casting, boring, and fitting would require an article. You might take a hint or two from the cylinder drawn by F. A. M. in the copy of Work for November 30th, and you can get Pocock's "Model Engine Making," but I would attempt something better if I were you, say a model of an actual slide valve engine. (3) You can get a screw plate and taps suitable for model work for four or five shillings, but die stocks with movable dies are more expensive, and the cheapest would be scarcely less than a sovereign. Drill chucks will cost from half a sovereign to five pounds each; for these you can consult the catalogues. (4) If you mean rods of iron and brass of ⅛ in. or ¼ in. diameter, you can make a little carrier for such out of a small nut blank, or small metal collar, by drilling a hole on one side and tapping a pinching screw in, but if you mean disc-shaped pieces, these must be variously clamped according to shape in the dog chuck or in the dogs of a slotted face plate.—J.

Metal Castings.—W. D. (*London, N.W.*)—Founders in various white metals are, Osborne & Co., 11, Great Gordon Street, London, E.—J.

Typewriter Ink.—Typewriter.—I am not acquainted with the preparation of the ink used on typewriting ribbons. It is kept a close secret by the manufacturers. If you find the dyes you name are not permanent, but that your experiments are otherwise successful, why not use a carbon instead of an aniline pigment? I fancy you would find gas black durable enough.—D. A.

Staining.—Musician (*Laisterdyke*).—You cannot do better than use a stain composed of Vandyke brown, ammonia, and water to make your American white-wood walnut colour. Mix the brown with sufficient liquid ammonia to form a thin plate paste, then add water to liquefy.—D. D.

Gold Bevel-Edged Mounts and Cards.—C. T. D. (*Sheffield*).—The bevel edge on these cards is done by special machinery, and requires a special stamp and die for every shape. Nearly the whole of this work is done in France and Germany, and the English manufacturer cannot compete with his foreign rivals neither as to quality or price. Gilding the edges with gold leaf is a tedious process, and requires much practice and skill. Surely C. T. D. does not think of going in for home manufacture in these goods, he can always buy them in the finished state much cheaper. Gold blocking for window-ticket purposes, both in letters and figures, is done by Surflen & Clarke, 3, Bucknall Street, Oxford Street, W.C., who may also supply machines, steam and hand. For machines, tools, and brass letters apply to Kampe & Co., 78, High Holborn, W.C.; or Knight & Cotterill, 9 and 10, St. Bride's Avenue, Fleet Street, E.C.; and for embossing presses to Baddeley & Reynolds, 19 and 20, Old Bailey, E.C.—H. L. B.

Tempering Steel.—Blacksmith (*Liverpool*).—Get your steel to a low red heat, and quench it in water; then bring it to a purple colour and quench it finally in water. The first operation hardens, the second tempers, but the details of the process and the different shades of purple will vary with the size of the tool, its purpose, and the quality of the steel; and much of this can only be learned by experience. In by far the majority of cutting tools the cutting points only require to be hardened, the body being better if left soft. In all such cases the precise method adopted is as follows:—Say it is a cold chisel or a drill. At a low red heat the cutting point only will be plunged into water to harden it; on its removal, the tool being still held in the tongs, the smith observes the gradual change of colour in the point caused by the transmission of heat thereto from the shank. The latter not having been quenched, retains sufficient heat in its body to raise the temperature of the point to the precise shade of purple or straw required. Then the point is quenched again. If the shank still retains excessive heat the process may be repeated a second time, but usually in tools of moderate size the entire work is

plunged beneath the water. Now there are two or three cardinal points, little matters some would deem them, which affect results very materially. All scale left from the forge should be filed or ground off before hardening. Also, in taking a tool from the fire the slight film of oxide which then appears should be rubbed off with a bit of stone, and the point wiped with a bit of waste, so that the rapidly changing colours may be readily apparent. Also cutting tools should be plunged vertically, never diagonally, into the water. The steel should never be overheated, excessive heat will burn and spoil it. The fire used should be clear, and in small work it is better to make use of the heat of an iron bar, first made red hot in the fire; the temperature imported by this to the tools when laid upon it is more readily observed, and more under control than that of the fire, and is less injurious to small tools than the sulphurous fire.—J.

Small Wheels for Engines.—W. D. (*Scaforth*).—I suppose you mean fly wheels. If so, you can get them of any model maker, as Bateman, or Lee, both of High Holborn; Mills, of Sunderland; Stiffin, who advertises in WORK, and several others.—J.

Rubber Stamps.—W. D. (*Scaforth*).—You will have seen that an exhaustive paper on "India-rubber Stamp Making" appeared in No. 38 of WORK. The first step will be to fix the letters composing the name, or whatever it may be, in a small iron frame. By means of a soft brush, the type, as well as all the surrounding parts, should be well oiled. Then mix some plaster of Paris to a consistency of pap, and pour it over the type, and, with a stout brush, drive the plaster into all intricate spaces and interstices, until all details are thoroughly covered. After this the remaining plaster is poured in, until the frame is filled. In a short time the plaster will be sufficiently hardened to be removed from the mould. The plaster should then be baked in an oven for a period of from four to six hours. When taken out, give it a coat of shellac, to impart smoothness and strength. Then masticate pure indiarubber with from five to ten per cent. of sulphur, and place over the plaster cast. But as the caoutchouc has a tendency to return to its previous shape, it must be subjected to another process. The caoutchouc being pressed on the plaster should be subjected to a heat of from 250° to 260° Fahrenheit, for about half an hour. Remove it from the plaster and it will retain the impression, and be ready for use.—J.

Glasses of Telescopes.—A. C. (*Edinburgh*).—I can see no objection to your attempting to make the little Galilean telescope—for that is what it amounts to—and I will answer your questions *seriatim*. The principle of construction is, as you suggest, a double concave lens and a concave eye glass; but the best result would be obtained with a convexo-plane object glass and a concavo-plane eye glass, placed apart at a distance equal to the difference of their focal lengths. The magnifying power can be approximately ascertained by dividing the focal length of the eye glass into that of the object glass. Thus, if the object glass be of 4 in. focus, and the eye lens of 1 in., the power will be $\frac{4}{1} = 4$; or, with an eye lens of ½ in. focus, $\frac{4}{\frac{1}{2}} = 8$. This will enable you to decide for yourself what combination of lenses will give you, taking all your desires into consideration, the greatest power. The diameter of the object glass in a Galilean telescope has nothing to do with the magnifying power, but with the field of view. If you can be content with a limited field of view, you may have a small object glass. There is no necessity for the eye glass to be greater in diameter than the fully distended pupil of the eye, but it should not be smaller. I should advise you to try your hand at a single little telescope first. I have seen one, such as you evidently want, so constructed as to shut up in the space of an ordinary watch; though if you have not a lathe, I fear you will find it almost impossible to connect the tubes. In ordering the lenses, be very careful to order them "edged and centred." So far as price is concerned, I cannot help you: opticians differ. If you write to H. & E. J. Dale, of Ludgate Hill, London, E.C., and tell them the focus and diameter of the lenses you want, they will, so far as my experience goes, assist you. The two lenses for a single telescope, non-achromatic, should not cost more than half a crown or three shillings. If the object lens be desired achromatic—which means better definition—it will cost more.—E. A. F.

Staining.—J. M. (*Gateshead*).—You do not state what wood the table you wish to stain is, but, presuming it is pine, you cannot do better than use Bismarck brown alone if you want a bright red mahogany colour. By adding Vandyke brown you can modify the colour to almost any extent. To get a really fine rich dark mahogany, the best way is to stain with weak walnut stain and then French polish with red polish. Do not attempt to make your own varnish, as you can buy it better and cheaper than you can prepare it.—D. A.

Polishing.—W. H. (*Ashton*).—See above answer to J. M.'s inquiry on "Staining," as it also replies to your question. Before using polish, go over the wood with a coat of size. This will be found a very good filler for pine.—D. A.

Staining Wardrobe.—J. R. (*Skerries*).—See answers to J. M. (*Gateshead*) and W. H. (*Ashton*) on staining and polishing.

Griscom Electro-Motor.—W. D. (*Leeds*).—A Griscom motor to drive a sewing machine should have a diameter of 6 in.; length of field magnets, 4½ in., wound with 1 lb. No. 18 d.c.c. wire, to form consecutive poles; length of armature 3 in., diameter 1½ in., Siemens H girder pattern, wound with three oz. No. 20 silk-covered wire. This will take the current from six large bichromate cells, gallon size, to develop enough power to drive a sewing machine. As you have never seen a Griscom motor, I should not advise you to make one, since I cannot now spare time, nor have I space at my command, to fully describe and illustrate such a motor. Even if I could do so, I am not sure you could succeed in making one, as every part of this machine must be well made, proportioned, and fitted by a skilled workman to render it at all effective.—G. E. B.

Converting Bicycle Bell to Electric Bell.—C. L. (*Glasgow*).—The gong or dome only of the bicycle bell could be utilised in making an electric bell. Directions for making all the other parts of the bell were given on page 180, No. 12, Vol. I., and page 279, No. 18, Vol. I. You should choose the dimensions for wire and parts given in the first line of the table on page 180 for a 2½-in. bell. On page 279, Vol. I., will be found full-size illustrations of the necessary parts.—G. E. B.

Process Block Making.—F. J. T. (*Bristol*).—No doubt F. J. T., if he is a careful reader of WORK, will have ere this seen our reply to J. W. S. (*Sheffield*) on this subject. We may add that process blocks, even when done by the very best workmen, are not to be compared with even cheap wood engravings, being devoid of artistic feeling and too shallow and hard for good printing.—J. W. H.

Fret Lead Glazing.—P. S.—(1) The best iron I have met with for soldering the above is one made by Fletcher, of Queen Victoria Street, London, and Warrington. I send herewith a rough copy from their catalogue. It is heated by an atmospheric gas burner; A is the flame, which is continually heating the copper bit; B, the tinned end; C, hook

Fret Glazing Iron.

for hanging up when not in use; D, inlet for air; E, wood handle; F, connection for indiarubber tube; so that all you have to do is to take off the burner from any ordinary gas bracket and pass the tube over the nose-piece and the nozzle at F, light the gas at A, and the iron will be ready for use when sufficiently heated. (2) Be sure that the points of contact of your lead cams are clean, and a dab of tallow will be all that you require in the way of flux. (3) As you only seem to require to do very small jobs, common black putty will be sufficient for stopping in the glass to prevent rattling.—E. D.

Phonograph, Where to Purchase.—PHONOGRAPH.—Edison's latest phonograph is not yet on sale, and it is extremely difficult to procure one. The European agent hires them out and generally sends a demonstrator with them. The hire is something like £20 or £30. I am pleased to see you take an interest in the phonograph. It is truly a wonderful instrument, and when the day comes when it will be in general use what a saving of time and labour it will effect to the merchant. By the way, do you want the instrument for experimental purposes? If so, why not make one, it is just the kind of work for workmen who have brains. I have made one, and will send, by-and-by, an article with working drawings (subject to the Editor's approval) for the pages of WORK.—W. D.

Cutting Edges of Books.—H. S. (*London, E.*).—There is no special tool for cutting the edges of books, unless we go to the bookbinder, who has machinery for the purpose; a sketch of a cutting machine would be useless for your purpose. If you are going to try and cut them yourself all you require is a shoemaker's knife and a straight-edge to cut against. You will find this operation fully explained in No. 17 of WORK. Any bookbinder will oblige an amateur by cutting his book-edges for a few coppers, and as this is really a difficult matter for the amateur to do himself, I would certainly advise him to get his books cut by a binder.—G. C.

Organ Building, Books on.—R. E. (*Derby*).—You will find useful works on organ building in "Practical Organ Building," by Dickson, 2s. 6d. (Lockwood & Co.); "Organ Building," by Wicks, 3s. 6d. (Ward, Lock, & Co.).

Weight of Iron and Steel.—R. N. (*Cornwall*). The weight of wrought iron 12 in. wide by 2½ in. thick is 100 lbs. per foot run, and steel of the quality used commonly for bridge work, 102 lbs., or 2 per cent. more. The crushing strength of *very short pieces* of wrought iron is about 18 tons per square inch of cross sectional area, but the resistance to compressive force decreases rapidly with increase of length, in accordance with the formula

$$f = \frac{18}{1 + \frac{r2}{3000}}$$

in which f is the breaking load per square inch of sectional area in tons, and r is the length divided by the diameter or least width. For very short pieces of steel the resistance to crushing will vary from 30 to 40 tons per square inch, according to the make of the steel. In taking out weights of wrought iron it may help you to remember that a square foot of iron ¼ in. thick weighs 10 lbs.; also bars weigh 10 lbs. for each square inch of section per yard of length. Cast iron is 2½ per cent. lighter than wrought iron.—F. C.

Darkening Mahogany.—C. Q. (*Bethnal Green*).—The process of darkening mahogany by ammonia, or as it is commonly called fumigation, is exactly the same as that adopted when oak is to be darkened by the same means. As you state you are a French polisher I presume you are acquainted with this, so that it is unnecessary for me to explain *my* process for darkening mahogany—in fact, I have not got one of my own. I am quite at a loss to understand your assertion that ammonia does not darken mahogany nor change the colour in the slightest degree, except sometimes making it slightly pink. Perhaps if you were to explain the process you and your unsuccessful friends have adopted I might be able to state the probable cause of failure. I daresay you are aware that some kinds of oak are not susceptible to ammonia vapour, but surely you would not on that account say that oak cannot be fumigated. I may also assume that you are acquainted with the difference between cedar and mahogany, and that you have not mistaken a piece of the former for the latter. Possibly your ammonia has not been strong enough, but if you get this in the Winchester quarts I can only suppose you have mistaken some wood for mahogany. Get a bit of good hard wood, not the soft colourless stuff which is so often used in your district by the makers, not stuff without figure which requires to be raddled before it is taken out on the "buzz," and subject it to the vapour of ·880 ammonia, and you will soon see that it darkens. I may tell you of a plan I adopt as a test when I want to see if a piece of wood can be fumigated; I do not know that it is a new one, but the hint may be useful to you as a polisher, as I don't think you know much about fumigation. Get a piece of wood cleaned up on at least one side, take the stopper out of the bottle, and lay the wood over the mouth. The vapour of course will be strong, and if the wood can be darkened it will very soon show a patch of altered colour. A small bit of wood will do, anything large enough to cover the bottle's mouth. On a larger scale you can try by pouring some of the ammonia into a cup and covering the top in a similar way. Certainly mahogany can be stained and polished to exactly match the oldest wood, but you know that a liquid stain has some objectionable features, though I am not aware that I have ever endeavoured to inculcate the notion that they should never be used, and I think if you read the passage which you quote you will see that it cannot be construed as anything but a suggestion. We do not know how wood which has been artificially stained will look after a length of time, but it is only reasonable to suppose that it will not look the same as that which has darkened naturally. Something more will probably be said on this point in the forthcoming articles on polishing, as their author is well acquainted with his subject, so that the valuable space of "Shop" need not be further taken up at present. I cannot, however, agree with your assertion that as "the wood itself gets darker the stain fades out." It may do so to a certain extent, depending on the nature of the stain, but surely you would not wish one to infer that a wood whose colour has been changed by chemical means can revert to its original condition plus age. If the stain were of the nature of a paint, not chemically changing, but simply mechanically colouring the wood, and such as would become colourless and invisible, the case might be different, but I am not aware that our knowledge of stained wood goes sufficiently far back to enable any one to state positively how artificially darkened wood will look after the lapse of a century. It might be interesting to many others, and it certainly would be to me, to know within what period of time you have noticed the changes you say take place, with particulars of the stain and wood—perhaps you will kindly supply these particulars. Ask any questions you like about the sideboard, though surely, as a professional French polisher, you have sufficient acquaintance with furniture to enable you to overcome any difficulties of constructive details. A "professional" French polisher and an "amateur" cabinet maker in one person seems rather an anomaly. As the former you must have had so many sideboards through your hands that surely you know all about them; nevertheless, ask if you are in a difficulty.—D. D.

Emery Wheels, etc.—T. J. W. (*Swansea*).—You will find it best to buy your emery wheels; you are hardly likely to succeed in making them, and should one fly in pieces it might be awkward. The surface velocity should be 4,000 to 4,500 feet per minute, and for tools and small work the wheel should run in water to prevent over-heating, but the wheel should not be left in water when at rest, otherwise the immersed part may become soft. Crocus and similar polishing powders may be used with oil with advantage upon a wheel or lap made of lead and antimony in the proportions of 9 parts by weight of lead to 1 part of antimony. You can melt over an ordinary fire by melting the lead first and then adding the antimony, which, although requiring a higher temperature by itself, will dissolve in the molten lead.—F. C.

Elastic.—NERVINE (*Chesterfield*).—Your query is somewhat vague, since uncovered elastic is sold in different forms at toy-shops, but probably you will

be able to procure what you require if you apply to the India-rubber, Gutta-percha, and Telegraph Co., whose head office is at 106, Cannon Street, London, E.C., and who have a branch establishment at 64a, High Street, Sheffield.—QUI VIVE.

Currying Leather.—G. S. G.—The business of finishing or currying leather for shoes, harness, etc., is not one about which there is much to be told. The tanned hide, placed against a suitable support known as a beam, is pared down on the flesh side to the proper thickness with a currier's knife, in which the cutting edge is at right angles to the blade generally. It has then to be soaked in water, stretched on a table, and worked with a stretching iron. It is thus freed from lumps and such-like irregularities, and is ready to be smeared over both on the hair and flesh sides with tallow and fish oil, and is well worked with proper tools. Finally the colouring on the hair side is commonly given by laying on a mixture of lampblack, oil, and grease. We do not call to mind any useful text-book on currying. Possibly some reader of WORK may be able to help G. S. G. to the title of such a work.—M. M.

Book Cutter.—J. C. S. (*Upton Manor*).—I have already given a description of how a book may be cut with a knife and runner in WORK (see No. 17, Vol. I.), also sketches and detailed instructions to make a plough to be used in conjunction with the lying-press (see No. 45). If Samson reads these up he may be able to get what he wants.—G. C.

Gold, Silver, Brass, and Copper Solution.—BRASSWORKER (*Birmingham*).—Full information will be given in WORK on how to make up gold, silver, brass, and copper solutions for plating on all kinds of metals, but the instructions will have to be given in separate articles, each dealing with its own special subject, as in that on "Brass and Brassing." Gold, silver, and amber lacquers are bought by us made up ready for use by men who have convenience for making them and know how to make them. If you will call on Messrs. J. E. Hartley and Co., 13, St. Paul's Square, Birmingham, they will show you a variety of excellent lacquers for lacquering gold, silver, brass, or any other metal. Their transparent Kristaline is a splendid article for lacquering silver-plated ornamental goods to protect them from tarnish.—G. E. B.

Phonograph.—PHONO (*Sheffield*). — To give a detailed description of Edison's latest phonograph would occupy more space than could be spared in this column. I would therefore advise PHONO, if he is particular to have a description of this special instrument, to go to the free library of his town and look up the volume of "Patent Specifications" for the year 1888. But I may say that the latest or "perfected" phonograph, as it is called, differs but little from the first instrument of this kind produced by Edison. The phonograph is intended to *record* and *reproduce* speech, and in the perfected instrument this is accomplished by means of *two* needles attached to their respective diaphragms or tympanums. The one needle cuts the sound waves in the cylinder, and the other, which is differently shaped, reproduces the vibrations, and consequently the sounds. It has a further difference of being actuated by a motor with a battery. The cylinder is also different, but what these cylinders are composed of it would be difficult to state definitely, as some accounts give paraffin wax as the material employed, whilst others have it "a hollow tube of cardboard covered with wax;" another description gives it as a soft substance composed of wax and resin. And whilst Col. Gourand was introducing this instrument to the British Association he said that "he had lately received a telegram from the inventor stating that 'wax was out of it,' and that another and better material had been discovered which was not affected as wax was by a change of temperature." As the phonograph, in its present perfect condition, is not yet on sale, but only let out on hire at a very high rentage, I think it would be a difficult matter to obtain the cylinders, as they are only made use of by those who rent the machines. But if PHONO cares he may write to Messrs. Mawson, Swan, & Morgan, Grainger Street, Newcastle-on-Tyne (who had one of these instruments on view during the sitting of the British Association in that city); they *might* give him the desired information on this point. I trust that this querist will not think me wanting in courtesy. I always endeavour to give all the information I can on any subject that comes within the range of my knowledge, but I have a natural aversion to describe "patented" articles—articles such as the one under discussion, which is, so to speak, covered from head to heel with patents. If PHONO only wants a phonograph for experimental purposes, or for the purpose of amusing an audience, he will find that the old form with the cast-iron cylinder covered with tin-foil will answer as well as the much vaunted perfected instrument. I hope to give an article shortly on this subject, and to supply working drawings which will enable any one to make a reliable phonograph for the above purposes.—W. D.

Cheap Home-Made Machine for Cabinet Makers.—ARTISAN.—I am sorry that space forbids your letter to be published in full, because the opinions expressed very closely coincide with my own, particularly those with reference to the tendency perceptible in some quarters to sink the individuality of the workman and make him merely an adjunct to a machine. I can't quite agree with all your views, but you write in such a manly, straightforward style that it is a pleasure to receive them. I cannot take such a gloomy view as you do of the commercial prospects for a cabinet maker who cannot avail himself of machinery. Certainly in making some classes of furniture this is being largely used, but then, even when it is, the skilled hand of the practised artisan is generally required to a very considerable extent. When all is said in support of your view the fact still remains that the vast proportion of furniture used in this country is not machine made, and certainly the best is not. Mouldings may be struck, and parts of the work done by the aid of machinery or appliances which, to a great extent, facilitate operations, but the great bulk of the cabinet making details depend on the craftsman. If there is any ground for fearing the decline of sound cabinet making, I think it is rather to be apprehended from the immense quantity of inferior furniture which is made in London and sold to dealers in the provinces. The chief merit of such furniture in the eyes of the public, the ultimate buyers to whom it is sold by cabinet makers (?) or house furnishers, is that it is low priced when compared with sounder work. The great majority of the public are utterly unable to judge of quality, and of course when they see two things equally pretty, or what they consider so, they naturally buy the lowest priced. Were they more discriminating they would realise that the low priced stuff, made as it is, cannot be of even proportionate value when compared with that made in a good, though small, provincial shop. I have met with many men in provincial cities who are under the impression that the low price at which some London furniture is sold—and much of it you are aware is quite as good as that made elsewhere—is owing to the use of machinery. Possibly this may be your notion if you are not personally familiar with the conditions under which the trade is carried on, or rather under which the goods are made, and I may explain for your consolation that the sole reason for any advantage in London value is because the work is so much subdivided. You probably are able to turn your hand to making anything, from a sideboard to a dining table, even frames (chair) perhaps, or at least most of the furniture required in a house, but were you working for the "trade" in London you would confine your attention to one class of article. You would, after a fashion, grow very expert in making these—though whether you would make them in the best way is another matter altogether—and of course you would make more of them in a given time than you can now, hence they would be lower in price. I think you will find, if you consider, that it is only in the production of the everyday run of stuff, say a 4 by 8 mahogany diner of the commoner class, that the small man who makes everything he sells in his own shop is handicapped by price, for out-of-the-way things, or even things of special design, can be made quite as favourably by him as by any so-called wholesale house. The great bane of the cabinet trade, therefore, is the demand for low priced rubbish by the public and the facilities with which they can obtain it. When buyers are able to recognise the difference between good and bad articles they will buy the former even if it be more costly, and I regard WORK as a powerful educator in this respect, and an important factor in elevating and maintaining our artistic handicrafts to a higher standard. As you say, I know the needs of the trade, and so long as I have the honour to be connected with this magazine my knowledge is at its disposal to the best of my ability, and you need not apologise for "buttonholing" me "on our mutual meeting ground, 'Shop.'" I have given my views at some length, but I fear I cannot help you in devising such a machine as you suggest. The bare notion of a contrivance which could be made by the user, not too costly, more speedy than hand labour, and capable of doing sawing, grooving, tongueing, rabbeting, chamfering, moulding, scroll sawing, boring, and turning, takes away one's breath. It might be desirable to have this, but I do not see its practicability nor how I can help you. There are comparatively inexpensive machines which will do several of these operations, though perhaps not on the same machine. For instance, there is the circular saw, etc., of the Britannia Co. of Colchester. This, with one or two other small pieces of machinery workable by hand or foot power, such as a lathe, would be a good outfit, and leave a good deal of change out of £100. The same company advise me they are just producing an appliance to be added to lathes for striking mouldings, and from what I hear it ought to be useful to you, but I have not seen it.—D. A.

Stencil Cutting, Sheet Metal Work, etc.—J. F. (*Elgin, N.B.*)—It is very good of J. F. (No. 33, page 524, Vol. I.) to say that he has nothing to say by way of correction of the method given by myself (page 364, Vol. I.). It would have been strange if he had, considering that it is the method usually adopted by practical men. With regard to the method J. F. puts forward as simpler and quicker, I maintain that it is neither the one nor the other. I will even go farther and say that it is utterly useless and impracticable for *general work*. With stencils of such small dimension that they can be placed over a *basin*, I have very little to do. The kind I am in the habit of making are those used by grocers, maltsters, brewers, hop merchants, farmers, etc., varying in size from 9 by 12 to 36 by 50, and even larger, some with designs or trade-marks in the centre, and perhaps thirty or more letters. With such as these J. F.'s method is impossible, which I will proceed to demonstrate. In both cases the letters have to be marked off first, as I presume that neither J. F. nor the ordinary average workman is sufficiently skilled to leave properly formed and spaced letters on a blank ground by painting round without some guide. Now this said painting or filling in is going to take a long time, as it must be done with great care, and the smaller the plate the more difficult it becomes; in fact, I very much doubt if any one not skilled in the use of a fine lining brush could do it at all. Now while this painting process is going on, any one used to the work would have cut the letters out, or very nearly so. So much for the quickness of J. F.'s method; now for the superiority of it. The corners have now to be turned up, and then soldered, and then comes the most ludicrous part of the whole affair, namely, the pouring in of a quantity of raw spirits and salts. Now let us consider for a moment the result. In the first place a waste of spirits; in the second place we have the fumes of the spirits, offensive to the nose and injuring everything they come in contact with; thirdly—ah! let us look at the plate after the zinc has been on a short time, and what do we see for thirdly? We see that, owing perhaps to the zinc being a trifle thicker in some places than others, or to impurities in the metal, or both combined, we see, I say, that two or three holes have been eaten in some part of the plate and let all the spirits out. What is to be done now? The rest of the plate not half eaten away! The only thing to do is to wash it out and finish in the ordinary way, which will take just as long as if it had been done that way at first. And even supposing that the spirits did eat it all out equally, when we look at the extra trouble of painting, turning up edges, knocking down again, cleaning off paint and the general "messiness" of the whole affair, I think it will be quite clear in the minds of all who can "read, mark, learn, and inwardly digest" facts, that J. F.'s method is no good for practical men or real work. With regard to the latter part of J. F.'s letter *re* "Sheet Metal 'Workings,'" as he terms it, the articles are framed on a plan suggested by our Editor, and considered by him and myself also to be the best for the general readers of WORK. J. F. says, "It is all very well those lessons on soldering for amateurs, but it won't do for those who have learned or are learning the art." Precisely so, J. F., but won't you give the amateurs a chance, and wait and see if anything will appear that is of use to yourself and others more advanced? Why it is even certain that when I have finished my subjects some one will have read them who knows as much as I do, as I do not profess to have any exclusive information. What I know I am willing to impart to the readers of WORK, and if J. F. does not find anything to learn in my articles, I am certain that many others will.—R. A.

Phonograph. — WAX CYLINDERS.—See above reply to PHONO given on this subject.—W. D.

Taking out a Patent.—J. S. (Patent Agent) is thanked for kindly pointing out an oversight in the above-named article. By a slip of the pen I referred to "Form A¹" in a manner which might lead to the inference that upon it application might be made for protection in the colonies. It is not for this purpose. As J. S. obligingly points out, inventors in this country cannot obtain such protection through our British Patent Office. "To obtain protection in the colonies involves separate and independent applications to each of the British Colonies, and these have all separate patent laws differing more or less from each other, and involving of course separate modes of procedure." Form A¹ is a form of application for inventors in the Colonies or foreign countries who seek protection in Great Britain. J. S. is, moreover, apprehensive that what I have said with regard to the application of the word "Patent" to inventions which are only provisionally protected, may lead the inventor into danger. On this point I do not share his fears. The practice was plainly stated to be *illegal;* and all must know that an illegal act, however common, is only to be done at the personal risk of the man who does it.—C. C. C.

Maps on Linen.—S. C. W. (*Huddersfield*).—If you mean maps on tracing linen, you may use Indian ink and ordinary water-colours. Perhaps what you require are maps drawn or printed on paper and mounted on linen.—F. C.

Scratches in Violin.—B. R. B. (*London*).—It is very likely that your instrument has been covered with a varnish composed largely of resin, in which case the scratches will appear white. A coat of thin spirit varnish might make these nearly solid again.—B.

Lathe for Planing.—C. C. L. (*Birmingham*).—Yes, I think you would certainly get enough power with an ordinary lathe to do planing ¾ in. wide with a rotary cutter. I suppose you want to thicken a number of thin strips. Remember you require a high speed and sharp cutters. Ask an ironmonger to show you Churchill's catalogue and look at the cut of Barnes' foot power former, it will show you what can be done. A fly wheel of unusual weight would be of use if you cut short pieces, because it will store the power of your leg while you pick up the next piece of wood.—F. A. M.

Violin Varnish.—VIOLIN.—The answer to your first query, how to varnish a violin, will be given at the close of the "Instructions in Violin Making," which are in the Editor's hands. The "bass bar" is a very important part of the violin, both in regard to length, depth, thickness, and position, all of which will be given in the articles named. If you have had no previous experience, don't interfere with so vital a part of the interior of a violin. In future inquiries please give your name and address for the Editor's use, not for publication.—B.

Hot-Air Engine.—S. C. W. (*Huddersfield*).—There are several kinds of air engines; in some the whole of the products of combustion enter the working cylinder, but in others the air is heated in vessels separate from the furnace. Taking the latter class, we may assume that the bottom of the working cylinder is kept hot by a fire beneath it; then cold air being pumped into it becomes heated, expands and drives the piston up, after which it may be exhausted into the air, or for economy passed through a regenerator of wire gauze or thin plates to take up part of the waste heat; then this heat may be picked up by cold air passing to the working cylinder. The great disadvantage of the hot-air engine is the high temperature necessary to obtain any considerable pressure; to double the pressure, that is to raise it to 15 lbs. above the atmosphere, a temperature of 490 degrees Fahrenheit is necessary, a heat utterly destructive of packings, etc. To protect the interior of the working cylinder as far as possible from the heat, the piston is usually made with a prolongation passing down into a lower vessel and approaching its sides very closely, so that only a very small portion of the highly heated air enters the working cylinder itself, and that part against which it mainly acts can be lined with non-conducting material. Some thirty years since engines worked by vapour and air mixed were tried by a Mr. Gill, of Palermo, but with no great success; and although for some purposes small hot-air engines are now used to some extent, they do not seem applicable for high powers.—F. C.

Clock Case Designs.—(*Drury Lane*).—This is rather out of my way, for I am sorry to say I am a poor hand at inventing and designing, but I think there have been some designs in WORK for clock cases which you might alter to fit the particular size clock, and the makers or clock sellers of the American have on hand an assortment of iron stands to suit nearly all of them, and are very cheap and effective; you might copy some of those. I have seen them fitted up in grandfather's cases (small), also in cases similar to cuckoo clocks, and you might probably get some designs from the fretwork dealers that would suit you.—A. B. C.

Cardboard Models.—H. J. L.—I do not know of any one supplying cardboard models of mechanical motions, but printed sheets of such movements are sold by several London patent agents and others. In working out inventions, it is a very good plan to make card models of all proposed movements of a novel character; if this were done in every case we should not find so many impossibilities recorded in the archives of the Patent Office.—F. C.

Lettering Book-Backs.—J. S. (*Manchester*).—I do not think that you will be able to make a job of lettering your books with bronze powder; in fact, I would advise you to give up the notion of doing so, and letter them in gold instead. Bronze is never used for this purpose, and the stuff which would have to be used to make it stick is far too messy and dirty for books. Turn up No. 24 of WORK, page 381, and you will find instructions for lettering books, which if you follow out will make your books fit to be shown to your friends, which would not be the case if you did them in bronze. Of course it can be done, and I hope you will not think me disobliging for not giving the necessary instructions. You state that you can bind a book all right; well, then, by all means try and do the lettering in the proper manner. Rather than use the bronze powder, get Judson's gold paint, and write the titles on with a pen or brush. As you are only a novice, take the advice of a practical man and letter them in gold. You can buy alphabets of metal type from Messrs. George Royle & Son, 7, Lovell's Court, Paternoster Row, London, E.C.; for this purpose they must be made of brass. There is no book on bookbinding and lettering to be had that would be of any assistance to the amateur bookbinder that I know of, and that is one of the reasons why I have written a series of articles on this subject, and which will appear in course of time in WORK. It is a pleasure to me to be able to help you, and I am sure the Editor will be able to appreciate your remarks concerning WORK. I hope you will succeed in making a good job of your books; if at any time you come to a difficulty, I will try and put you right, so please do not be afraid to write.—G. C.

Model Steam Engine.—E. K. (*Eastbourne*).—The book you want is "The Model Steam Engine," 1s., Houlston & Sons, Paternoster Square, London.—F. J. C.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Chords for Organette.—R. B. (*Pallas Green*) writes:—"Having an organette, and so far succeeded as to be able to cut the tunes to suit it on paper, I find the notes of the subject (as I call it) are too poor by themselves without some chords to enrich them, and would be thankful for the way to add them on, and the rule for doing so, as I am informed there is such a rule. I hope some kind correspondent will enable me to complete the work."

Wooden Cakes.—BAYHAM CORNER (*Kent*) writes:—"Will any brother chip kindly favour by instructions through 'Shop' how to line out an 'excell,' better known in the country as a 'wooden cake?' If the instructor could, by giving a working drawing, I feel well persuaded that it would prove a benefit to me, as well as many others in the trade. I saw with much pleasure in No. 55 of WORK how to measure timber."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Book on Sheet-Metal Work.—ALIQUANDO writes:—"The book on this subject by Warn (not Warne), inquired for by L. P. (*Deal*) (see page 782, Vol. I.), was, I think, privately printed, not published in the ordinary way. It used to be frequently advertised, but I do not know where it can now be obtained, as I have not lately seen any advertisement of it. In WORK, 14th December, page 619, RODNEY (*Newport*) says that the book by Warn is the best he knows of, dealing exhaustively with sheet metal, and gives an address where he obtained his copy, but that was 'twenty years ago.' Let me, however, introduce to your notice, sir, as you are not acquainted with it (see page 318, Vol. I.), a book that is bound to supersede Warn's, and let me strongly advise ST. MUNGO and L. P. (*Deal*), that if they desire to make real study in pattern-cutting in sheet metal, to get and master 'Metal Plate Work: its Patterns and Their Geometry,' by C. T. Millis; 1887 (Spon). (No. I. of the 'Finsbury Technical Manuals.') This work reduces pattern-cutting to system for the first time, and is immeasurably in advance of Warn's book, which is merely an arbitrary collection of problems (with numerous errors) and constructions practically impossible for large work. Millis's book is as great an advance upon Warn's as Warn's was upon the—what may I call it?—pattern-cutting by tradition, that alone existed before his day. It has constructions for every case, and 'short radii' methods for all kinds of work; it is, moreover, cheaper than Warn's book."

Sheet-Metal Work Book.—J. B. (*Exmouth*) writes in reply to L. P. (*Deal*) (see page 782, Vol. I.):—"The 'Sheet-Metal Worker's Instructor,' by Rueben H. Warn, is published by Henry Carey, Baird, & Co., 810, Walnut Street, Philadelphia. I have one by Blinn, which is very good, published by the same firm."

Cigarette Maker.—In reply to C. W. B. (*Plymouth*) (see page 779, Vol. I.) THOMASO writes:—"My friend, you're all up a tree. I never said anything about leaving an opening along the hinge when the tube was shut. That is a little 'improvement' of your own, which has necessarily failed. But because your idea has failed is no reason why you should say mine is a 'complete failure' also. Just look at the fifth line from the bottom of my description on page 670, Vol. I., and you will see these words: 'The two halves should fit well together.' You say yours do not. There you have the reason of your failure. 'Oh, but,' you say, 'you show an opening along the hinge in your sketch.' Very true. If you stand your room door wide open, you will see an opening down the hinge of that about ¼ in. wide; but there won't be any opening to speak of when the door is shut. The same with the tube figured on page 670, Vol. I. Although I show an opening along the hinge, the tube being open, if it was closed there would be no opening, provided the hinges were properly fixed on. My sketch is therefore perfectly correct. Take your tube back to the man who made it for you. Tell him to take the hinges right off both halves of the tube, and then put them (the halves) together, so as to make a perfect tube, without any opening down either join. Then tell him to bind fine wire round the halves, so as to keep them together while he solders the hinges on again. When that is done, take off the wire and the tube will be all right."

Re-waxing Meerschaum.—ALPHA writes:—"In answer to TOBACCONIST (see page 814, Vol. I.), meerschaum pipes are cleaned by carefully rubbing all over with soft rag wetted with methylated spirit and dipped in pumice powder, finishing with soft clean rag. To re-wax, place a small spirit lamp underneath the pipe, sufficiently near to melt a piece of white wax held against the pipe, which must be kept burning, so that the wax only touches the part to be coloured, and, when cold, carefully remove surplus with soft rag. Re-waxing is usually done in the lathe, by which means you get a more decided line round the pipe."

Strip Iron.—J. W. F. (*Mansfield*) writes in reply to TIM BOBBIN, J. P. S., and others (see page 830, Vol. I.):—"I have obtained strip iron and all necessary tools for bent iron work from C. Pool, whose address they will find in 'Sale' column, and who, no doubt, will be glad to send particulars."

Springs for Artificial Legs.—H. S. (*Birmingham*) writes in reply to R. F. (*Landore*) (see page 814, Vol. I.):—"If you will write to W. Tunbridge, 7, Jervoise Street, West Bromwich, Staffs., he would supply you with anything you may require in the way of springs."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers or by await space in SHOP, upon which there is great pressure:—G. H. (*Middlesboro'*); GILDER; HARE'S FOOT; L. W. (*Wantage*); J. B. (*Londonderry*); C. E. D. (*Bradford*); ENQUIRER (*Alfreton*); M. R. D. (*Liverpool*); SECTIO; AMATEUR PLATER; H. P. (*Blackheath*); AN ADMIRER OF "WORK"; OPTUS; G. R. (*London, E.C.*); J. S. (*Hammersmith*); PLATINUM; KILDONAN; T. D. (*Inverness*); J. J. (*Belfast*); CONSTANT READER; W. D. (*Newcastle-on-Tyne*); 3 C.; F. J. W. (*Ipswich*); Q. S. (*London, N.*); B FLAT; ROCK FERRY; A READER; J. O. (*Huddersfield*); EIKO (*United States of America*); J. S. (*Salisbury*); A. P. B. (*Walthamstow*); ÆOLIAN HARP; J. R. (*Newcastle-on-Tyne*); W. J. C. (*New Hampden*); M. J. T. (*Sunderland*); J. M. (*Bootle*); ECONOMIC; CARADOC; NAME PLATE; SCOT; CELT; A. O. (*Glasgow*); J. A. S. (*Liverpool*); W. A. (*Keighley*); W. W. (*Northampton*); C. E. S. (*Stoke Newington*); A. R. (*Fulham*); E. C.; SOMERSET; F. S. (*Islington*); H. W. (*Westminster*); J. P. O. M. (*Morpeth*); W. E. L. (*Bournville*); GAMMA; J. B. (*Suffolk*); J. R. (*Skerries*); NEMO; W. J. C (*London*); D. MCK. (*Glasgow*); E. MCM. (*Armagh*); E. R. S.; W. K. (*Cardiff*); M. D. C. (*Liverpool*); W. E. R. (*Cornwall*); P. F. (*Ebbw Vale*); WOODCUT; A. L. H. (*Liverpool*); A. W. (*Wakefield*); SEMPER FIDELIS; H. R. W. (*Ripley*); J. M. (*Glasgow*); SHOPMATE; JOINT; STONE FLOGGER; A METAL WORKER; H. J. (*Birmingham*).

Trade Note.

GUILD AND SCHOOL OF HANDICRAFT,
34, COMMERCIAL STREET, E.

I HAVE very much pleasure in calling attention to the following course of Six Lectures on "Architecture as the Language of the English People," which will be delivered during the next Summer Term in the workshop of the School of Handicraft, by C. R. ASHBEE, Esq., B.A., of King's College, Cambridge, Architect and Hon. Director of the Guild and School of Handicraft. The titles and dates of delivery of the lectures are as follows:—

1. Monday, May 5th.—"THE ARCHITECTURAL STORY OF ENGLAND."
2. Wednesday, May 7th.—"MEDIÆVAL ENGLAND."
3. " " 14th.—"RENAISSANCE ENGLAND."
4. " " 21st.—"PURITAN ENGLAND."
5. " " 28th.—"MODERN ENGLAND."
6. " June 4th.—"ARCHITECTURE AS A LANGUAGE. What it has Told us in the Past, what it is Trying to Tell us in the Present, and may Tell us in the Future."

Each lecture will commence at 8 p.m., and will be fully illustrated with Lantern Slides, Pictures, Drawings, etc. Tickets for the course—One Shilling, but free admission will be granted to the First Lecture, on which occasion the chair will be taken by the most Hon. THE MARQUIS OF RIPON, K.G. A full Explanatory Syllabus has been prepared to accompany the lectures. Price 3d. Application for Tickets, Syllabuses, and all particulars relating to the course, should be made to the Hon. Secretary of the School Committee,

H. LLEWELLYN SMITH,
34, Commercial Street, E.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [15 R

Complete Fount of Rubber Type.—Two alphabets, to form any word or name, box, pad, ink, and holder, post free, 1s. 6d.; extra alphabets, 6d. per set; figures, 3d. Business, address, and pocket stamps equally cheap.—W. C. PRESTRIDGE, Manufacturer, Cumberland Street, Bristol. Established 1870. [2 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [3 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Powerful Miniature Shocking Coil and Battery.—Carried in waistcoat pocket. Complete Instructions for making, 9d.—BELDAIR, 25, Livingstone Road, Bath. [10 R

Machinery and Tools.—Largest stock in London. BRITANNIA CO., 100, Houndsditch. Cash or hire purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks, Dies, Forges, etc.; catalogue of new, 6d., or list second-hand, 2d.—BRITANNIA CO., Colchester.

Best Book on Lathe.—Chapters on metal spinning and screw cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [11 R

Stickall Cement (patented).—Will securely stick paper, leather, wood, ivory, marble, iron, earthenware, glass, etc., for which purpose it entirely supersedes paste, gum, glue, and every other substance; made up in self-opening tins, 6d. and 1s. each, per post 3d. extra.—The EVER-CLEAN COLLAR CO., 100, Wood Street, E.C. [12 R

Electric Alarum Clocks, to place in circuit with bell; can be removed at will without having to disconnect wires; carriage paid, 6s. 6d.; Bell Sets from 7s. 6d.; Motors for lathes, circular saws, fret machines, etc., Lighting Sets, etc.—O. OTTLEY, Cannon Street Road, London, E. [14 R

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 sheets, 2s. 6d. All post free. Lists free.—F. COULTHARD, East Cliff Terrace, Bournemouth. [1 S

Safety Bicycle for Sale.—Diamond frame, perfect condition; splendid easy going machine, 1890 make, bright parts beautifully nickel plated; balls all parts, including pedals; good reason selling; no fault whatever; £7 15s., rare bargain, seldom seen, bound satisfy.—WOODBRIDGE, 34, Hill Street, Ipswich. [3 S

Decorators' and Artisans' Handbook, containing 550 recipes, with instructions; 1s. 1d. free.—McQUHAE, Cockermouth. [2 S

Optical.—Microscopes, microscopical requisites, microscopic objects, photographic apparatus, optical lanterns, telescopes, opera and field glasses, stereoscopes; separate catalogues.—HENRY EBBAGE, 344, Caledonian Road, London. [4 S

Money-making Trade Secrets.—Sure living to any enterprising person; over 5,000 unsolicited testimonials; list, 1d.—STANLEY, 5, Billsow Street, Poplar, London. [5 S

Model Work.—Castings, models, etc. Illustrated list, 4d.—STIFFIN & CO., 324, Essex Road, London, N. [6 S

I.—LETTERS FROM CORRESPONDENTS.

Case Hardening.—CONSTANT READER writes:—"In answer to the inquiry in WORK of March 22nd, 1890 (see page 14), *re* case-hardening powder, I beg to say that I have used Minns' case-hardening powder for years, and find it acts admirably, and would thoroughly recommend same to AJAX (*Edinburgh*) and others requiring it. Samples and prices can be obtained of Messrs. Sidney Minns & Co., Trafalgar Road, Dalston, London, N.E."

Wood Carving.—T. J. P. (*Dalston*) writes:—"It might interest some of the readers of your useful and instructive journal (especially those interested in wood carving) to know that we hold an exhibition of works of art of the Peoples' Palace at Essex House, before going to Kensington for examination. We have some excellent specimens of wood carving by our amateur students on view. Admission free."

Fairy Bells.—J. W. S. (*Walthamstow*) writes:—"I see R. F. writes in reply to SUBSCRIBER (*Bristol*) (see page 651, Vol. I.) about fairy bells. I have been a maker of them for fifteen years; also a player. I wish to point out that instead of making one with 8 strings, as shown in diagram, have 13 or 15, because you can play more tunes, and it does not take much more material, and the cost is very little more. I have one myself with 26 strings; it is 9 in. wide and 24 in. long, and has three bars on the back, and the strings are a ¼ in. apart. It is made to play on the table or rest on anything. Or if you have a large hand, it can be thrown about the same as the small ones. I also wish to point out that R. F. must make a mistake as regards size of wire used. I always use No. 9 and 10 to 8-stringed, and 8, 9, 10, 11, to 13- or 15-stringed, instruments; my own is 8, 9, 11, 12; the bass strings, or the last 4 or 6, are the best brass spring wire, size about 15 or 16, which give a very rich and powerful tone. I do not wish to find fault with R. F., but to use such heavy wire I cannot conceive how it will stand the strain without bars on the back. I shall be most willing to answer any questions on this subject, or give further explanations, as I consider the fairy bells a very mellow and sweet-toned musical instrument, if played as they should be."

Folding Chair Rivets.—To-Po writes:—"Iron folding chair rivets can be had of J. W. Roberson, Columbia Ironmongery Stores, 77, Virginia Road, E., back of Shoreditch Church; also of Hewett, Ironmonger, Shoreditch, close to the Church. Also at latter place, mail cart wheels and axle can be had for 5s., iron rims, and 6s. with rubber tires, 22½ in. diameter, the largest he keeps. Springs can be had for 7d. per pair, or, including iron legs for steps, 1s. 6d. Bolts are extra, but very cheap—about a halfpenny each, perhaps."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Connecting Alarum Bell to Calendar Clock.—TEMPUS (*Preston*).—If you are accustomed to the use of fine tools and such delicate workmanship as that required in the repair of clocks, the job need not present any insuperable difficulties. It will be necessary to drill a fine hole through the dial of the clock, outside the time dial near the figure VII., to receive the pivot of the alarum hand. The hole must be bushed with ivory or bone, if the dial is of metal, to insulate the pivot from the dial. The stem of the pivot must fit tight in a metal socket at the back of the dial, or in a metal tube in which it can only turn stiffly, much as the hour hand socket of a clock turns on its stem. This socket or tube must then be connected to a binding screw outside the clock by a length of No. 20 silk-covered copper wire, the ends bared of their silk covering, and clipped tightly or soldered to the socket and binding screw. The alarum hand may be made small and fitted to the pivot as the hands of a clock are fitted. To the end of the hand must be stiffly jointed a flattened length of No. 20 platinum wire, and this adjusted to make contact with the hour hand anywhere between IV. and VIII. I think this will help you over your difficulty.—G. E. B.

Plumbers' Cloths.—D. A. (*Hampstead*).—Fustian or moleskin for making these cloths is easily obtainable. I should think you have not gone to the right shops. When you say you have tried a few good shops, what shops do you mean? linendrapers', ironmongers', or what? You can get it at any outfitters who make a speciality of workmen's clothing; and even if you cannot procure fustian, you can always get stout ticking anywhere, which is used by very many good plumbers in preference to fustian, though, of course, you would require to make your "wipe" of more thicknesses of ticking than if you used fustian.—R. A.

Clock Weights.—G. E. M. (*Leamington*).—The weight for thirty hour English clock is generally 10 lbs., those for eight day being 14 lbs. each as a rule, but I have sometimes replaced the 10 lbs. one with an 8 lbs. with advantage, and at times the 14 lbs. I have made 12 lbs. or even 10 lbs., at others as much as 16 lbs. To tell gold, get a testing stone from the tool (watch) shops, rub a piece of gold, the quality of which you are certain of, on the stone, also the gold you want to test and compare the colours, first testing it by the acid aquafortis, to see that it will stand it.—A. B. C.

Æolian Harp.—A. F. (*Barrow-in-Furness*).—This interesting instrument is very simple, and also very inexpensive in its construction, costing but a few shillings. It does not require any actual knowledge of music to string the same, so long as all the strings are brought by their tension to produce exactly the same sound; any discord, as it is termed, may be at once detected by the ears of any average person, and corrected by tightening or slackening the strings until the desired effect is obtained. The mode of construction is as follows:—Procure a piece of ⅜-in. pine board, sound and well seasoned, 8 ft. long by 5 in. wide; this should be well planed up and the edges nicely squared. Cut this into two pieces of 3 ft. 6 in. each, and two pieces of 6 in. each; the ends of each piece should be neatly dovetailed to fit into one another, and form the sides and ends of a box measuring 3 ft. 6 in. by 6 in. Now take two pieces of perfectly sound, well-seasoned pine $\frac{3}{16}$ in. thick, and 3 ft. 6 in. by 6 in; nicely plane this, and finish off well with glass paper. In one of these pieces at about 1 ft. from each end, and exactly in the centre, longitudinally cut with a fret saw, or sharp pen-knife, two holes about 1½ in. in diameter; this piece will form the sound-board of the instrument; it will, however, require strengthening to withstand the strain of the strings, which will be stretched along it from end to end. This may be done by cutting two pieces of 1-in. beech or similar hard wood 5 in. square, and affixing them by means of glue and thin screws from the under side on to the thin sound-board at the distance of half an inch from each end, and the same from each side. A reference to the annexed sketches will make this very clear, Fig. 1 showing half the sound-board as

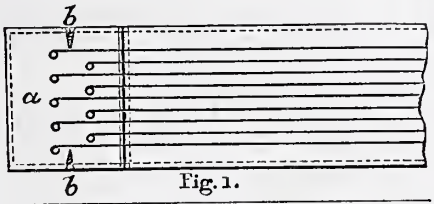


Fig. 1.

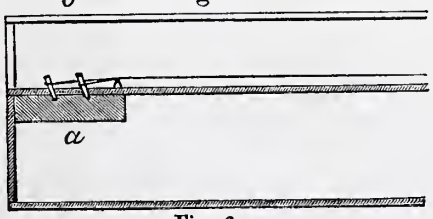


Fig. 2.

Æolian Harp. Fig. 1.—Half plan of top. Fig. 2.—Half section.

seen from the top, *a* being the block shown by dotted lines on the under side thereof; the other half of the board, being identically the same, is not represented. Now bore in the face of the sound-board, through into the blocks underneath, the holes for the reception of the pegs; the number of these is a matter of choice; half of them will be those used in stringing a pianoforte (iron), and half, wooden pegs, with a thumbpiece as used on a violin; the iron will be placed at one end, and the wood at the other; the position of the holes will be seen on reference to Fig. 1. You may now fasten this board on to the framework with glue and small screws, and to make it more firm and solid, run in a thin screw through the sides into the block as shown at *b*, Fig. 1. Affix the other piece of board on to the bottom in a similar manner, and the box is complete. Bridges will be required to stretch the strings across; these are made by taking two pieces of hard wood, 4½ in. long, ½ in. wide, and $\frac{3}{16}$ in. thick; cut off two edges to make an apex along the centre, and glue one across each end of the sound-board just in front of the peg holes. Now to string the instrument. Procure some catgut—that known as violin first string E is most suitable; place this through the hole in the iron pegs, twist it round once or twice, carry it along the face of the board across the bridges to the other end, and twist it round the wooden pegs. The strings may now be tuned by turning the thumb pegs, thus straining the strings until they are in unison, producing the note A, which may be got from a tuning fork or piano. It would be a great improvement to make a cover which will direct the current of air across the strings; this is represented in section in the unshaded portion of Fig. 2, and is simply made of two pieces of wood 3 in. by 6 in. fastened across each end of a piece of thin board, 3 ft. 6 in. long by 6 in. wide; this will rest on the top of the harp as shown, and, when the instrument is placed on the window ledge, the window will close on to it. I trust these instructions will be lucid enough, and wish your excellent journal the success it deserves.—C. R. W.

Cabinet Plans.—CABINET (*Salisbury*).—Deal will do as well as any other wood for your cabinet. India or china matting will be the best material with which to cover the top. The cabinet, if made to your details, will do well enough, but the following suggestions may be useful to you. Be careful to arrange your hinges so that the door swings free of the corner upright of the cabinet. According to your Fig. 5 you would find that if the hinges are fastened with only the knuckles projecting the doors will not open. As no hinges are shown, perhaps you have already anticipated the difficulty. I think it would be an improvement to have either one piece of glass in each door, that is without the bamboo rail across the middle of each, or else to put another pine rail to which to affix the bamboo and use two pieces of glass in each door. I do not see how you can otherwise fix the bamboo rail securely. If the design is carefully carried out the cabinet ought to look well, and presuming you are an amateur, you are to be congratulated on your draughtsmanship. Mr. F. Westbury, Great Dover Street, Boro', London, S.E., gave me the prices to which you refer.—D. D.

Builders' Books.—ESTIMATOR (*Chepstow*).—I think you will find "Beaton's Pocket Estimator," published by Crosby Lockwood & Co., 7, Stationers' Hall Court, London, will suit your purpose, and "Equation Tables," by K. C. Richardson (Whitehead, Morris, & Lowe, 167 and 168, Fenchurch Street, London) will at once explain the difficulties usually met with in converting the St. Petersburg standard into the various scantlings used in England. In the event of the above tables not being what you require, I shall have much pleasure in acquainting you with other publications on receipt of further particulars. You will find that your local bookseller would be able to obtain any back numbers of WORK.—E. D.

House Plastering.—PLASTER (*Manchester*).—In answer to your query as to the probable cost of plastering the front of a house, a great deal depends on the rate of wages, price of materials, etc. You likewise do not state what you want it plastered with; if you wish it to last, I should say render it with Portland cement and washed sand. There are several cheaper materials, but you would find the cheaper you have this sort of work done the more trouble you buy. Then there is the class of work; are there many off-sets, cornices, mouldings, trusses, pilasters, sunk faces, etc. etc.? You must also take into consideration that you must either buy or hire all tools, plant, and scaffolding, get all your moulds, running and nib rules, etc., made, for I can assure you that there are a quantity of things requisite, even for such a thing as plastering, and which you would find very expensive, and be of very little use to you afterwards. Now, last, but certainly not least, what is the size of the house? I think you will gather from the above remarks that your question is rather vague. Your next query—"Could an amateur manage it? If so, kindly give directions"—conveys to me the idea that you certainly could not; and the explanation of tools, materials, plant, and method of working, would be far too lengthy to enter into in "Shop." Everything considered, the best thing you can do is to ask a local tradesman to give you a price for the job. But I should not advise you to have it done in the winter.—E. D.

Stencil Cutting.—CLIO (*Hull*).—The article on stencil cutting is concluded in No. 31.

Wood Sample.—LINDUM (*King's Lynn*).—The sample of wood sent is a species of teak, and is used for boxes, cases, etc., locally, but not imported into this country as timber. In future, in sending samples, do not put the linseed oil on, as it is easier to tell without it, as the oil alters the colour and deadens any natural smell in the wood.—A. J. H.

A Future Subject.—WELL WISHER (*Kew*).—A paper on such a craft as you mention is in preparation.

Sword Blades.—J. T. H. (*Sheffield*).—"If, in hardening, the blades warp or 'run,' how straighten them, or get back to the shape of the template?" Should it occur that a blade warps or "runs," it is a clear proof that it was not fit for tempering. Why, would be only a matter of conjecture on my part. The workman who forged the blade could best answer that question, which is far more important, in my view, than getting it back to the shape of the template, which, without remaking by passing through the furnace again, would be futile, or something worse: to warm, twist, and tap-hammer it true, and call it a sword blade. There is an inorganic vitality about steel that responds to operation it undergoes in working. Working "unfairly"—this seems a strange expression, yet every steel worker will understand it—that will cause it to "run" or warp; unequal heating, incautious cooling (one part more than another), or some other of the many unobserved chances of defective operation, may have caused the defect to become manifest in the hardening. It is not the hardening at fault that reveals an existing wrong, and critical attention to work will avert it.—J. C. K.

Filter.—M. T. (*Warbleton*).—A good cheap filter may be made with an ordinary flower pot partly filled with charcoal and sand in layers. The water in percolating through these is freed from its impurities, and drops through the hole in the bottom of the pot into any vessel placed below to receive it.—D. A.

Maize Treatment.—MAIZE (*Bridge of Weir*).—I am sorry I am unable to give such particulars of the preparation of cornflour on a small scale as are likely to be of much service to you. You seem to have read up the subject pretty fully. As you are about to proceed to a colony where maize is largely grown, does it not occur to you that you are much more likely to be able to pick up the information you require there?—D. A.

Staining and Polishing.—J. W. F. (*London, E.C.*).—From your question I do not understand whether you wish for a stain to make light wood the colour of mahogany or whether you wish to stain mahogany a darker colour. Directions for both have already been given in "Shop," as well

as fairly full directions for polishing. To make a mahogany stain dissolve Bismarck brown in methylated spirit and add water to reduce. To darken mahogany use a solution of bichromate of potash or of permanganate of potash in water. Articles on polishing will shortly appear in WORK, but you will gather many useful hints by looking over "Shop."—D. A.

Garden Chair.—T. P. (*Staffordshire*).—The chair you refer to cannot be made to fold, but I give you herewith a sketch of a folding chair with arms that may perhaps suit you. It is very portable, being on the campstool principle, and folds up flat. The long pieces for the back are 4 ft.; the short legs are 2 ft. long; the wood may be ash or any other tough wood that you can easily procure, and the size 1½ in. wide by ⅞ in. thick; the arms are of the same width and thickness. There are rails at A, B, and C. These rails are ⅞ in. square, and 1 ft. 6 in. long. A and B are mortised into the back legs at the top and bottom; C is mortised into the top end of the short legs. The legs are secured by a rivet where they cross. The top end of the arms is secured by a rivet to the back legs, the lower end being cut to fit on a stud at the top of the short legs; this stud, with the mode of

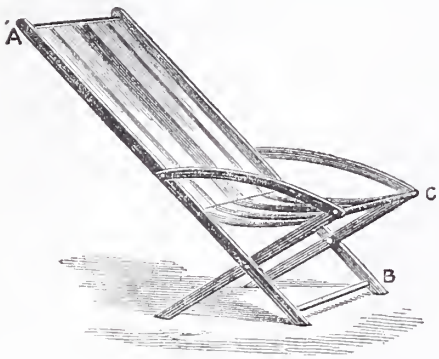


Fig. 1.

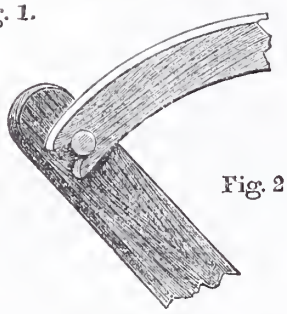


Fig. 2.

Garden Chair.

cutting the arms to fit it, is shown at Fig. 2. The seat is formed of a piece of stout carpet or canvas firmly attached to the rails, A and C, and long enough to allow of sufficient "sag" to form a comfortable seat. Of course you will, as a matter of course, give the woodwork three coats of varnish, preferably oak, and if you use brass or copper for your rivets you will have quite a presentable chair, and one that does not require much labour or skill to construct. I think you will understand from the drawing that to fold the chair the arms are slipped off the studs and turned upwards, the legs then closing up together. I hope that by the aid of these brief instructions you will be able to make a chair to suit your requirements, and in which you may enjoy many hours of quiet, rest, and comfort.—G. LE B.

Varnishing Sequoia.—DUMMIE (*Aberdeen*).—Californian redpine or sequoia is not a wood which I can recommend for work to be finished by polishing or varnishing. It certainly is not improved by treating in the ordinary way, but rather the contrary. The most satisfactory results, and they may be disappointing, can be got as follows: Body in with white polish, use no filling, and finish off with a mixture of glaze and white polish applied with a rubber in the usual manner. The wire fret saws you refer to do not seem to meet with much favour, and I do not know of any dealers, except Melhuish and Son, who keep them.—D. A.

Furniture Polish.—J. R. (*Elton*).—I do not want to contradict your assertion that you are a careful reader of WORK, but if you go over the "Shop" columns you will find that inquiries similar to yours have been answered giving all the information you ask for. It seems a pity to stain a piece of oak furniture to a mahogany colour, and I think it would be much more satisfactory were you just to darken it to resemble brown oak. Unfortunately you do not say whether your oak dresser is old or new, or whether it is still in the white, so that I am not able to direct you with any degree of certainty. If the oak is quite new and light you cannot do better than adopt the plan of staining it with the weak walnut stain which has so frequently been referred to in these columns, and then polishing it with red French polish. This is made by colouring the ordinary polish with Bismarck brown. A brighter mahogany colour may be got by simply using a mahogany stain (Bismarck brown), and then finishing with plain polish. I cannot advise you to make your own polish, but if you will, you may do so by dissolving shellac in methylated spirits. If your dresser is darkened by age or artificial staining, the process roughly indicated above must be modified accordingly, but without knowing full particulars I cannot direct you what to do. Papers on polishing will shortly appear in WORK. When they do appear, study them carefully, and also read the "Shop" columns, as many valuable hints on polishing have already been given. If you like to tell me something more about your dresser I may be able to help you further.—D. A.

Staining Chairs.—J. H. (*Liverpool*).—You do not state of what wood the kitchen chairs you wish to stain are made of, nor their condition, whether new or old with previous varnishing. Assuming they are "in the white," you cannot do better than go over them with resin varnish, which you may easily make by dissolving resin in ordinary French polish. If you use a dark resin, no stain or other colouring matter will be required to give your chairs a rich yellow colour. As regards your inquiry about making soda-water I hardly know what to say, for a good deal depends on what scale you wish to make it. If you want to manufacture it for sale I am afraid it would be impossible to help you satisfactorily in "Shop," but if you only want it in small quantities for home consumption you cannot do better than get a gazogène or seltzogène. They are to be had at Lewis's.—D. D.

Mitre-Cutting Machines.—HOCKAGE (*Bishopsgate*).—The mitre-cutting machine you mention I have found answer the purpose admirably for picture-frame making. You can set the adjusting screw to get any mitre you wish—a ½-in. moulding to a 4-in. moulding; in regard to corner cramp I suppose use is everything. I found the vice much better—can make my frame in half the time I am screwing it up with the cramp. A *fixed* vice permits one to drive a nail in the mitre without moving, and I can now after a few trials cut and make my frame ready for fitting picture in, etc., under a quarter of an hour.—G. R.

Cleaning Gold Frames.—A. J. C. B. (*Loughboro'*).—I am sorry I do not for the moment know of anybody in your immediate neighbourhood who would undertake the work, but perhaps some of our readers may notice this and help us. The following, I have found, is a good method for cleaning real good English gold frames: Take your picture out of frame, also glass and backs if they have any in; give the frames a good dusting with a brush so as to thoroughly remove from the ornaments, take a basin of soft boiled water (cold), wash carefully until the gold appears bright and clear of dirt; when all the parts are so done, let it dry, then resize with best strained vellum size, and your frames are as new again.—G. R.

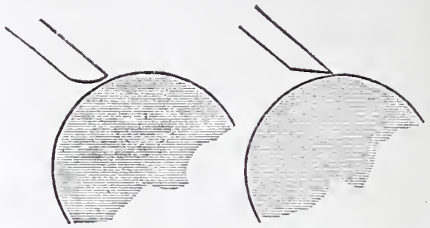
Hard Glue Brush.—W. O. D. (*Ipswich*).—I am not personally acquainted with water glue, but I presume there is no difficulty in keeping the brush in order by washing it each time after using. Try this, and if you do not find it satisfactory write to the agents or manufacturers.—D. A.

Polishing Bookcase.—NOLO (*Ruspidge*).—Questions almost identical with yours have several times been answered in "Shop." The walnut stain recommended is composed of Vandyke brown, a little liquid ammonia, and water. The polish is made by dissolving shellac in methylated spirits. After applying the stain and allowing the wood to become dry size it over. When again dry, the wood may be polished in the usual manner by first bodying in and then spiriting off.—D. A.

Overmantel, etc.—UNCO PHEC (*Surrey*).—It is a matter of opinion whether the shelves would be too heavy in appearance if made 7 in. wide, and you cannot do better than be guided by what is to be placed on them. There is no fixed rule for such dimensions. The same may be said of thickness. From these and other details you inquire about you may safely conclude that you may adopt any mode of construction which may be most convenient, and this of course a good deal depends on your skill, and what tools are available. I certainly think that linerusta finished as you suggest would be a very suitable backing, and much enhance the appearance of the overmantel. It is just in such little details as this that a workman, whether amateur or professional, shows his taste, and the remarks accompanying the illustration were more suggestive than minute in order to draw out this faculty in our readers. I hope your overmantel will be a source of pleasure both in making and in subsequent contemplation. Thanks for information about water glue. The other subject you mention shall receive due attention.—D. A.

Oil Polishing.—F. P. (*Andover*).—An article on this will be given shortly, but the following hints may be of assistance to you in the meantime. Use raw linseed oil. Apply it to the wood with a rag and rub as much as you like. Repeat the process as often as you choose, for the more "elbow grease" you use the better the result will be. Do not saturate the wood with oil.—D. A.

Phonograph Parts.—E. B. W. (*Nottingham*).—The material used for making the diaphragm of a phonograph varies according to the ideas of various experimenters. Some use vellum or parchment, some wood veneer, some thin sheet iron, and some mica or other thin substances. Any of these substances may be used; and as the phonograph is even yet in the experimental stage, you might gain something by making a few experiments; perhaps you may be able to discover some material which will give better results than any of the above. The essential point in choosing a material for this purpose is to have it thin enough so as to be capable of vibrating beneath the sonorous waves which



Phonograph Needles. The curved line in both cases represents the cylinder.

impinge upon it through the funnel-shaped mouthpiece. The wax tubes which slip on and off the cylinder, and which receive the impressions, are made of paraffin wax (see recent replies on this subject). The needles, or styles as they are generally called, are made of a piece of fine steel ribbon. They may be made from the points of ordinary sewing needles. The proper shape is a difficult matter to get, and just as difficult to describe. The point of the transmitting style is shaped somewhat like a knife, while that of the recording style is more chisel-like. Perhaps the above diagram will make my meaning clear.—W. D.

Hat and Umbrella Stand.—F. H.W. (*Manchester*).—Designs of a hat and umbrella stand have already been given in No. 44 of WORK.

Japanese Fishing Rods.—F. J. C.—(*Maidstone*).—These may be obtained from or through almost any dealers in Japanese fancy articles and curios. I do not know the names of any dealers in Maidstone, but I think if you keep your eyes open you will soon find them. If not, apply to Messrs. Phillips & Co., King William Street, E.C. Prices vary according to size, but the rods are quite inexpensive.—D. A.

Tarnish.—D. T. (*Halifax*).—If the gilding is worn off there is no way of renovating except regilding. If, however, the gilding is merely dirty, it may be cleaned. I have lately done so with the gilt brass parts of a valuable grandfather's clock, using monkey brand soap.—D. A.

Rubber Letters.—J. H. W. (*Wakefield*).—As you will have seen, the manufacture of rubber letters has been fully treated in the paper published in WORK, No. 38.—QUI VIVE.

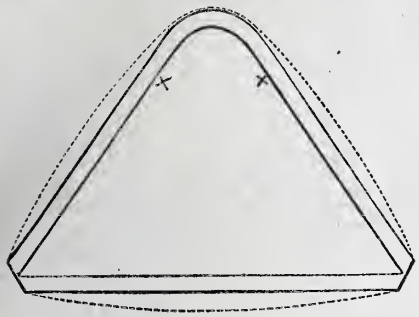
Modelling in Clay.—GOUGE (*Brighton*).—Being myself a carver in wood as well as a modeller, I can fully endorse the views propounded by GOUGE as to the value of modelling to the carver, whenever the design is to be in the round or in bold relief. I am unable to point out any sound practical book on the subject. Papers on this subject have already been commenced, and appeared in No. 53 of WORK.—M. M.

Taking Out a Patent.—G. W. (*Bournemouth*) will find the matter to which he refers fully explained in the answer to B. D. on page 97.—C. C. C.

Piano Making Questions.—W. B. (*Liverpool*).—You complain that the description of making the back of piano to your mind is vague. It is not expected that a person having no knowledge of a particular trade can simply read down a few columns of type, and grasp the details without thinking, although every detail may be as clearly written as words can express it. Yet it is necessary to read it thoughtfully and carefully, so that you may understand what it is the author's intention to convey. I cannot think that you have taken sufficient care in reading the article. You say you never heard of a wrest board; you will find that wrest plank is the term used, which is the technical name as it is known in the trade. I will answer as clearly as I can the parts that seem so vague to you. If you cut the veneer the width of your wrest plank until you have sufficient to cover its entire length, then it indicates clearly that this crosses the plank. If the strips of paper are glued over to keep it together, you would not toothe this off, as it would fall apart; and further on you may read that you glue the side of your veneer that is not papered, clearly showing that the paper remains on up to this point. Then again, take the sheet of veneer the length and width of wrest plank; it is obvious that this crosses the first veneer from end to end of wrest plank. While further on it states that the reason one veneer crosses the plank and the other is put on straight is to prevent the plank splitting, which shows that two veneers are used. As to gluing the back together, I cannot see any great difficulty with a friend to assist you. Warm one end first; while you are gluing this end, the other end is at the fire; then reverse the positions, and the end you have glued is being kept warm while you are gluing the other. You ask which side of wrest plank is glued to back. It is stated that the front veneer is put on straight, showing this is the front side of the plank. I hope that this will remove the doubts from your mind.

We always deem it a pleasure to enlighten our readers on any point that may not seem clear to them.—T. E.

Tin Foot-Warmer. — O. C. (*Hampton*). — The end of a foot-warmer, such as you describe, is what is termed "capped," or slipped on, as distinguished from knocked up, or double-seamed, as some call it. Make your body of good strong tin, or when you solder round the bottoms the body will buckle inwards and look bad. Lay the body on a piece of tin and mark round it; cut ⅛ larger all round. Now if you want hollowed ends you must cut a little different (see illustration). The inner line represents the body, the outer line the bottom—marked out to be put on flat—and the dotted line how to cut it for hollowing. The more you hollow the more curve



Tin Foot-Warmer.

you must give on the sides, and allow more margin. Notch off the two corners, and with a mallet, or the end of your crease iron, or anything with a square edge, turn up the bottom; now offer it on the body, and see if you think it wants any trimming; if not, then turn the other two sides as far as the place marked ×, on the same tool as before; then take a round end tool, or small half-moon stake; or, if you have nothing of the sort, then a piece of inch-round iron, with the end bevelled off and fixed on the vice, will answer. Turn up the rounding part on this; it will probably pucker. Lay on a flat tool and tap with a light hammer. Run round again on the tool to smooth slip on and solder.—R. A.

Hot Water Heating.—EXCELSIOR (*Kennington*). —As the system you refer to is Bacon's patent, I should advise you to apply there for a description.—J. S.

Classes for Plumbing.—EXCELSIOR (*Kennington*).—I know of no class for teaching plumbing in the district referred to. There is a book on plumbing by Davies, published by Bemrose.

The Laws of Chance.—CEPHAS.—This is quite out of my line; I cannot, therefore give an answer, but I may say there are *no laws of chance*. Probabilities of duration of life are determined by empirical formula based on observed facts, and used by assurance societies. The odds reckoned by betting men have no foundation in mathematics because there are no data to go upon; although they can give you a formula by which you *must* win, they never seem to make fortunes themselves. The question, though disguised, looks very like horse-race gambling, and, perhaps, comes from some youth who is taking his first step to ruin on the turf.—F. C.

Tools and Patents.—UNCERTAIN (*Liverpool*). If you wish to make and use patented tools, your best plan is to act honestly and obtain the patentee's permission, otherwise you may make yourself liable to the costs of an injunction to restrain you from using them.—F. C.

Taking Out a Patent.—M. T. (*Hawkhurst*).—The *Illustrated Official Journal* is published at the Patent Office Sale Branch, 38, Cursitor Street, Chancery Lane, London, E.C., every Wednesday. Price 6d., by post, 8d. Annual subscription, including postage, £1 15s. Annual subscriptions to date from Jan. 1st. Subscriptions not received for less than three months, commencing with the 1st days of January, April, July, or October. Payments (which must be in advance) may be remitted by postal or post office order.—C. C. C.

A Sweating Roof.—A corrugated roof cannot "sweat;" it must become moist by precipitating the moisture from the air in the building, the same as occurs upon the insides of window glass in cold weather. The remedy is to line the roof with some non-conducting material such as felt, or a thick coating of non-conducting paint.—F. C.

Microscope Lenses.—T. P. D. (*Glasgow*) complains that he has not been able to secure lenses from Lancaster according to the focal length given in my article on the microscope. I have a letter now lying before me received from Messrs. Lancaster saying they continue to supply all kinds of lenses to amateurs and others. Now it is just possible that lenses of the exact focal length were not in stock, yet the lenses sent may be equally serviceable. The focal lengths given in my article were *typical*, and there is no absolute need why they should be rigidly adhered to, as long as the principle is observed. I have placed in the hands of the Editor a short paper dealing with eye-pieces exclusively, and which, I have no doubt, will help T. P. D.; in the meanwhile, I will say that the focal lengths of the lenses must be as 2 to 1, and the diameter about 2 to 1. That is to say, suppose the field lens is 1½ in. focus then the eye lens must be ¾ in., and so on; whatever may be the focal length of the field lens, the other stands in the same proportion. They must be separated one half the combined focal length: for example, 1½ and ¾ added equals 2¼; they must be separated therefore one half that distance, or 1⅛ in. This rule must always be observed. The field lens will be about 1 in. in diameter, consequently the eye lens will be about ½ in. In a postscript T. P. D. gives measurements of the lenses. I presume he has secured eye lens 1 in. focus, field lens, 2 in. focus. Well, this will make a very good low power eye-piece; let them be separated 1½ in. As to O.G., well, that will depend on the length and strength of one's purse. Some years ago I had an excellent 1-in. O.G., foreign, from Mr. Lancaster, the price of which was 7s. 6d. T. P. D. further says, "I wish to say I am very pleased with the design, it has a very handsome appearance." I am grateful to know this. Several letters have come to hand stating the same opinion as to the design. I am always glad to know I am helpful to any one.—O. B.

Work on Slöjd.—W. J. B. (*Manchester*).—"Slöjd" as a means of teaching the essential elements of education, by Emily Lord, foolscap 8vo, 6d. (Cassell & Co.), is such a book as you require.—F. J. C.

Straightening Wire.—W. G. (*Glasgow*).—Tinmen's rollers (not rolls) would be of very little use to you for straightening wire of such small gauges as you mention. The method shown by A. E. D. in No. 34 is as good an arrangement as you can have for long lengths. I should not use too many pieces of wire in the block, and not put them too much on the zigzag, or it will be harder work; for short lengths of wire, block of hard wood and a light hammer, assisted by the thumb and fingers, will do all that is necessary. Tinmen's rollers vary in price from £3 5s. and upwards to £15, and may be had from Rhodes & Sons, Wakefield; Fenn, London Bridge, and others.—R. A.

Shooting Board.—A NOVICE (*Clapton*). — An article will be devoted to this subject.—D. A.

Book on Organ Building.—YORKSHIRE BITE (*Liverpool*).—I am sorry that I cannot refer you to any books on organ building on the tubular pneumatic principle other than those to which you refer, and which will not suit your purpose. I am also unable to give you the names of towns in the United States (East), New Zealand, Australia, and the Cape of Good Hope, in which the trade of organ building is carried on. Perhaps some other contributor to WORK may be able to give this information.—M. W.

Taking Out a Patent.—A. B. (*Brockley Road*). —If A. B. wishes to determine his patent at any given time, he has only to discontinue his payments. —C. C. C.

Taking Out a Patent.—A. D. (*Bury*) writes:—"I think that the article, 'How to Take Out a Patent,' will be a means of greatly assisting a good many poor inventors. Having procured my own patent provisional protection, I can truthfully say the information is all that is desired; but if you had put at foot of article that a circular of information can be obtained at Patent Office, through post, free, it would have made it more generally known." I am glad to publish A. D.'s hint, and I may add that, so far as I can speak from my own experience, if one asks the Patent Office authorities for information on any point, the reply will come in the form of a pamphlet, post free, with the paragraph containing the information sought indicated by a mark in red or blue, though it should be noted that the Comptroller-General announces that he does not give legal advice or opinions on matters connected with the Patent law.—C. C. C.

Taking Out a Patent.—B. D. (Patent agent).—This gentleman I have to thank, as well as J. S., for kindly pointing out the oversight with regard to Form A¹. The error is not really of any serious consequence, as an inventor, applying at a post office for the form in question, under an erroneous impression, would at once be told by the postmaster, or would see from its heading, that it was not the thing required. But I am none the less indebted to B. D., since the criticism of practical men is the best and perhaps the only means of correcting such slips as are liable to occur in the most carefully-written book or article.—C. C. C.

Fret Designs.—H. W. (*Liverpool*).—Designs issued by the leading publishers in Germany and England can be got through their agents or factors in this country. For German designs apply to Messrs. H. Zilles & Co., Wilson Street, Finsbury, London, E.C. The Italian designs can be procured from Mr. Busschotts, Park Lane, Liverpool. Whether either of these firms will supply you at "wholesale prices" depends entirely on the quantity you are prepared to order. Small lots for your own use you cannot reasonably expect to get at wholesale quotations.—D. A.

Salt Melter.—J. R.—The only solid which will melt salt is ice. In winter, salt is scattered over ice to melt the latter, but the action is reciprocal, and the ice melts the salt as much as the salt melts the ice. But salt is so very soluble in water, 2½ parts of which will melt or dissolve 1 of salt, that if you moisten the salt with a few drops of water, it will probably melt the whole, forming a syrupy liquid. If you had mentioned your object in melting salt with a solid, I could have answered your question more usefully.—F. B. C.

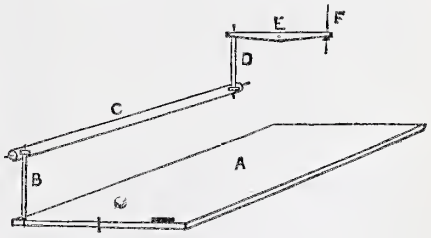
Wrought Iron.—A. S. (*Forest Gate*).—I presume you mean the bent iron work, which is now becoming a ladies' leisure occupation. This is very simple as there is no heating or welding of the iron required. Small rods of rectangular section are employed, varying in width from ⅜ in. to ⅛ in., and from $\frac{1}{16}$ in. to $\frac{1}{32}$ in. in thickness. These are bent with pliers into artistic curves, and united one to another with little hoops of iron. The effect is very pleasing, and the only difficulty is in bending round and making the loops quite secure, without which the articles would lack rigidity. You may either work out your own designs, or you may purchase a good selection from Miss Cheyne, 24, Barons Court Road, West Kensington, for 3s. 6d. Lamp brackets, stands for glasses, light fire screens, suspending lamp supports, lamp shades, hanging pots for ferns, candlesticks, lantern frames, and many others are designed and made in the bent iron. The iron work is finished and protected from rust by giving it a coat of Judson's artist's black, or a Venetian black, sold by Messrs. Powell and Sons, 22, Alfred Place West, South Kensington.—J.

Bamboo.—WOODWORKER (*Southsea*).—For such a small quantity of bamboo as you require, your best plan will be to obtain it from some local cabinet maker who deals in bamboo furniture. If you cannot obtain it in this way, Ellmore & Sons, City Road, London, E.C., might possibly oblige you. I cannot advise you about using up your broken glass. Your idea concerning it seems altogether impracticable.—D. A.

Gassner Dry Battery.—G. A. B. (*Ascot*).—The cells may be made of any size and in whatever shape you may choose. The shape and size will not in any way affect the power of the battery, the E.M.F. of each cell being the same for all sizes. The size of the cells does, however, affect the volume of the current. Large cells give a larger volume for a longer period than small cells. Make them 3½ in. square by 6 in. in height, of ⅛ in. zinc, and charge them with equal parts—by weight—of powdered gypsum and zinc oxide, sprinkled with a little chloride of zinc solution. Seal with pitch, or with marine glue, leaving two holes in the top for ventilation.—G. E. B.

Work on Engraving and Etching (for Beginners).—A. B. H.—We know of no really good work on this subject, except a most expensive work by our great English etcher, Hamerton. We hope, however, one day to give a few rudimental hints on this subject, which the present demand for our valuable space will preclude, we fear, for some time to come. Why not consult some copper-plate engraver?—J. W. H.

Organ Pipes and Connecting Action.—ORGAN BUILDER (*Macclesfield*).—The large pipes at the sides of the sound-boards of small organs are generally those of the lower notes of the manual, and are usually placed alternately right and left of the sound-board. Thus C C would be on the right hand, and C C sharp on the left hand. The action connecting the keyboard with these pipes is generally a roller action, of which a sketch is now given. The rollers are placed close together on a vertical board at the back of the keyboard, and each roller works in a stud at each end the same as the roller of a common roller window-blind. It will



Organ Pipes and Connecting Action.

A, Keyboard. B, Sticker to roller arm. C, Roller. D, Sticker from roller arm to backfall. E, Backfall. F, Pull-down of valve.

be seen that it can be made to carry the action of a key to any reasonable distance right or left of the keyboard. When the key is pressed down it pushes up the sticker, which, instead of being connected with the backfall, is connected with the arm of the roller immediately over the key tail. The arm at the other end of the roller is immediately under the end of the backfall connected with the valve of the channel supplying the pipe, and a sticker pushes the back end of this backfall up and thus brings down the front end, and with it the valve. Pipes brought to the front or sides (as show pipes) usually have the wind conducted to them from the channels by conducting tubes. The rollers may be of wood 1 in. in diameter, or of iron gas piping ⅜ in. diameter. The arms are about 1½ in. long.—M. W.

Nickel-Plating.—G. B. M. (*London, W.C.*).—As a nickel-plating plant suitable to the purpose would cost at the least £4, and you can get the hoop plated at a cost of as many shillings, it follows that it will not pay you to plate it yourself. There are several shops in Clerkenwell where it can be done. I hope to describe the whole process of nickel-plating in a future number of WORK.—G. E. B.

Zinc Binding Screws.—G. A. B. (*Ascot*).—I cannot see any advantage in these over brass screws. On the contrary, zinc would be more brittle and more easily attacked by acid and other fumes. I may give illustrated instructions for making a model arc lamp in my papers on "Model Electric Light," but cannot do so here.—G. E. B.

About WORK.—J. B. (*Manchester*).—It would not be practicable for us to include any later numbers than at present in the monthly part. The requirements of wrapping, packing, and delivery prevent our doing so. The journal to which you allude in your letter can be produced considerably in advance of publication, but WORK, consisting of different material, cannot be so treated. Our "Answers to Correspondents," for instance, is a feature which necessitates our delaying going to press till the last moment.

Piano Keys.—SALFORD (*Stockton*).—You do not state whether your piano keys are ivory or celluloid. As each requires different treatment in the polishing, I had better give you both methods. As you have made them level with glass-paper, make a pad with flannel or light-coloured cloth, and put round a small piece of wood, that you can hold conveniently in the hand. If for ivory, make a paste on your pad with whiting and methylated spirit, and rub briskly to and fro, until you have got a polish, and finish with a little tallow on the palm of the hand and rub over them; wipe with a soft linen rag. For celluloid, make the paste of pumice powder and paraffin oil, and use as in polishing ivory. Celluloid may be known by being opaque, and warmer to the touch than ivory.—T. E.

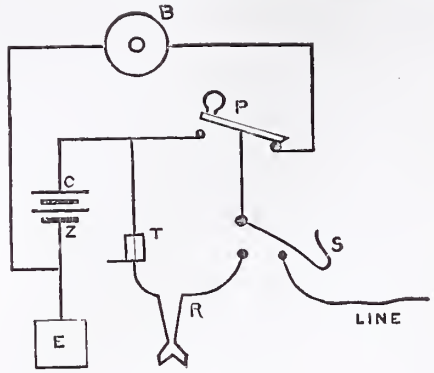
Enamelled Iron Signboards.—J. R.—The task J. R. proposes to himself is not only utterly beyond the scope of any amateur, but requires very expensive furnaces and other plant. If J. R. succeeded, he would probably find himself involved in two lawsuits: one for infringement of patent rights, and the other for interfering with the royalty of Willing & Co., King's Cross, who have the sole right to make these signs in the United Kingdom.—J. W. H.

Agglomerate Blocks and Electric Bells.—A. W. (*Glasgow*).—As the blocks you have seen in a Leclanché cell are made of crushed manganese and carbon, by machinery, and are consolidated by enormous pressure whilst hot, they cannot be successfully made by an amateur. Full illustrated directions on how to make an electric bell have been given in the series of articles on "Burglar Alarums," published in Nos. 12, 18, and 20 of WORK. Directions for winding the coils were given in No. 18, page 279.—G. E. B.

Inattention to Electrical Queries.—J. L. R. (*Stamford*).—If you sent a query to the Editor, it would have been forwarded to me, unless lost in the post between yourself and the office. If forwarded to me it would have received prompt attention, and have been registered. On looking over my register of letters I fail to find any bearing your name or initials, so think you must have made a mistake. Nickel-plating with a dynamo turned by hand would be equal drudgery to turning a grindstone all day.—G. E. B.

Type-writing Ink.—TYPE-WRITER.—(1) We have no information on the above subject. We believe, however, that if you will address Messrs. F. Stanbury & Co., West Harding Street, E.C., or Messrs. Fleming & Co., Leith, Edinburgh, both ink manufacturers of high standing, who employ chemists expressly to make experiments, you will find the article you want. (2) Any printed matter can be rendered copyable by dusting with a mixture of protosulphate of iron and gallic acid, well pounded in a mortar till a very fine, almost impalpable, powder is obtained. Dust over with a well-baked hare's foot, and take care the paper is perfectly dry, the ink "tacky," and that no powder is left adhering, except on the printed parts. The copying paper ought to be rather moist. Your black ink, as you admit, is not first-rate, but this, we think, is due a good deal to the use, at any rate in this case, of too hard-sized a paper. A soft-sized paper would give a much better result.—J. W. H.

Telephone Connections, etc.—E. M. (*Cheltenham*).—The reasons why I did not go fully into the subject of practical telephony in my article are various, the principal one being I had not sufficient time at my disposal to devote to that subject. Below I have given a sketch of telephone connections, which I think you will easily understand. It is only for one end of the line; in connecting the other end the carbon and zinc of the battery will have to be reversed. I have not reproduced your arrangement of switch-board and connections. About the electrical engineering I do not know how to advise you, as in one part of your letter you ask not to be referred to books, while in another you want to know what books to read. Now don't you think that is just a trifle inconsistent. And besides, an electrical engineer is quite different from "a man to take charge of a dynamo." If that is the height of your ambition it will be as well to stick to your present trade. However, as you want something to read up, try "Dynamo Electric Machinery," by S. P. Thomson, published by E. and F. Spon. When you have completely mastered that, if you write again I will give you the title of another—that is, if you are still determined to go in for electrical engineering. As I did not write the articles on the aquarium and fountain, I may be allowed to say that I consider the whole thing a very capital arrangement, suitable for any "drawing-room or dining-room." It would certainly be an ornament wherever it was placed. Your idea of making the fountain automatic is also a capital one, and would be very easily accomplished, if it

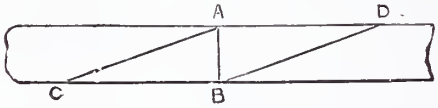


Telephone Connections.

S, Spring which is kept down by weight of receiver hung on hook. P, Press button with back contact. B, Bell. T, Transmitter. R, Receiver.

were possible for a man to carry himself round a room by the band of his own trousers. You need not apologise for writing. It is always a pleasure to assist amateurs.—W. D.

Splicing Bicycle Tire.—A. C. (*London, W.*).—The tire must be removed entirely from the rim, then with a sharp knife dipped in water make a clean even cut on the line, A C (see sketch), on the *outside* of the tire, that is the side that comes in contact with the ground. Make another similar cut on the line, B D, both cuts starting from the



Splicing Bicycle Tire.

cross line, A B; this will take in the tire two inches. Now to join them. Get a bottle of Snell & Brown's Octopus rubber cement, coat the two cut surfaces, and leave aside *not joined* for two or three hours, then join them carefully and evenly, pressing them well together; now you will not be able to pull them asunder. Snell & Brown's cement from any of the cycle stores about London, bottle 1s.—A. S. P.

Cutting Zinc Pipe.—H. Y. (*Sutton*).—You do not state the size or the thickness of the pipes that you are in the habit of cutting, but if it is thin zinc pipe such as used for rain-water pipes, etc., a saw is not the proper thing to use to cut them with, as it would hang and jag the metal too much; besides, a saw is of no use for hard metal pipes unless they can be held in a vice, and you cannot hold zinc pipe in a vice firmly enough to resist the pressure of the saw. I use for cutting zinc pipe a half round file, any convenient size, say 10 in., and never attempt to cut two pieces so that they will match as an angle; I find it less trouble to cut the pipe straight across, and then to trim it to whatever angle I require it with the snips; or I should, if making up the

Sketch to illustrate Gauge for cutting Zinc Pipe.

pipe myself, cut the angle out in the flat. To hold the pipe firm whilst cutting I slip it partly on a mandrel; this holds it sufficiently firm for the file to work against. If, however, you still wish to cut the pipe to an angle, I suggest that you make a kind of gauge of stout iron, say $\frac{1}{16}$ thick; get this to the angle that you want to cut your pipes, slip it over your pipe, have it sufficiently long to afford a grasp, and do not let it meet by $\frac{1}{8}$ of an inch, so that, when you hold it, it will clip the pipe tightly; you can then file round the pipe, keeping the flat edge of your file to the gauge; when cut in two it will be sure to match. The sketch will show what I mean more clearly perhaps. I trust this will be of use to you.—R. A.

Lenses.—A LOVER OF "WORK."—Your object glass is a double convex lens cemented with Canada balsam to a plano-concave, but without seeing the glass I could not speak with certainty as to the nature or cause of the spots you describe. If it has become cloudy in places through damp, I believe it is incurable, but possibly they are caused by air bubbles which have formed in the balsam. As object glasses are extremely liable to be scratched and consequently spoiled in inexperienced hands, by far the best way would be to send it to some practical optician such as Mr. Lovegrove, High Street, Slough; but, as you evidently wish to attempt their separation and repair the mischief yourself, you must first of all mark the edge of the combination with a cross, using the edge of a file moistened with turpentine for the purpose, so that on replacing them they will occupy the same relative position to each other. The balsam may be dissolved by immersion in benzole, after which the surface should be gently rubbed with chemically clean cotton wool, dipped in absolute alcohol, several pieces being applied in succession until all the balsam is cleared away and the surface of each lens appears bright and clean, the final polish being given with a piece of new and perfectly clean wash leather. To re-unite the lenses, cut out a hole the exact size of the plano-concave in a piece of stout cardboard about 4 in. square, so that when the lens is mounted or inserted in it the balsam which oozes out all round will be prevented from reaching the plane face of the lens, which should now be laid on a piece of clean white paper, and a few drops of Canada balsam dissolved in chloroform or benzole applied to the concave side; then, to prevent the formation of air bubbles, dip the convex lens in turpentine, and, noting which is the inside face, lower it gently into its original position. It must now be put away in a warm place for a week to harden, when the cardboard and any balsam on the edge must be carefully removed with a knife. Should any balsam have reached the face of the lens, recourse must be had to the cotton wool and alcohol as before, but the smallest possible quantity of alcohol must be taken up at one time lest it attack the balsam in the joint. Canada balsam may be had ready prepared for use, as also the other chemicals mentioned, from Mr. W. Hume, Technical Chemist, 1, Lothian Street, Edinburgh, or any of the dealers in mediums for mounting microscopic objects.—T. R.

Telescope Dining Table.—W. T. A. (*Stockton-on-Tees*).—This subject will be dealt with in course of time, but I cannot say when, as there are so many articles in hand at present. To give all particulars with drawings is not possible in "Shop."—D. A.

Repairs to Chairs.—A. H. (*Mitcham*).—As I do not know the construction or kind of chairs which have become rickety, I am afraid I cannot advise you definitely what to do beyond telling you that your safest plan would be to submit them to some practical man accustomed to chair work. If you will let us know what kind of chairs yours are, if possible giving a rough sketch, I shall probably be able to tell you how to treat them. If they are valuable I can hardly recommend you to attempt to repair them yourself. Writing in the broadest sense, the only way to make a thoroughly good job is to rework the joints, but if the frames are only loose at the back legs you might "botch" them by running a screw nail through the feet into the framing. You will have no difficulty in perceiving that in either case you run a considerable risk of spoiling your chairs.—D. D.

Swiss Pine.—DICK WHITTINGTON.—I cannot find any yard where "Swiss pine" can be bought, but I am given to understand that American white-wood answers the same purpose, and this can be bought in most timber yards at the following prices, planed ready for use: $\frac{1}{8}$ in. 2¼d., $\frac{3}{16}$ in. 2¾d., ¼ in. 3d., ⅜ in. 3½d., ½ in. 4d., and 1 in. thick unplaned from 3d. per foot. This can be obtained in High Street, Peckham, and the thinner sizes at Lothan's, Curtain Road, E.C.—A. J. H.

Clock Movement.—YOUNG WATCHMAKER.—I am afraid you will have some difficulty in getting a movement to fit the case as it is so narrow, for the dial work, with dial and hands, will take quite an inch unless cut too close to be safe; then there is room at the back, for the pendulum will require at least ¾ in., so that leaves ¾ in. for plates and trains. I don't think you can do it, to be at all certain of its going correctly; the only thing I can see would be to widen the case another 2 or 2½ in.; could you do that? if so, then you would have ample room. I don't like to crowd work if any way possible; if you can't do that, then I could only suggest a drum timepiece or clock, or you might squeeze in a French movement, or an American Echo timepiece, or one of the small striking clocks of Seth Thomas; or why not get the necessary wheels and make a plain timepiece to suit? or as a last thought a Vienna movement striking; you might do that with a short pendulum and a higher number scape wheel.

Composition for Raised Ornament.—H. S. F. (*Worcester*)—For raised ornament to be painted or gilded, probably the raising composition described on page 186, Vol. I., would be the thing required. It is made of whiting, with a little flake white, and mixed with gold size to the consistency of treacle. This is laid on with a brush. H. S. F. is warned not to attempt flat formal patterns in this unless he has time and patience to pumice his raised work to a level surface.—S. W.

Tar Paving.—W. B. (*Sussex*)—A *modus operandi* is as follows:—First ram the ground to an even surface, giving it any falls that may be requisite, and then spread over the ground a thin coating of heated coal tar, mixed with coke broken small. Next put on the top of this about two inches of sifted ballast, and on this the tar and coke as before, working it well between the ballast; the siftings of which may now be dusted on the top and the whole rammed.—E. D.

Cement Fastener.—O. R. (*Bolton*).—You will find that Le Page's "fish glue" mixed with a little zinc white will answer your purpose for fastening ivory on the keys of pianos, especially as you wish to stain the new ivory to match the old. A simple way to get the stain you require would be to boil the ivory in a strained decoction of the dry outside skin of an onion, finding out by experiment how strong the mixture should be, and how long the ivory must be immersed.—E. D.

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET,

Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

Ask at all Tobacco Sellers, Stores, &c., and take no other.

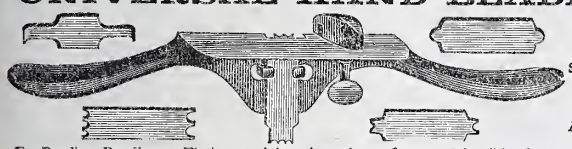
Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

NOTE.—Our New Illustrated 200-Page Catalogue is now ready, containing 700 Illustrations, of all the Latest Improved Tools for Carpenters, Joiners, Engineers, and all Metal Workers, Carvers, Fretworkers, &c. By post, **6d.** The Polytechnic List of Tools for Students on application.

UNIVERSAL HAND BEADER.



Iron Stock, with Seven Steel Cutters, **5s.** each.

Free by Post.

For Beading, Reeding, or Fluting, straight or irregular surfaces, and for all kinds of light Routering, this Tool is invaluable to Wood-workers. Seven superior Steel Cutters go with each Tool. Both ends are sharpened, thus embracing Six ordinary Sizes of Beads, Four Sets of Reeds, Two Fluters, and a Double Router iron (⅛ and ¼ inch). The Cutter is firmly clamped to the Stock. A Gauge with long straight bearing surfaces is used in ordinary work; and a Gauge with oval bearing surfaces is used for curved or irregular forms of work. Either Gauge can be shifted from one side of the Cutter to the other, without separating it from the Stock, and can be rigidly set at any required distance from either side of the Cutter.

Note the Address—**MOSELEY & SON, 323, High Holborn, W.C.**

HENRY MILNES,

MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING,

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,

TOOL MAKERS,

DUBLIN.

WATERPROOF FLUID GLUE.

(Patent.)

By post, **1s. 3d.** *and* **8d.**

WATERPROOF GLUE CO.,

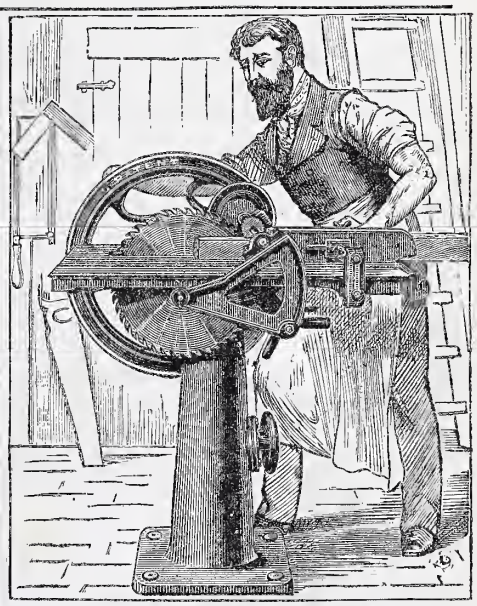
62, Dale Street,

LIVERPOOL.

MONTHLY, *4d.*

CASSELL'S

TIME TABLES.



"THE LEYTON"

New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of Mason's Extract of Herbs makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

Post Free on Application.

CASSELL'S CLASSIFIED CATALOGUE.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.

37, CHANCERY LANE, LONDON, E.C.

RUBBER STAMPS.

H. SAVAGE, Manufacturer and Patentee.

Rubber Stamps, Rubber-faced Type. The "Climax" and other Dating Stamps. Patent Ink Pads, &c. &c.

Makers of Boxes, Mounts, Presses, Vulcanizing and Moulding Machines, Brass Turned Ovals and other Shapes.

MATERIAL and all Supplies for the Trade. State your requirements to

H. SAVAGE, 33, CHEAPSIDE, LONDON.

ASPINALL'S ENAMEL.

COLOURS—EXQUISITE. SURFACE—LIKE PORCELAIN.

Testimonials from the Queen of Sweden, the Marchioness of Salisbury, &c.

FOR ALL SURFACES OF WICKER WOOD, METAL, GLASS, EARTHENWARE, CHINA, &c.

"Simply Perfection."—*The Queen.*

Made in over 100 Colours. Sold in Tins, 4½d., 1s. 3d., and 2s. 6d. For Baths (to resist Hot Water), 1s. 6d. and 3s. Post free, 7d., 1s. 6d., 3s.; 9d., 1s. 9d., and 3s. 6d.

READY FOR USE. A CHILD CAN APPLY IT.

SOLD EVERYWHERE.

ASPINALL'S ENAMEL WORKS, LONDON, S.E.

Telegrams—EDWARD ASPINALL, LONDON. COLOUR CARDS FREE.

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6d. OR FOR 7 STAMPS BIRMINGHAM. [33

GRATEFUL—COMFORTING.

EPPS'S COCOA

BOILING WATER OR MILK.

Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic WEAKNESS speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be Healthy and Strong permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercisers. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place),

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 59.] SATURDAY, MAY 3, 1890. [PRICE ONE PENNY.

SOME MOVABLE GARDEN FURNITURE.

BY ARTHUR YORKE.

MOVABLE GARDEN FURNITURE—A RUSTIC CHAIR—MATERIALS—A RUSTIC TABLE—VARNISHING AND PRESERVING GARDEN FURNITURE.

IN these days, when garden parties have so much usurped the place of the more substantial (and costly) hospitalities of our fathers, movable garden seats and garden tables have become matters of some importance. In nothing else can they be made in such good taste and keeping as in rustic work, and those who have a turn for garden carpentry will naturally wish to try their skill on them. Now, strongly as I advocate rustic work in general, I am obliged to own that, as regards movable seats, that style of work has not always been very successfully employed. Rustic chairs are too often neither sightly, comfortable, nor light for removal. In fixed seats, either for the summer-house or for the open air, we can do well in rustic work, but rarely in those which are not fixed. Larch, our best material, will not lend itself kindly to chair-making, and in crooked stuff it is a hard matter to get either an artistic design or a comfortable seat.

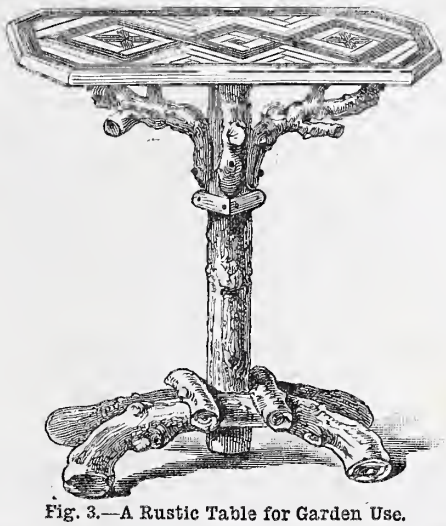


Fig. 3.—A Rustic Table for Garden Use.

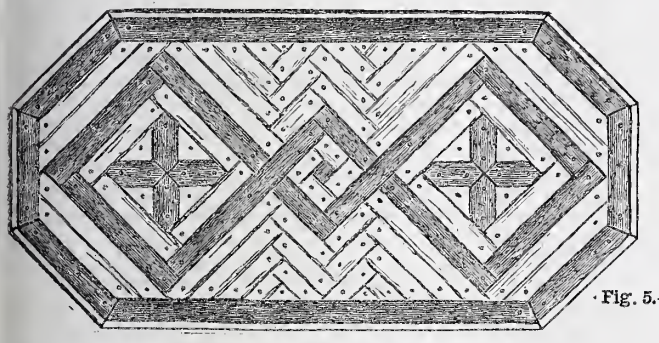


Fig. 5.—Top of Table in Rustic Mosaic Work.

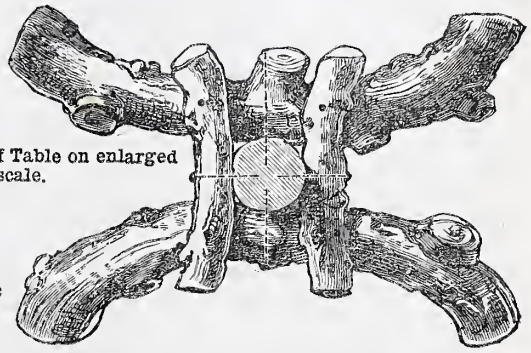


Fig. 4.—Foot of Table on enlarged scale.

Fig. 2.—A Support of the Seat.

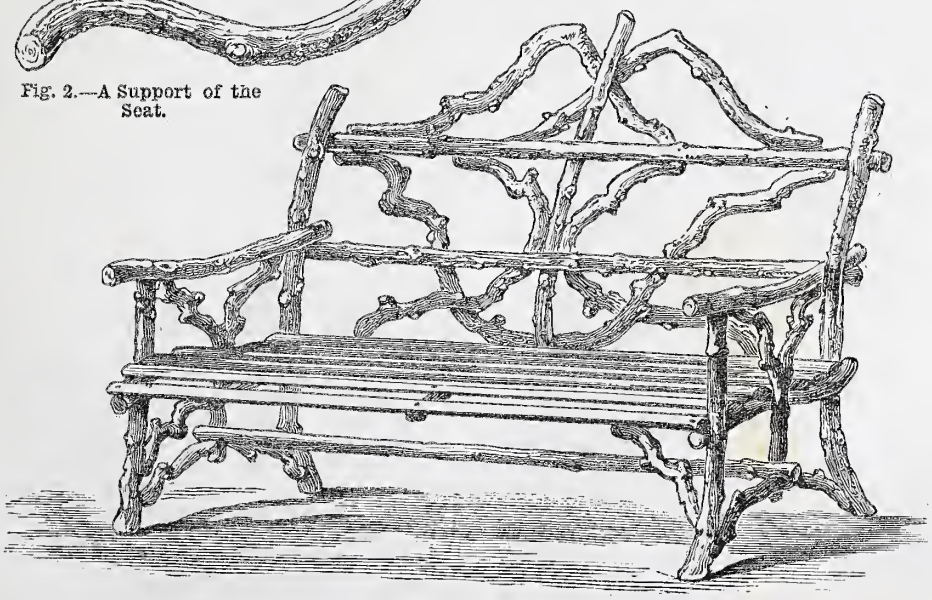


Fig. 1.—A Rustic Chair for Garden Use.

Still, since in a set of papers like the present the reader has a right to expect something of the kind, I have in Fig. 1 given a design for a movable seat in which an attempt has been made to unite comfort, appearance, and reasonable lightness. It is important, in such a piece of furniture as this, that there should be nothing that will hold water. A "gridiron" arrangement of the seat—one, that is, of sticks only—is much to be preferred to one of continuous board; and this point has been kept in view in the present example. Much of the back and ends will be seen to be formed of crooked stuff. It is likely that in the material at the disposal of the worker, he may be unable to find pieces which will very exactly tally with the curves given, for the growth of branches is highly eccentric. He must, therefore, rather look upon the drawing as suggestive than as a plan to be closely followed. His best chance of keeping near to it will, of course, lie in having a good quantity of stuff from which to select. The three pieces which support the rods forming the actual seat are, for the sake of comfort, of the form shown in Fig. 2. Such curves are frequent, and even in a small quantity of crooked stuff, it will not be hard to find three pieces of suitable growth; and of course their upper sides can be so trimmed as to make them correspond with tolerable accuracy.

Fig. 1 is not drawn to scale, but the dimensions of the chair are about 4 ft. long, 3 ft. high to top of back, and the actual seat 16 in. high, and the same in breadth.

Whether rough wood with its bark on or peeled wood should be used is much a question of taste; but, in any case, our favourite larch will not

be suitable for any part of the work. If white peeled wood is preferred—and this will make the lightest chair—it will be well to use withy for the straighter parts of the frame; also for the seat, which should be of withy rods 1 in. or so in thickness, or, if they are used split, somewhat thicker. The crooked parts would then be of peeled oak bangles. Should, however, wood with its natural bark be chosen, nothing will be better for the straighter parts than small elm saplings, except for the seat, where springy hazel rods should be used. Elm or apple-tree branches will in this case serve for the crooked work.

The carpentry, as shown by the illustration, is of the most simple kind. There are no mortises, all the pieces being merely nailed together.

To produce satisfactory garden tables is a much more easy matter. In Fig. 3, we have a movable rustic table of a size to be readily lifted from place to place, though so far solid in its lower part as not to be easily upset, which is a point of importance. The perspective view of this in Fig. 3 is not drawn to any exact scale, but it will be found close upon ½ in. to the foot. The dimensions are:—Height, 2 ft. 2 in.; length of top, 2 ft. 2 in.; breadth of top, 1 ft. 1 in.

The pillar, which forms rather an important feature in this table, cannot be made of anything more suitable or better looking than a piece of elm sapling. I mentioned this wood above as good for some parts of our rustic chair. In some districts where elms abound, such wood is easily to be got, the young elms springing up so thickly in the hedgerows that the majority have to be thinned out to allow the others to grow into timber. These young elms have commonly a very ornamental bark—the young wych elm in particular is frequently almost as picturesque in appearance as virgin cork. The piece required will be 1 ft. 11 in. long, and should be about 3½ in. in thickness.

The foot, which appears in plan (from above) in Fig. 4, is made of four pieces of rough, crooked stuff, the two larger ones not quite so thick as the pillar, but still sufficiently heavy to give the table a solid foundation. These larger pieces are 21 in. long, and the shorter ones about 10 in. Probably, no difficulty will be found in meeting with pieces of the curve shown; the curved side, it will be seen, is placed downwards and outwards, so as to ensure as firm a standing to the table as can be attained. In the upper and smaller pair, the curved form is only chosen because straight pieces would not look nearly so well. The illustration (Fig. 4) shows the foot pieces to be fastened to the pillar and to each other with large nails.

These pieces are drawn as of rough and knotted apple-tree wood, which of all others will be the most solid and the most picturesque for the purpose. Failing this, elm would do, or oak still better, provided sticks of the size can be found with the bark on. For the struts, it will not be difficult to find suitable branches, which, whilst they may differ, perhaps, in their details from those in the drawing and from each other, will yet in a general way agree with both, and give to the eye that satisfaction which arises from symmetry.

The top (26 in. by 13 in.) should be of 1 in. board, and as a safeguard against warping should have a couple of cross-ledgers screwed below. The ends of the struts should be let into mortise holes in these ledgers and firmly fixed there with screws. It is desirable that the struts should be well secured, so that no play of the top may be possible, for the foot is tolerably heavy, and when the table is lifted it is pretty certain to be by its top.

The upper surface, with its decorations of rustic mosaic, is shown to scale in Fig. 5. This kind of work has been fully dealt with in a former article. The dark bands in the present example are supposed to be of split hazel rods, and the filling-up between of peeled withy. The strip running round the edge of the table is also of the latter. Figs. 4 and 5 are drawn to a ¾ in. scale.

With a view to its proper preservation, our garden furniture should have a coating of inexpensive oak varnish, and an occasional revarnishing will be desirable. Movable seats, such as that in the design, will, of course, be housed during the winter, but through the summer the chances are that they will be left altogether exposed. The chair I have described is so made as to suffer very little from such exposure; the table, however, is an article which should be put under cover when not in use. A mere wetting will not hurt it, but if left so that the rain water can stand on its top, the bark will, notwithstanding varnish, crack and peel off, and the wood decay.

HINTS FOR WATCH WEARERS, AMATEURS, AND OTHERS.

BY HERR SPRING.

I propose to write some plain and simple facts about timekeepers, which may prove of service to the readers of this journal, and, through them, to the public at large.

The machinery of a watch is not unlike that of the human body. Every one knows some little about a watch, but only a specialist understands its inner workings, and even he, like a doctor, is often deceived in his diagnosis. Many simple rules have been laid down for the regulation of the human body, but very little is known as to the proper means of preserving the watch in the best working order. But there is no valid reason why much more may not be done by the general public, and particularly by the amateur mechanic, to increase the accuracy and usefulness of watches.

It cannot be said that such increased usefulness would be unworthy of some effort, for a moment's thought enables one to realise that watches and timekeepers of every kind are among the chief factors of modern life and civilisation.

A stranger going along a thoroughfare will often observe some peculiar object which has never been detected by a person who has passed and repassed the spot for half a generation, the simple explanation being that familiarity has blunted his sense of perception. It is much the same as regards timekeepers, which play such a wonderful part in the high-pressure life of the nineteenth century, and are so familiar to us that we rarely give them a passing thought. But only imagine the world awakening to-morrow morning to find all the timekeepers at a standstill, or all the wearers of watches reduced to the necessity of carrying in their pockets the watches worn in the days of their grandfathers. What confusion such an idea suggests in this age of lightning express trains and telegraphs!

In a less degree the inaccuracies of modern watches, small comparatively though they be, must have an influence not to be lightly under-estimated when we come to count the wearers by millions; and to assist in diminishing those inaccuracies is the object of the present writer.

The first point which a wearer must always steadily bear in mind is that a watch must be cleaned at least every eighteen months. This is of vital importance, not only for the purpose of good timekeeping, but also to preserve the machinery in proper order. But obvious as this is to those skilled in the art of horology, it is one of the points most frequently disregarded by wearers.

People often imagine that this advice is merely a plot hatched by watchmakers for their own benefit, and that so long as a watch seems to be keeping good time there is no reason why it should be interfered with; and in this we encounter the most widespread and most hurtful heresy indulged in by the public. Most people believe, and strenuously maintain, that a watch which has been lying in a drawer carefully wrapped up for years cannot possibly be dirty, ought to go when wound up as well as on the day when it was laid by, and cannot, on any account, be in need of cleaning.

But the simplest rudimentary knowledge of the true fact would cause this foolish idea to be dismissed for ever.

It is a fundamental principle that the oil with which the pivots are lubricated is of the same importance to a watch that food is to the human body. No food has yet been discovered that will sustain the body beyond a very limited period, and no oil has been found which will endure beyond an average period of eighteen months. In other words, oil plays a large part and dirt only a small part in the working of a watch, and, therefore, the very moment that the oil thickens, evaporates, or becomes absorbed, every bearing in the watch begins to cut and grind, and more damage may be done in a few days when the watch is in this condition than might be effected in twenty years were the oil in a pure and fluid condition, and in sufficient quantity.

An idea which cannot be considered irrational among the uninformed is that when a watch comes out of the hands of the watchmaker and in good order, it ought not to be interfered with until it comes to a standstill—then it requires cleaning. No idea could be more damaging. Apply the same theory to such a coarse article as a mangling machine, and the result is ruinous. Oil the mangling machine at the outset, and then use it till it becomes more and more difficult to turn the handle, and at last it is impossible to move it. Then take the machine to pieces, and you will find that every day's wear in this condition has done more injury than a year's legitimate use with clean oil.

My argument, of course, does not apply to exceptional cases. Instances have come under my notice often enough where a watch has been going for many years without cleaning or re-oiling, and yet with no perceptible injury to the pivots.

But these cases are quite out of the common, and are due to a remarkable combination of favourable circumstances, which could not be relied on for working purposes. No watch oil has been discovered that will, on an average, retain its virtue and remain intact for over eighteen months. There are two reasons for this. First, there is the native quality of the oil, and second, the minute quantity which is used for the lubrication of watches. And one may here add, the exceptional cases cut both ways. There are some oils which, in unfavourable conditions, will not last six months.

There are probably few watchmakers who are thoughtful mechanics who have not experimented in the making of oil for their own use, but it must be confessed that there are few who have even approached that horological elixir of life—a pure oil. In fact, most of the experiments are mere fads, and many of them little less than superstitions. It would be tedious and fruitless for me to mention the various schemes for the making of watch oil which have come within my own observation, and I shall be doing something more to the purpose by naming the kind of oil used by two distinguished watch manufacturers of vast experience and skill. And here I may add that the precise results from the use of various kinds of oil are naturally the more easily detected by makers of the highest classes of watches, like the two gentlemen referred to above. When very high class watches are under the careful and constant observation of the maker for many weeks before they are turned out of his hands, and when the smallest vagary or error is noted and the cause searched for, it is obvious that the oil comes in for more examination than it does under any other circumstance.

There are two makes of watch oil sold by material dealers, which have steadily held their own for many years: viz., Roberts' and Ezra Kelly's oil. Roberts' oil is derived from vegetable, and is made in France; Kelly's oil is from fish, and is produced in the United States. But although these two oils are perhaps the best which have ever been sold, each one has a fault. The great desideratum is an oil which is thin enough to perform its functions, and yet thick enough not to run away from the chamfer into which it has been dropped by the watchmaker. That desideratum has been found, perhaps as nearly as it is ever likely to be found, in the mixing together of the two oils named, great care being taken to shake them well together.

But as regards the endurance of the oil in a watch, a large allowance must be made for individual peculiarities. There are many influences which affect a watch in all manner of ways, and are yet almost unrecognised. The business of the wearer is no small influence. To take an extreme case, a flour dealer would in most cases be at a great disadvantage, for the fine dust in the atmosphere in which he carries on his business would, in a greater or less degree, find its way into the works of his watch and absorb the oil.

Constitutional peculiarities, which are seldom recognised, have an influence on watches. The general character of diet and the exhumations of the body seem to affect both the oil and the going of watches. Any one who knows how thoroughly an Italian is able to saturate himself with garlic will understand the kind of bodily atmosphere which may surround a watch.

In an exact sense, therefore, every watch wearer is, more or less, a law unto himself; and, to return to the human analogy with which I started, the saying that every man is a fool or a physician at forty applies in a mild way to the wearer of watches.

So much, then, for the present, and, as the letter-writers sometimes say, more next time. It may be said that my paper, as it does not deal with construction or decoration, is not exactly suitable for the pages of Work. But the next best thing to be done after making an article, or buying it, is to show how the possessor may best take care of it, and judged by this criterion I do not think my paper will be found a failure.

HOW TO MAKE A USEFUL AND CHEAP CHILD'S CHAIR.

BY "OUTIS."

My object in this paper being to enable unskilled amateurs to make a cheap and useful article of nursery furniture, I shall not offend the practical reader by a long and wordy introduction.

Suffice it to say that the history of my modest manufacture is simply this. I possess one American-made child's chair, for which I paid 28s. I also possess two little children, who cannot both occupy the same chair at the same time. My purse is but a slenderly lined one. The American chair was too stiff a job for an amateur like myself to copy, and too dear to buy a duplicate of it.

So I designed and made a chair which combines cheapness and utility, elegance and durability, and which cost me when finished only about 5s.

Having thus explained why I made my chair, let me describe more fully how I made it. Professional workmen, pray forbear to criticise too severely. The writer humbly confesses that he is "only an amateur," and writes only for the benefit of amateurs; although the design shown in the accompanying illustrations may possibly be useful to others also.

First of all, I made a rough sketch of my idea, the length of the various parts of the chair having to be suited to the capacity of a small "Prize Demas" lathe. Next—and most important step—I made a full-sized working drawing, showing every detail of construction. And now all was ready for a beginning.

In the accompanying illustrations, Fig. 1 shows a front view of the chair, or rather, strictly speaking, of the combined chair-table; Fig. 2 gives a side view; Figs. 3, 4, and 5, respectively, illustrate the shape and sizes of the chair seat, back, and step.

To begin with the table, or lower part. First, I procured a piece of well-seasoned wood, 14 in. square by 1 in. thick, and planed this all over, taking pains to make the sides and ends true and square. Then I drew light pencil lines from corner to corner of the square, and marked off from the centre (where the lines crossed each other) exactly $8\frac{1}{2}$ in. along each diagonal line for the centres of the legs. With a $\frac{5}{16}$ in. centre-bit, a hole was then bored in the middle of the square to allow the screw A to be easily inserted and withdrawn. With a $1\frac{1}{8}$ centre-bit, another hole was made at each corner of the square, $\frac{1}{8}$ of an inch deep, to prevent the bottom of the chair legs from slipping when screwed to the table. Then, using these same four centres, with a 1 in. centre-bit, I bored right through the wood to receive the tops of the table legs. Having cleaned the surfaces with sand-paper, a beading $1\frac{1}{4}$ in. deep by $\frac{1}{4}$ in. thick, half-round at the top, was mitred and fixed along the sides and ends of the square flush with the bottom. Picture-frame nails, otherwise brads, 1 in. long, were used for the purpose, the heads being punched a little below the surface of the beading, and the holes filled up with putty. The table top was now complete.

For the legs of the table, four pieces of wood, about 16 in. long by $1\frac{3}{8}$ in. square, were needed. My first care here was to turn that part of the leg which was to be fitted in the 1 in. hole in the table top, so as to ensure a tight fit. I began, therefore, by turning this at the end of the wood next to the loose headstock of the lathe, so that it could be removed and tried in the hole before finishing the rest of the leg. This done, the length of the leg, 14 in., was carefully marked off from the shoulder, and the leg finished according to pattern; a light line being set off $5\frac{1}{2}$ in. from the bottom of the leg, and another 3 in. above this for the respective centres of the holes to receive the cross bars as shown in the illustration. The leg was then cut off and removed from the lathe, and the holes referred to bored with a $\frac{5}{8}$ in. bit, at right angles to each other about half-way through the wood.

Having turned four legs exactly the same size in every respect, the crossbars (of which there are six alike, four in the table and two in the chair, at the sides) were next made out of wood 13 in. long by 1 in. square, turned to the right length and shape, and accurately fitted to the holes bored for them in the legs.

The whole table was then fitted together with hot and strong glue, the various joints being made doubly firm by driving in small nails—at an angle—from the inner side, so as not to be seen.

In constructing the chair proper, the same method was followed as in the case of the table just described. The only parts of the chair, therefore, which seem to require special mention are the seat, back, and step, shown in Figs. 3, 4, and 5. It should, however, be particularly noticed that the two front legs and supports for the arms are made all in one piece, the seat being slipped over the top, and resting on the shoulders, *a a*. The back legs also project through the seat (into which they must be tightly fitted), terminating at the top in a neatly turned ball as shown in the drawing.

Let us begin again with the seat (Fig. 3). For this is needed a piece of sound wood, even-grained and free from knots, $14\frac{1}{2}$ in. square by 1 in. thick.

Having planed your wood, set out the centres for the legs exactly as described in the case of the table top. Then, from these centres, mark out with compasses the rounded corners as shown in the sketch. Next, describe the curve at back of seat. This can be done by using a thin piece of wood sufficiently long, fixed at one end with a pin or round nail, and fitted at the other end with a short pencil. At a distance of 1 in. inside of this curve, make another on which to set out the holes to receive bars connecting seat to back.

Mark position of centres of these holes. Join together the arcs at front and end of seat, and mark off the shape at the front as shown in the drawing. You can then set to work to bore the holes, and cut out your design. The chief difficulties here, I found, were in boring the $\frac{5}{8}$ in. holes at the proper angle, and in hollowing out the seat to add to the comfort of the sitter. The former difficulty can be got over with a little care; but some amateurs may find it better to get the help of a joiner.

To overcome the latter difficulty, not possessing a compass plane, I set out with my compasses a circle of 10 in. diameter in the centre of the seat; and, with a rather flat inside gouge, carefully cut the required hollow (about $\frac{1}{4}$ in. deep in the centre), working on the slope from the circumference of the circle towards its centre, and finally finishing off with coarse and fine sand-paper alternately.

The outside of the seat was then shaped out with chisel, gouge, and spokeshave, and made smooth and even with sand-paper.

For the chair back (Fig. 4), take a piece

of even-grained wood, 14 in. long by 2½ in. deep and 2 in. thick. Plane up quite true, and mark off a centre-line all round the four sides. Set the wood on its bottom face, and mark a pencil outline of it on the bench, with centre-line projecting at each side. Then set out curved lines at the required radius (see sketch) on the top of the wood. Reverse the wood, place accurately in position again on bench, and set out curves same as before, with an extra one midway between the outer two for centres of holes to receive bars joining back to seat. Mark centres of these holes as shown, and carefully bore (or get a joiner to bore) the holes to the required depth at the proper angle.

arms, to prevent a child falling out, should be made of tough, hard wood, with a head at one end and a screwed wooden nut at the other.

I did not fit one to my chair, but it will be safer to do so. If thought necessary, projecting feet can also be fitted to bottom of back legs of table, so that the chair cannot be tipped backwards.

The screw at A is of the kind sometimes fitted in small window frames, and can be bought at any ironmonger's. The bar to which it is fitted is flattened on top to receive brass screw plate. The corresponding screwed plate is fitted to underside of table top. Of course,

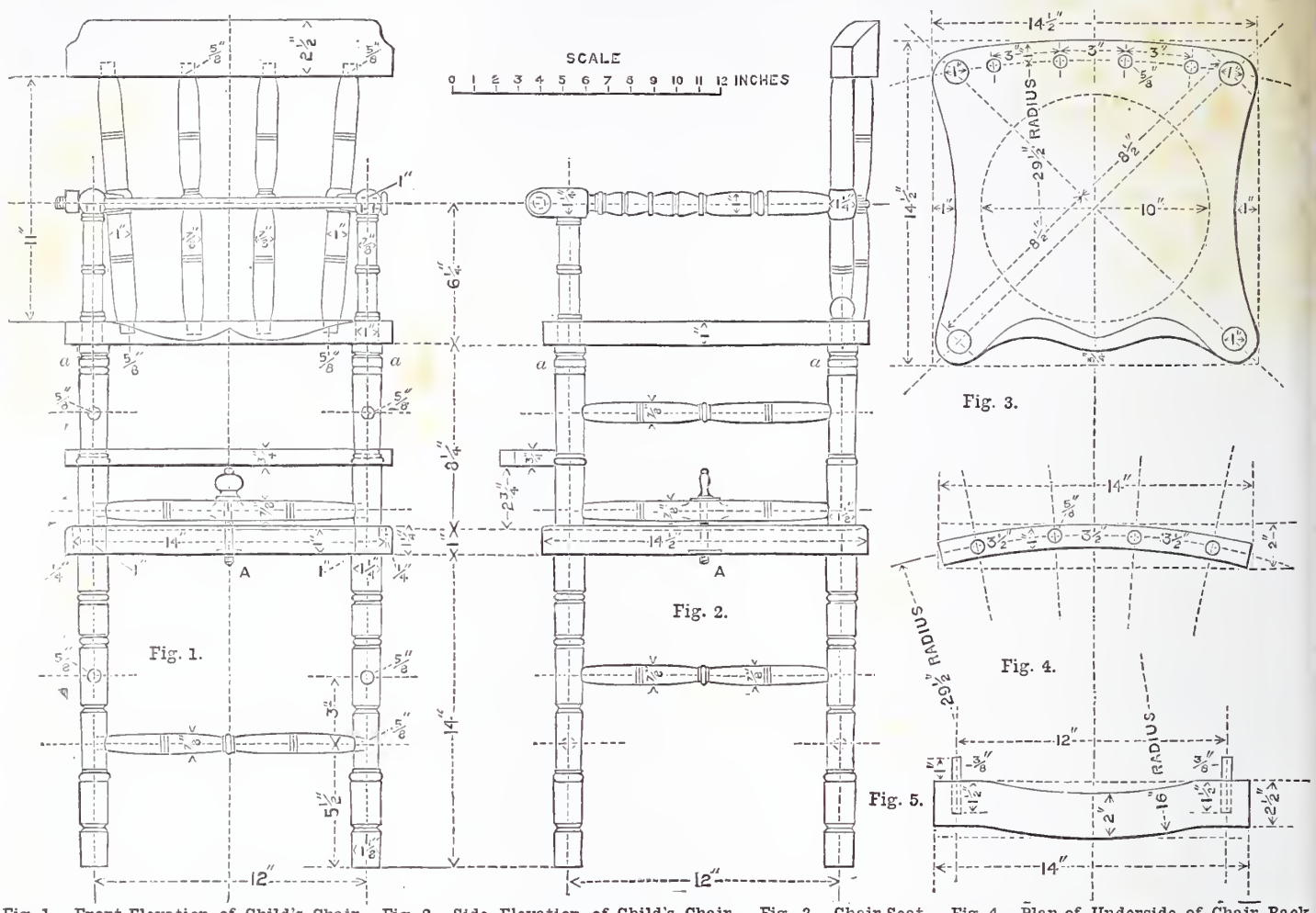


Fig. 1.—Front Elevation of Child's Chair. Fig. 2.—Side Elevation of Child's Chair. Fig. 3.—Chair Seat. Fig. 4.—Plan of Underside of Chair Back. Fig. 5.—Chair Step. (Scale throughout, 1½ in. to 1 ft.)

Then with chisel, gouge, and spokeshave shape your chair back according to drawing.

For the step (Fig. 5), a piece of wood, 14 in. long by 2½ in. wide by 3¼ in. thick, will be wanted. The construction of this is simple, and requires no explanation beyond that given in the drawing. To fit the step to the front legs of the chair, however, so as to make a good strong job, requires great care. Before planing your wood, place it edge upwards in the bench screw, and mark off two centres, 12 in. apart, exactly in the middle of thickness of wood.

Bore with ⅜ in. worm-bit two holes 1½ in. deep, to correspond with similar holes in front legs of chair (which should be bored nearly through the legs). Then turn two pins of the required size—of tough, hard wood—and, when your step is shaped and finished, fit tightly with good hot glue in position.

Only one or two general remarks are now needed, perhaps. The bar at front of chair

all the parts of the chair must be fitted and secured with great care; but especial care should be taken to secure the arms to the two back upright bars.

I may just add that my chair, after twelve months' regular use, is as steady and strong to-day as when first constructed. It was made of yellow pine throughout, stained and varnished to resemble mahogany.

For those who have no lathe, the cheapest and best plan of constructing a similar chair-table may be to procure and adapt some of the turned patterns referred to in WORK, Vol. I., page 338. It must be borne in mind, nevertheless, that as these are intended to serve as the legs of washstands, balusters, etc., it is manifest that there will be considerable difficulty in picking out patterns that will suit in every way the exigences of a child's chair, whose legs after all are of a make peculiar to itself.

VERTICAL SUN-DIALS.

BY ARTHUR YORKE.

NORTH AND SOUTH DIALS.

ADVANTAGES OF VERTICAL DIALS—THEIR PRINCIPLES—SETTING OUT A VERTICAL SOUTH DIAL—SETTING OUT A VERTICAL NORTH DIAL.

ALTHOUGH the horizontal dial is the most comprehensive, telling the time for the greatest number of hours, in other respects the advantages are rather on the side of the vertical dial. The latter needs no pedestal, since it can generally be affixed to a wall; it can be made more conspicuous, and therefore by inference more useful; it can be placed high and out of harm's way, which can scarcely be done with the horizontal dial; and moreover, it can frequently be made a decorative feature of the building to which it is attached.

The principle of the vertical dial is perhaps somewhat more difficult of explanation than that of the horizontal one. In my former paper I mentioned that the stile (that is the shadow-casting edge of the gnomon) represented in *all* dials the axis of the earth, and that the angle at which the stile of a horizontal dial would incline to the face would be the same as that at which the axis of the earth inclined to the plane of the horizon at the latitude for which the dial was made. I also mentioned that in a vertical dial the face, instead of representing, as in the horizontal dial, the plane of the horizon, represents a plane at right angles to the plane of the horizon. Hence it will be obvious that in such vertical dials

s are made to face due south r north, the angle at which the ile inclines will not be an angle ual to the latitude of the place, ut one equal to the complement f that angle—that is to say, the ngle will be of as many degrees s will with the latitude make n angle of 90°, which is a right ngle. This may be more readily nderstood by reference to Fig. 1, hich is supposed to show a por- on of the earth, N S being the xis, whilst E represents the quator, and A B a line parallel the axis; *c d* represents the lane of the horizon 34° north; e angle at *d* is therefore an ngle of 34°, and would give the levation of a stile for a hori- ontal dial for that latitude; *e f* epresents the edge of a plane erpendicular to *c d*, and may erefore be said to represent, lgewise, the face of a vertical outh dial for latitude 34°. This, will be observed, makes at *f* an ngle with the axis of 56°; 56° dded to 34° make 90°, or a ght angle: 56° is therefore the omplement of 34°, and is the orrect angle of elevation for the tile of a vertical south dial for titude 34°. For London (51½°), e elevation would of course be 8½°; for Edinburgh (56°), it ould be 34°.

To set out a *vertical south dial* we may roceed in the manner directed for setting ut a horizontal dial, but making this differ- nce—instead of setting off on the 6 o'clock ne the angle of the latitude, we must set ff the complement of that angle. The eader is asked to refer to Fig. 2 in my rticle on the *horizontal dial* (see page 17), nd he will there see that the angle set off one of 56° for Edinburgh. Had the pro- osed dial been a vertical one, the angle set ff would have been one of 34°.

A method, however, more frequently em- loyed by diallists is that exemplified in ig. 2 of the present article. A eridian, A B, is first drawn, nd cutting this at right angles, second line, C, which will be e 6 o'clock line. Then, at ny convenient point on the eridian, as at *d*, a perpen- icular is raised, and a line drawn om C, forming with C *d* an ngle equal to the complement f the latitude of the place cut- ng *d* in *e*. Then from *e*, and t right angles with C *e*, another ne is drawn cutting the me- dian at *f*. t *f*, the ne, *g h*, is hen drawn, utting the eridian at ight angles. aking *f e* n the com- asses, we mark off *f i* equal to *e*, and with *i* as a centre and *i f* s radius, we describe a quarter f a circle, *f k*. This quadrant as to be divided into six equal arts, at 1, 2, 3, 4, 5, and through hese points lines are drawn from till they cut *g h*. Through he points thus gained on *g h*, nes are drawn from C to the

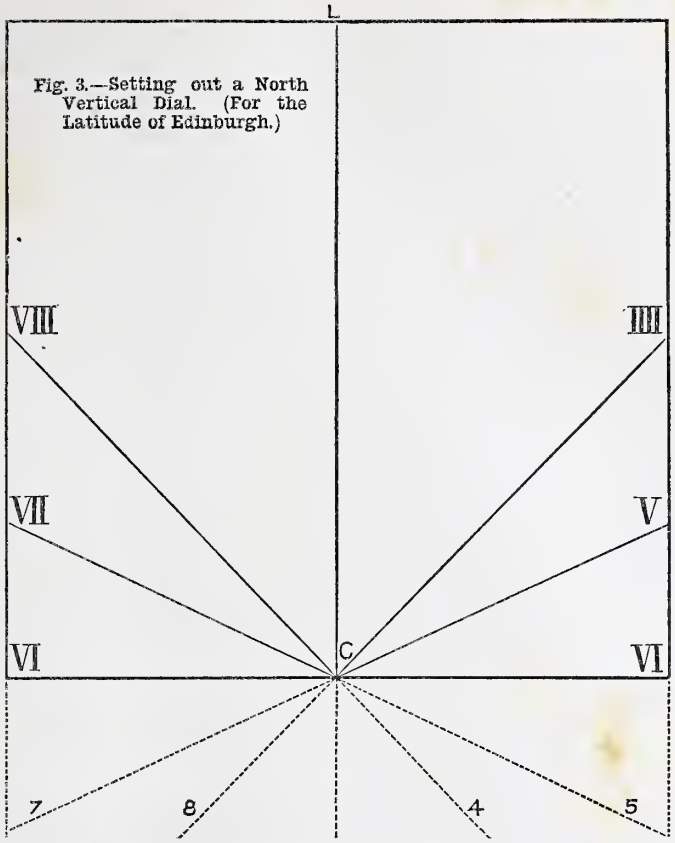


Fig. 3.—Setting out a North Vertical Dial. (For the Latitude of Edinburgh.)

outside of the paper, and these will be the hour lines for one-half of the day. If we transfer these lines to the opposite side, we shall have the whole dial required.

The gnomon for this dial must, of course, have its stile inclining to the dial at the angle of the complement (in the present instance at an angle of 34°). Such an angle is that at *d* C *e*, and could the triangle, *d* C *e*, be turned upright on its edge, so that C *d* should form the substile and C *e* the stile we should (in theory) have the gnomon we require. In practice, however, this gnomon would be too short to throw its shadow to the numerals which mark the hours. In this and in all cases, as was insisted in my former article, due space must be allowed for the thickness of the gnomon in transferring the plan to the actual dial.

In setting out a *vertical north dial*, the most easy method is first to plan a vertical south dial as above directed, then to take the paper on which the plan of the north dial is to be drawn, and so fix it that its bottom edge may exactly coincide with the 6 o'clock line on that plan. This procedure is illustrated in Fig. 3; VI. C VI. is the 6 o'clock line in Fig. 2, and the dotted lines below it represent the lines in the upper portions of Fig. 2. All that then remains to be done is first to produce the meridian, as

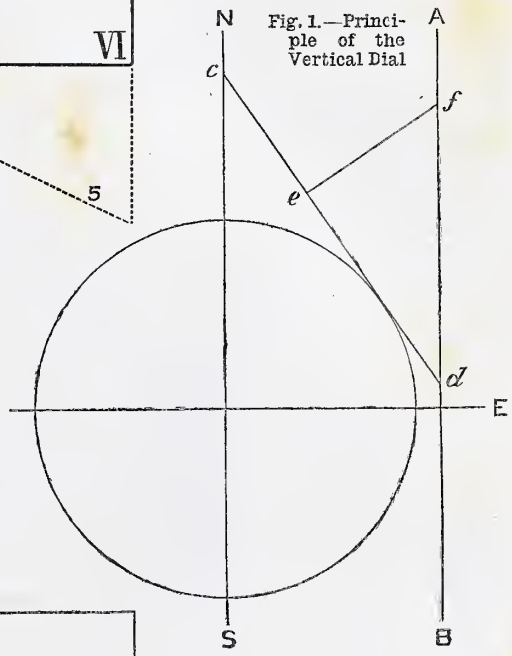


Fig. 1.—Principle of the Vertical Dial

at L; next to produce the lines 7, 8, 4, 5 through C to the edge of the paper, and these will give respectively the morning hour lines, V. and IIII., and the evening hour lines, VII. and VIII.; we have the VI. line already, and for the remainder of the day a north dial is useless.

The gnomon is precisely the same as that of the south dial, but *placed bottom upwards*, the angle equal to the complement resting on C, and the substile falling along the meridian in the direction of L.

In a third and concluding paper I shall show the reader how east and west vertical dials are constructed, and thus bring my remarks on this interesting subject to a close.

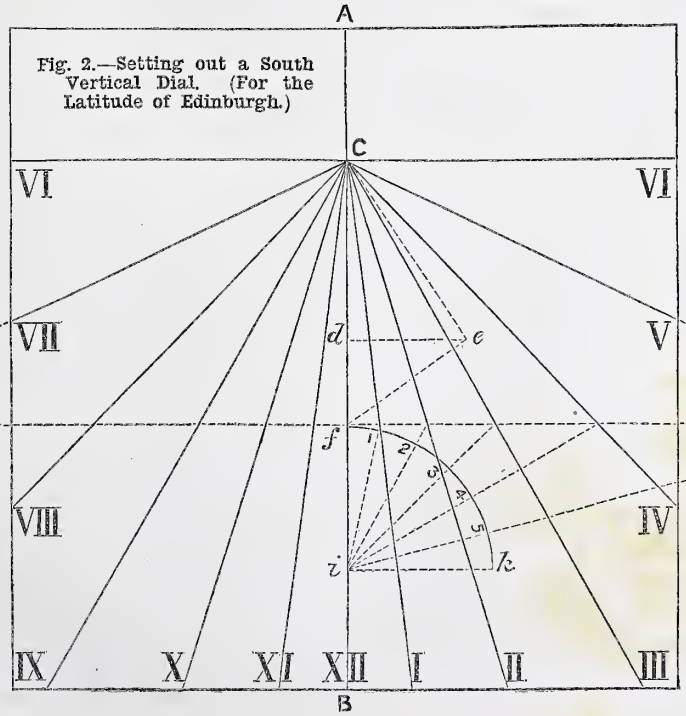


Fig. 2.—Setting out a South Vertical Dial. (For the Latitude of Edinburgh.)

MEANS, MODES, AND METHODS.

A New Method of Enlarging Drawings, Diagrams, etc.

Of enlarging methods, first comes the simple one mentioned by O. B. in Vol. I., p. 210, and myself in Vol. I., p. 552, of squaring, which method is also available for the reduction of drawings, etc. Then there is the

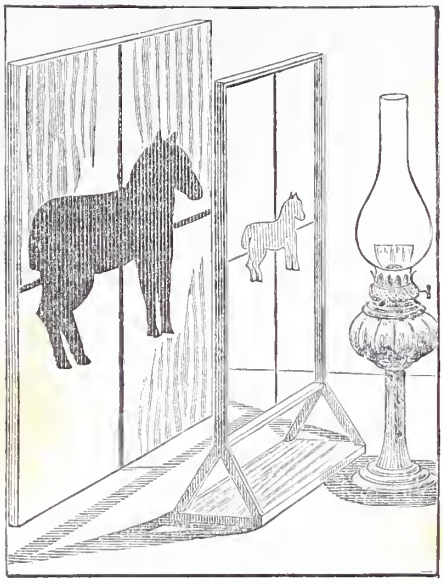


Fig. 1.—Mode of enlargement of Cut-out Diagrams.

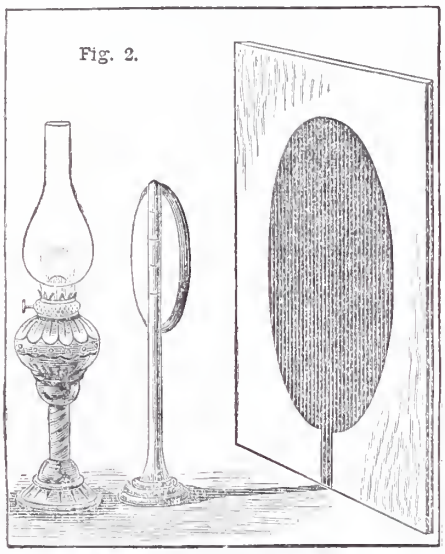


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 2.—Mode of obtaining Oval with Circular Board. Figs. 3, 4.—Extremes of Ovals thus obtained.

pantograph, Vol. I., p. 669; and now comes a method which I have never before heard of, and yet it is very simple. The artist of the Waterloo panorama has stated that he has a secret process of enlarging drawings and pictures, and that the present stupendous paintings were reproduced from a roll of drawings *ten times* smaller in size. Whether the method I mention is adopted by him, of course I cannot say; but it is capable of being so used if the paintings are done on *very* transparent paper, which process, however, would be nothing more nor less than that of the magic-lantern idea. I have never heard, however, of the *shadow* process being used, and so I give it, knowing that it is open widely for improvement.

Every one knows that when an object is placed between a light and something solid a shadow of the object is thrown upon the latter; and that, according to the distance the object is from the light, so is the size of the shadow regulated. Supposing it is required to enlarge a drawing (of course this plan only gives outlines, unless, indeed, the trouble is gone to of cutting with a sharp knife along the internal lines of the drawing, when the light shining through the lines would be a guide), for example, say, take the half foot in Vol. I., p. 553, and paste the sheet on to a piece of thick card; then cut it out nicely. Another similar half, shaped, and pasted to it in the reverse direction, will give the complete foot. A strong powerful light is needed, and it should be level with the centre of the object, the latter being held quite perpendicular. The board to be cut should be placed at a short distance from the light, and the object to be reproduced must be fixed by some means when its position is decided upon, as in Fig. 1. A sharp outline to the shadow can be obtained by properly regulating the distances of the object and board from the light. The advantage of this method is that, as the reader may choose upon another size for an intended article than that given by any particular writer, he can thus easily reproduce it *any* size.—J. S.

An Easy Method of Obtaining Ovals of any Size.

In reference to my shadow-enlarging process, I have found a most simple way of obtaining an oval upon a board, the exact size of which it may be difficult to decide upon. Get a *circular* board, say about 1 ft. in diameter, and mount it so that it will revolve upon a stand, similar to that shown in Fig. 2. Place the board to be cut at a distance from the light. A circle, or *any* proportioned oval, from the elongated one shown in Fig. 3 to the true one shown in Fig. 4, can be obtained by revolving the circular board; and *any sized* oval can be obtained by regulating the distance of the circular board from the light. The edge of the circular board must be bevelled.—J. S.

HOW TO FIX LOCKS.

BY B. A. BAXTER.

The great and perpetual annoyance caused by ill-fitted and badly-fixed locks is the only, but perhaps sufficient, excuse for this paper, and the hope that the writer may assist some few young workmen is his encouragement to explain what he can of the matter.

In the first place there are a great variety of locks, of which some are easily fitted, and some with much greater difficulty. Rim locks, for instance, are the ordinary door locks fixed on bedroom doors in the cheaper sort of houses. (Please to understand, not low-rented houses, but houses built at a low price.) These locks are about the simplest to fix of any, and they shall, therefore, be the first to be explained.

In fixing a rim lock, then, first fit the flange—which, by the way, does not now always exist, but used to do. Having applied the lock to the door, and marked round the flange with a knife or a pointed awl, cut the recess for its reception with a sharp chisel. A second application of the lock ought to prove that the flange exactly fills the recess. The holes for the spindle and the key can then be marked with a sharp-pointed awl. Bore the holes as nearly the size as the bits can be obtained, and, if possible, have a Jennings bit. There are no better, and every tool maker supplies them. Be very careful not to force the bit to cut faster than it will. A $\frac{3}{8}$ in. bit is about the size required for an average key, but as these bits are made to every sixteenth from $\frac{1}{4}$ in. to $\frac{3}{4}$ in., and every eighth beyond, and they are so useful for many other purposes, they may be bought freely, and the purchaser will not regret the outlay.

On the key will be found a shoulder or stop, which, abutting against the plate of the lock, keeps it in its right position to enter and turn. This shoulder will give the size of the bit required, for the hole must be large enough to give freedom, but small enough to give guidance, so as to make it easy to go right, but difficult to go wrong.

It is essential to the proper entrance of the key that this hole be square to the surface of the door, both when a square is applied with the stock horizontally and vertically. This reminds me of an ingenious, though simple, appliance sent out with a lock which I saw recently in a West-end mansion in course of repair. It was a cast iron guide, having a plate similar to the edge flange of a mortise lock, which was to be fixed temporarily on the door, the holes (which were bored for the purpose) being in the correct position for the lock itself when it came to be fixed. The hole, cylindrical, 1 in. in diameter, having been turned out, was truly at right angles to the flange, and the workman could, therefore, bore a 1 in. hole quite truly with ease and certainty for the reception of (in this case) the cylindrical lock. I ought to say that the appliance was to be returned to the lock maker, as, of course, it would be of greater value than the profit of one or two locks would cover.

However, any one could take a hint and bore a hole through a piece of wood from end to end—say, 6 in. long—get it turned, and a disc shouldered on, and also turned on a mandrel, having the hole, therefore, truly centred.

But though useful as a guide, this refinement of accuracy is not needed for our rim lock. It will be true enough if we take precaution that the head of the stock is held the same height as the point of the bit and in the other direction as square as the workman can judge. Do not, when the bit ceases to progress, force it, but rather remove the chips if they should be filling the grooves of the bit, and examine the other side of the door to see if the point has made its appearance. If so, the hole may be completed from that side. Another hole should be made for the bit of the key with a boring bit of a suitable size, with the same attention as to squareness, and the two holes cut into one by a key-hole saw. Take care not to cut away too much, which a crooked saw will almost be sure to do; but if in danger of so doing, only cut once in the centre of the hole required from one to the other, and complete with a thin chisel.

The hole for the spindle can be bored with a $\frac{1}{2}$ in. bit, and if each has been carefully done, nothing remains but to screw the lock on and fix the box or staple, cutting in the edge if needful; or in the unusual case of a too shallow box or staple,

mount it on a piece of wood. In either case, see that the bolt and latch of the lock have just enough freedom when the door is locked—say, about the thickness of a veneer or stout card.

A till or drawer lock presents some difficulty to young workmen, but by taking each detail singly, and being careful to do each correctly, a neat job can be done by the young cabinet-maker.

First ascertain the centre of the drawer front and mark it *lightly* with a pencil. Mark the exact distance from the top edge of lock to the centre of the key-pin on the front of the drawer. Bore for the key on the intersection of the two lines above mentioned. Cut down for the bit of the key from the front with a pad-saw or a thin chisel. Carefully set out the position of the plate on the inside of the drawer. This can easily be done by measuring right and left from centre of key-pin. Let in for the body of lock and the top flange before venturing on cutting in for the back, trying the key to make sure that the position is correct before using the chisel too freely.

When screwed on, the bolt can be cut into the frame of the drawer by touching the bolt with oil soiled from the oilstone, then causing the bolt to touch with the key; the oiled bolt will then print its impression on the frame. A mortise must be cut with a small chisel for the reception of the bolt. If a thread escutcheon is to be used, the keyhole may as well be cut to fit the escutcheon at first as enlarged afterwards.

Thread escutcheons may be marked on the work by pressure or a slight tap with a hammer, which will imprint the outline of the escutcheon.

Cut cupboard locks are put on in a similar way, except that the hole for the key *can* be bored from the inside, which it would be difficult or impossible to do in a drawer.

Flat cupboard locks need no cutting in, but are unsightly. They have the advantage, however, of being equally available for right or left, which a cut-cupboard lock is not.

Chest and workbox locks are similar to drawer locks, and can be put on in the same manner. The link-plate, however, introduces a difficulty which does not exist in till locks.

It is best to let the link-plate remain in the lock while it is cut in, or it may be found that, though space sufficient for the lock has been made, yet room has not been obtained for the links. The key must be tried before fixing the lock, in order to ensure room for the movement of the bolt. In each of these locks the smallest key-hole that will allow the key to pass is the best, and the hole should be so bored that, when the lock is applied, the key-pin is in the centre of the hole. This, however, might be said of every key-hole, and of the fixing of every lock, were it not for the repetition which would occupy space and weary the intelligent reader. We may decide, however, that it is a less evil to *slightly* shift the lock to suit a key-hole cut somewhat in error than to destroy the shape and enlarge the key-hole in the attempt to rectify the error, or leave the key-hole so that the key binds in it.

There are, however, other locks which need a mortise for their reception. Camp-desk locks, pianoforte locks, and mortise locks for doors, all need mortising. Let us look first at door locks fixed in a mortise. It is obvious that, if the work is finished, as it frequently is, before the locks are fixed, we must not set out with pencils or gauges. We will apply the lock to the door first one side and then the other, similar to the method described for rim lock, but taking care that the flange is flush to the edge of the door. We can then mark the position of the key and spindle-holes with a pointer, as we did for rim locks. There is one caution needed—that is, to see that the edge of the door is square; if not, the marking out, as described, will not agree, but will differ by the amount of variation from the square edge. As is usually the case, truth lies between the extremes, and generally a compromise must be made, the amount of which must be left to the workman to decide. By all means cut the key-hole and bore for the spindle first, then proceed to mortise for the lock. In this case bore as much of the wood away as possible, and be sure not to make too tight a fit. If you do, in trying the lock and removing it you will disfigure the door and add materially to your labour, without any compensating advantage.

Having bored all you can (more than I have bored you), clear out with chisels. A curved mortise lock chisel is very useful to finish with. When enough has been cut away to let the lock in, the flange may be let in and the lock fixed.

Then comes the striking plate. We cannot do better than adopt the printing plan, as we did for till locks, and mortise for the latch and lock bolts; then when the brass plate is applied at the right height, and just showing the mortise edges coincident with the edges of brass striking plate, it can then be marked round, cut in, and fixed.

The patent mortise furniture now so much used in preference to the old set-screw fixed knobs gives some trouble, because the screws that fix the rose—in this case not merely an ornament, but a flange, on which the knob can turn, but yet is fixed—are so close to the knob that no tool can bore the holes as squarely to the face of the door as is desirable, and if the knob is not fixed correctly, it will have to be altered. The best way, probably, is to mark the position of the holes when the knob *is* in its right place, which can only be ascertained by trial with the square spindle in its place through lock and into knob. Then removing the knob, but noticing the position of flange, in order to keep the same holes to each other that have been marked, bore the holes, replace the knob, and fix. The reason why we must keep the flange as we have marked it is because the screw-holes bored in flange—generally four in number—are not always equally distant from the centre or from their next neighbour.

A remedy for this difficulty might be found in enlarging the rose and putting the screws nearer the outer edge, but we shall have to wait for this until lock-furniture makers fix a few sets of their own furniture.

Improvements are always to be looked for in those whose vision is enlarged by a little work in other than their own particular branch of trade. It must have impressed a lock-maker if he tried to turn the key in some of the old locks that its close proximity to the knob was a disadvantage, and that the knob would be better at a greater distance from the edge.

The writer of this must confess that had he not once caught his knuckles between the edge of a door frame and the handle of a Norfolk latch, fixed by some careless workman too close to the edge of door, he would have been less careful over every latch he has fixed, and hopes this hint is enough to prevent some other hands from harm. *Verb. sap.*

Camp-desk locks and pianoforte locks are also fixed in a mortise. In the first, be sure to see that the edge is bevelled to the right angle. In the second, the workman must see that the mortise is made at the correct angle, for the flange is not generally square to the body of the lock, and pianoforte locks are superior to the desk locks, inasmuch as, when unlocked, the bolts are flush with the surface, and therefore are not in the way. Desk locks are just the reverse of workbox locks, the hooked bolts taking the place of the link-plate.

Night latches for street doors are locks which require careful fixing. Measure accurately the distance from edge of lock to centre of key-pin, mark the same on inside of door, and bore for key-hole, cutting for bit of key with a small mortise chisel as neatly as possible. The latch can then be applied, and the flange cut, trying the key before fixing the lock. If the pin on which the key turns projects from the lock (which it does, generally), the workman can cut in the flange first to the correct size, and then applying the lock, taking care that it is held parallel to the door, though it cannot yet be held close to its surface, press enough to imprint the position of key-pin upon the door. This will at once, if the lock has been carefully adjusted to the position, give the centre of hole for key. This method is the better plan if key-pin is projecting enough, and particularly if it is pointed.

And now for a few words on ordering locks.

Always tell the ironmonger the thickness of the door, and see that the key is long enough, especially in rim locks or night latches; if not, either a return of the lock, an unnecessary cutting in, or an alteration of the key, is required. For a very thick outer door, I advise the use of mortise locks whenever the expenditure of a few pence is no object of consideration; and if you fix locks for a customer, provide the best you are allowed to supply. If you are required to fix common locks, be candid enough to say so, whether provided by you or by the householder.

Be always ready to say which side you want the locks, right or left—that is, looking at the door from the outside, the right-hand lock turns the bolt to the right, the left-hand turns the bolt to the left. In this the lock is supposed to be on the inside. In mortise locks of a modern form there is now no difficulty, as the latch-bolt is, in most instances, reversible, and the striking-plate finished and lacquered both sides; but as there is often no indication on the outside that the bolt is reversible, inquire if that is so, for the fact will be indicated on the label of the parcel from which the salesman takes the lock.

Although the ironmonger may be expected to know his stock, it is not reasonable to expect him to suggest the proper form of lock, or suitable fittings for any particular purpose. He often can, and does; but let the purchaser be thoroughly aware of his requirements, and able to distinguish between those that are obligatory and those that are less important. A rough sketch, no matter how rough, is a great help in obtaining suitable locks; and indeed any ironmongery, each article having its name, and these are so numerous that some time must elapse before a workman can know them all, hence the peculiar value of a sketch. The ironmonger knows at once what is required, and if, in the case of locks, the sketch takes the form of a plan of the door, having the hinges marked, the place of the lock (inside or outside), the thickness of the door,

width of stiles, and position of the door-steps, a mistake is rendered very unlikely, and waste of time and temper avoided.

Readers will recognise that there are many other locks in use than those treated upon here, but some are so easily fixed as to need no description, and others are so like those treated as to be easily fixed from these instructions.

A SERIES OF CIRCULAR PANELS IN FRETWORK.

WITH HINTS FOR THEIR SETTING.

BY J. W. GLEESON-WHITE.

A good many people loftily disdain using published fretwork designs. When one has asked, in all humble modesty, "From whence came your design?" they announce, with self-conscious dignity, that they evoke—or, as they say, "invent"—their own. There is a story that—although to some it verges dangerously near the profane—is so apt, that I may be absolved for quoting it. It tells how a self-made man having made his fellow-travellers mad by his egotistic boasting wound up the peroration of his eloquence by exclaiming, "I am a self-made man." To this a shrewd Yankee replied, "I am glad to hear it, sir. It relieves the Creator of an immense amount of responsibility!" Now, when these self-made designers announce the authorship of their patterns, one is tempted to paraphrase the American's witticism. But, alack! their assumption of the so-called parentage of their ideas is in no way warranted, for of many dozens of such, who ever saw one that was more original than any new group of numerals may claim to be? It may be that any one who writes down, say, thirty-two consecutive figures has never seen the

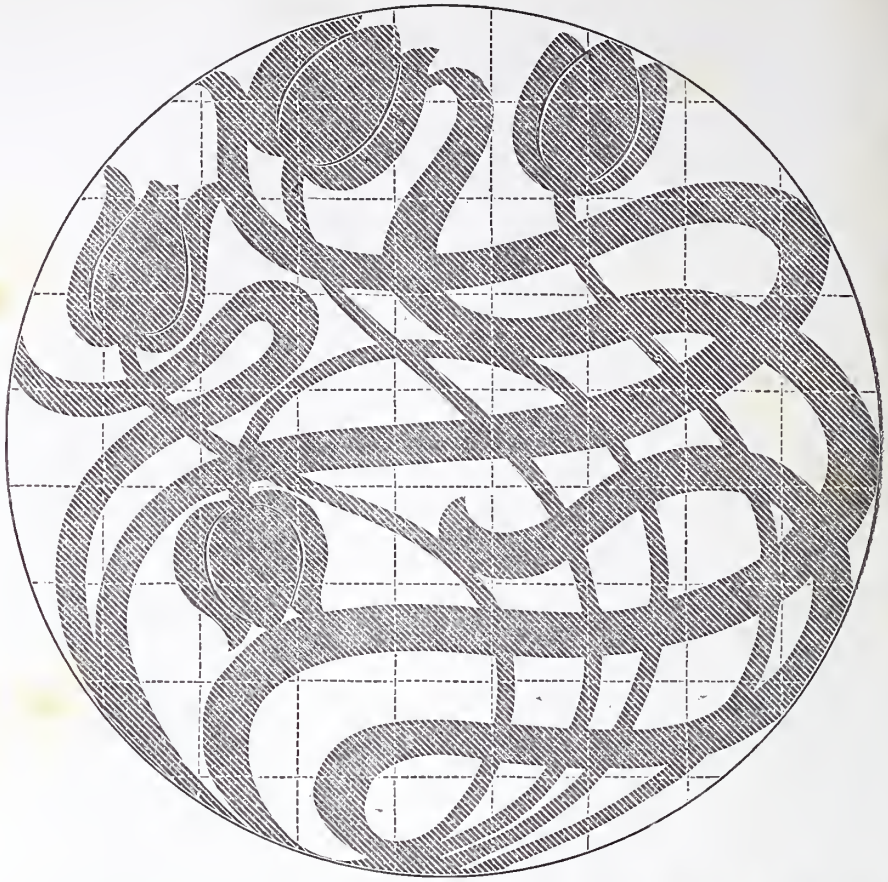


Fig. 1.—Circular Panel in Fretwork, No. 1. Half size, divided to facilitate enlargement to full size.

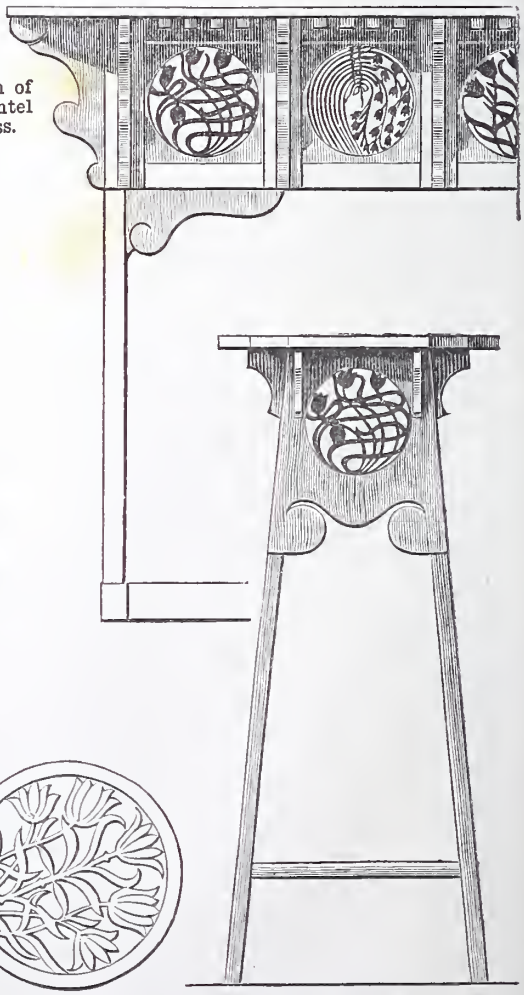


Fig. 3.—Application of Panels to Overmantel with Looking-Glass.

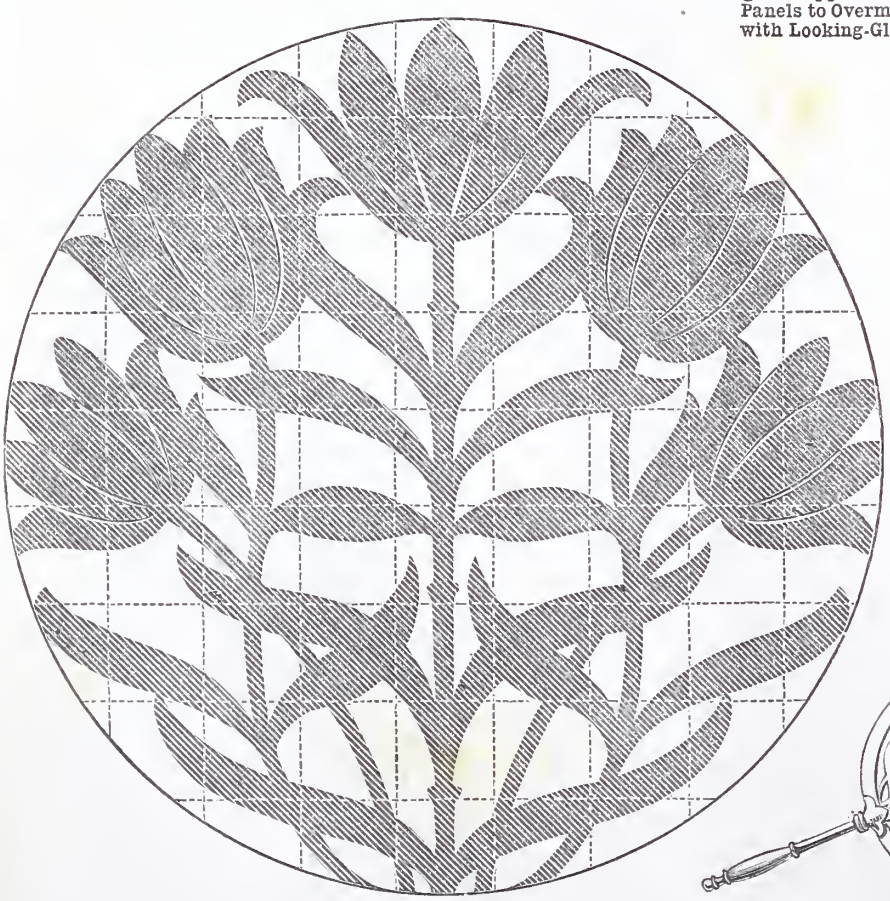


Fig. 2.—Circular Panel in Fretwork, No. 2: half size.

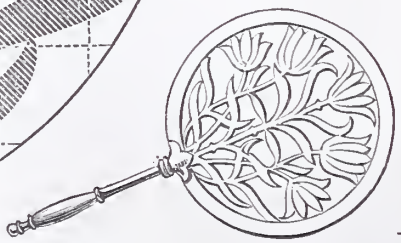


Fig. 4.—Circular Panel as Fan.

Fig. 5.—Panel in side of Flower-Pot Table.

Fig. 6.—Circular Panel in Fretwork, No. 3. Half size, divided to facilitate enlargement to full size.

same array in the same order, but the units that compose the alarming total are as old as the art of reckoning itself—or, at least, as its historical use.

Now, if the aforesaid amateurs would condescend to the truth, as some among them do, they would say, "I picked a bit of this and a bit of that pattern that took my fancy, and fixed them up in a way that just suited my purpose."

By offering motives of fretwork for use according to the taste of the worker, as a compromise between the self-arranged design and the purchased complete pattern, a compromise may be effected that shall please both parties.

These circular panels are intended as details to be worked into any object the operator may wish to decorate. For, be it remembered, a circular ornament has a twofold value: it tells as a distinct shape of ornament from a distance when all its details are lost; and yet this in no way diminishes the value of the decorative detail it may embody within its arc.

The forms here treated are merely natural flower shapes, suggesting wind-tossed groups of leaves and blossoms, set out in flat, conventional manner, within the true limits of fretwork design. Perhaps it is assuming too much to say imperatively they are so, and it would be more decent to qualify such assertion by saying they are attempts to gain that end.

In this way, cut as separate panels, there is no limit to their use. When feasible, they should be, indeed, worked out of the rectangular panel itself that they purpose to adorn. But since this course is often impracticable, they may be sunk within a circular hole of the material with equal effect.

So used, they may be applied to woodwork intended to be painted, when the

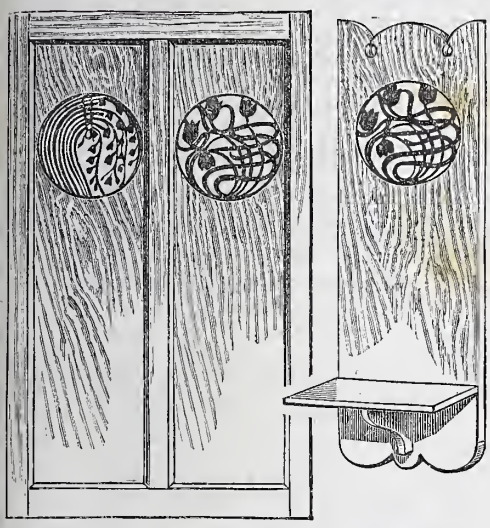


Fig. 7.—Application of Panel to Bracket.

Fig. 8.—Application of Panels to Larger Panels.

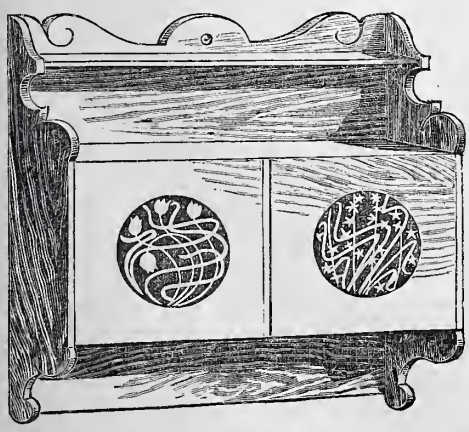


Fig. 9.—Application of Panels to Small Cupboards with Shelves.

Fig. 10.—Circular Panel in Fretwork, No. 4; half size.

slight relief they afford will break the monotony of the even surface of a panel without sacrificing the broad effect of a plain surface.

On no account should I advise them to be "picked out" in colour or gold. If only natural woods, polished or varnished, be employed, then indeed the wood may vary; but if paint, enamel, or ordinary oil colour, are either of them used, let the relief obtained be one of planes only; the shadows cast will sufficiently detach the pattern, with no attempt to exaggerate the ornament by use of divers colours.

The diagrams suggest a few of their possible applications to brackets, medicine cupboards, panels of doors, or sideboards, small tables, over-mantels. A hundred other purposes, to describe which would take needless space, readily suggest themselves.

When two or more of the same design are used, either reverse the pattern in tracing, or fix it at a different angle—that is, let the side that is uppermost in one pattern be the foot of the other. Save in one or two of the panels, this possible use has been provided for in the growth of the ornament.

By using Letts's sectional-scale tracing papers, the designs may be easily enlarged or reduced to new dimensions. They may also be used for stencils or other brush decoration, as well as their original purpose. As carved decoration in low relief, a very little adaptation would fit them for the altered requirements of wood carving. Possibly a future series may attempt similar aims in rectangular and irregularly-shaped panels.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

12.—Murray's Metal Frame for Chairs.

I have been asked by Mr. J. Henry Murray, Ashfield, Beau Parc, co. Meath, to make mention of a new mode of making chairs which he has recently invented, and for which I believe he has obtained provisional protection. I cannot illustrate the invention, because to do so would involve a good deal of space, and he, and my readers too, must be contented with the simple description. First of all, there is a metal frame in the ordinary form of a chair seat, having a broad ledge projecting inwards from its upper edge and indentations—or "re-entering angles," as the maker calls them—at each corner, wherein the wooden legs are fitted. Near the inner edge of the ledge are a number of holes, into which hooks are fitted, from and to which cords are laced, which form the bottom of the seat, and give support to the stuffing and upholstery; and utility and importance for this is claimed on the plea that it can be quickly unlaced when it is required to renew the stuffing of the chair seat. In the corners of the frame the legs, and at the rear the back, are inserted and bolted to the frame by screws and nuts, the nuts being on the inside so that all may be readily taken to pieces in case of removal. Mr. Murray claims that the formation of the angle metal frame gives great rigidity, combined with lightness and durability, and allows of the above method of fastening the legs. To make this and what is to follow completely clear to the reader, let the annexed diagram represent a section of the chair frame on the right-hand side, the section being so managed as to show the perforations in both members of the frame. Then A will be one of the holes in which S hooks are inserted to carry the lacing that forms the seat of the chair. The perforations, of which B is one, in line in the upper part of the lower member of the frame, enable the covering, or trimming, to be laced or stitched on, thereby avoiding the use of tacks. The moulding can be screwed on from the inside—that is to say, by screws passed into the moulding through the holes indicated by C. If preferred, the trimming and moulding can be finished in lengths, and screwed on afterwards by means of a thin slip of wood, to which the moulding is fastened by glue or otherwise. I have now given as fully as I can the principle of Mr. Murray's invention, and I wish him every success in disposing of it, I am bound, however, to say that, to my mind, the plan of bolting the legs, as separate parts, to the metal frame is structurally weak; and as chairs, especially heavy chairs, are not always lifted from spot to spot, those that are made in the manner described will soon get somewhat rickety. And no one will desire to be continually tightening up the nuts and laces of the chairs he has to sit on.

Fig. 1.—Diagram showing Means and Modes of adjusting Spectacles.

Fig. 2.—Spectacles adjusted for Shooting, etc.

Fig. 3.—Spectacles adjusted for Reading, etc.

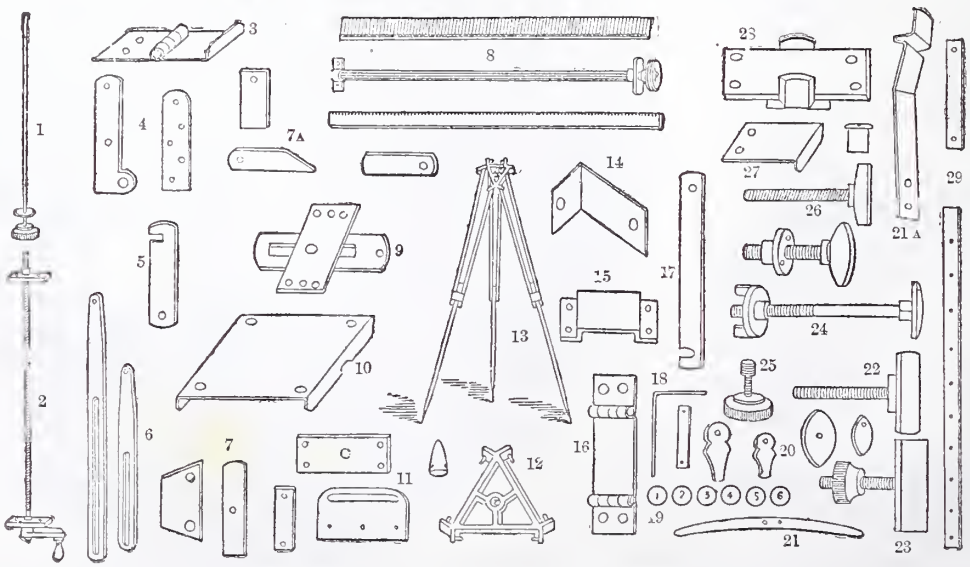
Section of Frame of Chair.

13.—More's New Adjustable Spectacles.

In Figs. 1, 2, and 3 are shown spectacles of a new and improved form, made on More's Patent, and sold by Mr. James White, optician, 209, Sauchiehall Street, Glasgow. The peculiarity of construction exhibited in the frame enables the wearer to adjust the lenses at any moment so as to put them in direct line between the eyes and the object looked at. By this simple contrivance the prismatic and distorted effects frequently resulting from the use of ordinary spectacles are completely obviated. The means adopted can be gathered from Fig. 1, which shows one only of the two glasses. The wires on each side turn by means of the loop, A, on the axis, so to speak, or the ends of the axis of the spectacles, and hence, when the spectacles are placed in position, the glasses can be easily adjusted to suit the requirements of the wearer—that is to say, they may be turned to accommodate the eye when directed upward (as in Fig. 2) for shooting, or downwards (as in Fig. 3) for reading. The adjustment, indeed, by the wearer to the best and most comfortable position for any kind of occupation or pursuit can be obtained at once, which is also very desirable for peculiar lenses ordered by oculists, as the frames, as already pointed out, can be adjusted to a nicety. The specimen glasses sent by Mr. White are well made, and comfortable to wear.

14.—Watkinson and Lonsdale's Photographic Brasswork.

I have received from Messrs. Watkinson and Lonsdale, manufacturers of photographic, scientific, and laboratory apparatus, photographic rack and pinion, milled screws, and camera fittings of every description, New Briggate, Leeds, a parcel of their photographic brasswork and fittings, finished and unfinished, which appear to me to be well made, and thoroughly well fitted for the purposes for which they are intended. Price lists, I may say, are sent free to all who may apply for them, and Messrs. Watkinson and Lonsdale will make any special fitting that may be required to order and drawing. I give herewith engravings in miniature of many of the fittings for cameras, etc., supplied by the courtesy of the manufacturers. These comprise (1) extension rod for reversible



Watkinson and Lonsdale's Photographic Furniture.

back, (2) focussing screws, (3) clip hinge, (4) side hinge plates, in lieu of rule hinges, for short focus cameras, (5) camera catch, (6) side struts (7, 7A) stops and turn buttons, (8) rack and pinion sets, (9) double swing-back fittings, (10) binding plate, (11) slotted plate for rising fronts, (12) triangles for tripods, (13) "Airedale" sliding stand, (14) corner plate, (15) bridge for strap handles for carrying camera, (16) double hinges for cameras, (17) hooked strut, (18) crank turn pin for dark slides, (19) ivory numbers for dark slides, (20) turn buttons, (21, 21A) springs for dark slides, (22, 23) T-bolts with milled nut, (24) tripod bolt, (25) milled head front screw, (26) camera screws for attaching camera to stand, (27) clip, (28) screw bolt for studio cameras, (29) guide strips for cameras. The prices, in all cases, appear to be extremely reasonable. THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Mitre Cramps.—H. B. (*Chatham*) writes:—"Having seen in WORK several mitre cramps and blocks in recent issues, and not seeing one the same as enclosed sketches, I send them hoping that they may be useful to some of my fellow-readers of your valuable WORK. Fig. 1.—C is a

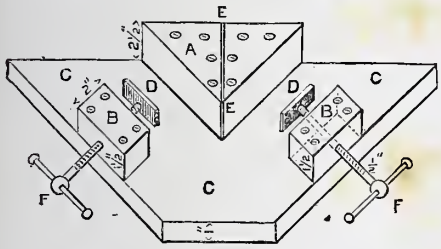


Fig. 1.

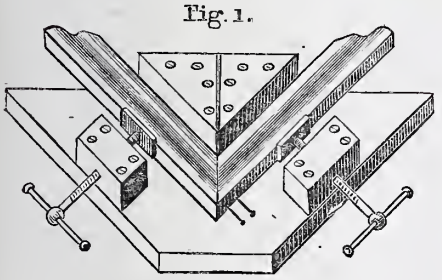


Fig. 2.

Mitre Cramp.

board 1 in. thick; A is a block 2½ in. thickness screwed to C; E is saw cut; B B, two blocks (wood) 2 in. by 1½ in. screwed to board, C; F is bolt with thread, the nut of which is let in the blocks, B; D is thin piece of iron to save the point of bolt damaging moulding. Fig. 2 is the moulding; after being cut it is screwed up ready for nailing."

Wheel Cutting.—ALIQUANDO writes:—"Let me remark that Mr. Campin's (Fig. 5, page 792, Vol. I.) wheel-cutting article conveys an erroneous idea. As Mr. Campin says, the centre of thickness of the rotary cutter must be exactly the same height as the line of the lathe centres. Represented as in Fig. 5, the rotary cutter is far above the line of lathe centres, for the top of the top table of the slide-rest is not much below the line of lathe centres (merely enough to take a tool), and to cut wheels in this way the rotary cutter should be represented as close to the top table, and bracket to correspond. Mr. Campin clearly means to convey the utilising for wheel-cutting a lathe's own slide-rest, not the fitting up of a second slide-rest to the lathe for such work."

[ALIQUANDO in his critical remark has answered himself in mentioning that I state the proper position of the cutter. It is nearly twenty-five years since I worked in a shop, but I know that the top slide must be taken away to adapt the cutter slide as I suggest.—F. C.].

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

To Cut and Polish Opals.—E. L. B. (*London, S.E.*).—E. L. B. asks how to cut and polish agates, jasper, and opals. And although I am willing to go into the whole matter as usually carried out, still the lapidary's bench and mills, which work horizontally, are not generally useful tools for an amateur, like an ordinary lathe is. So for a week or two I will postpone that part of the reply, as I rather fancy that some of the tools used by mechanical dentists may be made available for the purpose of polishing stones. The reason of this division is that the stones mentioned are of different hardness, and require different material and appliances for their working. Now, opal is a soft stone, and can be cut into shape with a (medium or fine) corundum file, and water—or even with a fine steel file. Next get them smooth by rubbing them with a piece of rag-stone, or water of Ayr stone, and water; or, better, in a grooved piece of same. Then when the surface has been got quite regular, it has to be polished, which you can do with a leather buff charged with putty powder and water (oxide of tin, I believe, is its other name). However, any jeweller's material shop, such as Gray, Clerkenwell Green, or one of those near Jerusalem Passage, will be able to supply the articles for a few pence. The above is all the actual process, but perhaps it will be as well to give further details. First of all the stone must be held somehow, as it is probably too small to hold in the fingers. So purchase a little lapidary's cement, and put it on a piece of stick, until it is in the form of Fig. 1; it is easily managed by holding it over the flame of a spirit lamp, or of gas. When the cement is in shape on the stick, then you may heat the end again and place your opal on it. Then mould the cement into a nice smooth shape

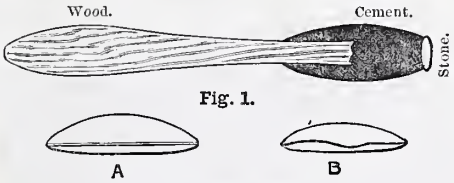


Fig. 1.

Cutting and Polishing Opals.

with the moistened fingers; and you may make your opal and the top of your cement just warm, but you will get into trouble if you heat this stone too much. When placed thus on the stick you can cut and polish one side and the edge, then by warming it again you can turn it over and do the other side. When you wish to remove the cement which adheres to the stone, just dip it into turpentine or methylated spirit, and it can then be rubbed off. The shape that opals are cut can be seen in any jeweller's window. They are convex everywhere except the edge; they must not be cut with flat surfaces. The edge or girdle itself should be a strong one, and quite straight, like A and not B. A lathe is always used for this work, but, as you state that you have none, I have given a method of cutting and polishing such soft stones without it. These are the materials you will require. (1) Corundum file, medium or smooth; (2) piece of rag-stone, or water of Ayr stone; (3) leather buff; (4) putty powder; (5) lapidary's cement; (6) sticks for same, which you can just as well make for yourself out of a piece of firewood: unless you prefer them turned, then you can buy them at some of the shops at or about Clerkenwell Green, E.C.—H. S. G.

Chair Rivets.—SPATZ (*Bridport*).—For one way of overcoming the difficulty of putting the rivets of the reclining chair in their proper positions see the reply to J. H., who has found the same difficulty as you. The chair, of course, will not fold flat as you seem to expect, but is folding in the sense that its position can be altered and the back raised or lowered as may be desired. The same plan of finding the rivet holes may be applied to No. 1. The position of the rail at B should be between the long stiles of the back and about 1 in. above where the end of the side piece of the seat crosses the lower end of them. This is not shown as clearly as could be wished in the drawing, the fact of its being in perspective being detrimental to the showing clearly of such minute details. For the attaching of the back and front ends of the rope to hang the chair you can either bore a hole in the framing, of the same diameter as the rope you use, and secure it by passing it through and tying a knot on the end, or you can use brass screw eyes, screwing them into the wood at the desired positions. I daresay that you have noticed in these columns a few weeks since a letter stating that chair No. 2 had been patented in this country. I do not know exactly what the pains and penalties attaching to the making of a patented article for your own use may be, but I merely call your attention to the fact, so that you may be aware of it.—G. LE B.

Polishing.—W. H. W. (*Rochdale*).—To polish your pine dressing table use ordinary French polish. Before applying this go over the work with a coat of size. When dry, body in with the polish and finally spirit off in the way which has several times been given in these columns. It is sometimes difficult to get the rubbers into corners so as to finish them off cleanly, and you may have to use a brush, *i.e.*, to put a little varnish in them. The subject of "graph" making will be dealt with on some future occasion in a special article. As has been frequently stated, it is utterly impossible to reply in "next week's issue."—D. A.

Brass, Tin, and Iron Flux.—WOOD-WORKER (*Southsea*).—The flux for brass, tin, and iron is diluted chloride of zinc, that is spirits of salts or hydrochloric acid "killed" by adding zinc cuttings to it till it ceases to work, and then diluting what is left with nearly the same quantity of water. If you are, as you say, a reader of WORK from commencement, you have not been a very careful one, or you would have found this information in my first article on soldering.—R. A.

Enamelling Steel.—AMATEUR (*Glasgow*).—If you have only to enamel a piece of steel 6 in. by 1 in. by ⅛ in., I should advise you to put it in the hands of a respectable ironmonger, who would get it done for you for a trifling sum. It would scarcely be worth while to take up the valuable space in "Shop" to describe the process of enamelling iron or steel, and I expect if it were given you would scarcely deem it worth your while to purchase the expensive plant of muffles, crucibles, chemicals, fluxes, etc. Correspondents can hardly expect that questions involving in their answer a full description of a mechanical trade or process can be dealt with in "Shop," which is more for detail in practice, space for answers being necessarily limited.—R. A.

Bell Telephone.—E. W. (*Hurstpierpoint*).—This querist has set me a task the magnitude of which almost overpowers me. I will, however, do my best to answer as fully as possible with a due regard to the limits of "Shop." I need not tell you that the Bell telephone is patented; you know that, and you know you must not make it for sale, but you want to know if you will be "lible" if you make it for your own use. Now I hardly know what you mean by the above expression, and I have very little experience of the working of the patent laws, but I fancy that if you made and used for business purposes a pair of telephones of the Bell type, you would be guilty of an infringement of Bell's patent rights, and you might be liable to prosecution if the United Telephone Co. thought it worth while to take the trouble. You want to know also if you can make any kind of transmitter with carbon as long as you do not make the one known as the Blake transmitter. Certainly you can, and you can also make the Blake transmitter if you like, but you cannot make and use for business purposes the Blake transmitter, and a great many other carbon transmitters, for the simple reason that they have been patented by their various inventors. All microphone transmitters are not made of carbon, and I do not know how you came by the knowledge that they were all patented. The first one, the one from which all the others have sprung, that of Prof. Hughes, was not patented, but given to the world in the generosity of genius. The microphone transmitter given in page 572, Vol. I., is not patented, for the simple reason that the maker did not apply for a patent for it, and he does not think that it is an infringement on any existing patent. But now comes the part of the task from which I shrink; you want to know what is really patented. I must ask you to try and find this out for yourself. And to guide you a little in your search, I may say that telephone matters began to be talked about seriously in the year 1876, and ever since that time, year after year, even day after day, specifications have continued to flow into the patent offices of this and other countries claiming novelties and modifications in telephone and microphone matters. So if there is a free library in your town, a nice little exercise for you in the evening will be to look up the volumes of specifications from 1876 to 1889, only thirteen years, but then there are about 90 or 100 volumes published every year. It is very interesting, and one gets a world of information from searching through these volumes. I have been there, and I think it would help you very much. The "English Mechanic" receiver is much the same as the one described in No. 28 of WORK. A soft iron rod is used instead of a permanent magnet; the wire on the bobbin is ¼ oz. of No. 30. The iron rod is magnetised by the passage of the battery current through the coil; the diaphragm is made of a piece of jam pot parchment, with a small bit of ribbon, steel, or milk tin stuck in the centre. Two No. 2 Leclanché cells at each end would be sufficient for 100 yards. I could not give instructions to make an automatic switch to work bell, microphone, etc., in this column, for instructions would be useless without detailed drawings, and these would take up too much space in "Shop." I may, however, prepare an article on this part of the subject of telephony, and if the Editor can find room in the body of the paper for it you may get your wish gratified.—W. D.

Pen.—D. B. (*Glasgow*).—I am not certain about it, but from your description I think the pen you want is that known as the audascript. It can be got from any good commercial stationer.—D. A.

Instructions for Cutting and Polishing Stones as Practised by Jewellers.—G. P. (*Camberwell*).—See above reply to E. L. B.

Microphone Making.—T. D. (*Nottingham*).—You ask for "the best source to obtain practical information on the making of microphone apparatus." Why, man! the best source to obtain information on this or any subject under the sun is WORK. In the number and on the page which you quote, besides the sketch, there is practical information given which will enable any one to make a microphone transmitter. But what is it you want? I can easily give you the name of a handbook on this subject, but you surely do not intend to set to and make all the microphone apparatus described in that book; if you do you will have little spare time this winter at any rate. The books on this subject are "legion," and the various apparatus described in each are "legion," therefore the apparatus may be actually termed legion of legions. As a beginning, you might try Du Moncel's "Telephone, Microphone, and the Phonograph." You might also try "The Age of Electricity, from Amber Soul to Telephone," or "Electricity and its Uses." But if you write to WORK, asking for instructions to enable you to make anything, you will not require to go much further afield.—W. D.

Gilding Moulded Frames.—J. T. L. (*Derby*).—For a short description of the proper method of preparing and gilding compo frames, and which is termed *water gilding*, I must refer you to my answer to B. P., page 603, Vol. I. I am not certain, however, whether you have any notion of this process, or whether your remarks apply to *oil gilding*. I should think the latter method the only one you can wish to take up, unless prepared to spend time and money, besides much patience, in acquiring a mastery of the former. If you have rough plaster or "compo" surfaces, get them clean and smooth with glass-paper and carver's tools; paint with two coats of *enamel paint* thinned with turpentine, and then, after stopping dents, etc., with white lead putty and this hardening, coat twice with enamel only, thus getting a good "face" upon the work before gold-sizing. If the size does not "take" on this nicely, dull it—the frame—down with rag and "turps," or ground pumice, water, and rag. Use *oil gold size*, and buy it ready for use. See several other replies on this subject.—F. P.

Spirit Varnish.—F. R. (*London, E.*).—The ordinary and most simple form of naphtha varnish can be made by dissolving shellac in wood naphtha—a preparation of which, termed "patent knotting," being much used by painters and kindred trades (see article on "Oils and Varnishes"). "Brown hard" would certainly be best for all general purposes, while the "chipping and cracking" qualities would most probably be only with an inferior article, or when used under unfair or improper conditions, into which space will not allow me to enter here. Like most inquirers, you don't mention what purpose you thought to put it to. I do not believe in making varnishes generally, unless for one's own professional use, and with experience to guide one—like polishers making their own French polish, etc., and which is a comparatively simple matter. Try Manders' patent knotting before you make any, and see if it answers your purpose before buying the ingredients.—F. P.

Paper-Hanging.—C. B. (*London, S.E.*)—I am unable to give you any information of the books you desire. I do not expect any such have yet been written. Paper-hanging, as a *distinct* trade calling, is but of recent date—say, the last twenty or thirty years. In earlier days it was as often a carpenter's job as a painter's, and it is only in the largest trade centres that we find it followed as a separate branch of work. The wide range in materials and prices of paper-hangings—from the cheapest "pulps" at 2d. a piece to the "Japanese leathers" at 60s., now provided for all classes of houses, and for all conditions of life—make the subject of "properly fixing them" a vast one, and altogether beyond the scope of "Shop." When our Editor is able to find room for a paper bearing on the entire process, you will, doubtless, be well rewarded by a study of it. As your note is but a *general* query, I cannot directly advise you, nor am I able to judge upon what *class* of goods and work you desire help with. We will aid you later on.—F. P.

Washable Distemper.—ONE AT SEA.—In common with yourself, there are many readers of WORK who would like to learn how "to make a washable distemper paint," the writer amongst them. Distemper, or *tempera*, is essentially a water-colour production that is prepared from substances dissolved in water and "bound" together with gum, size, glue, etc., and all of which are equally soluble in water at any time. The two distinctive natures of *oil* (that is, "washable"), paint and distemper (water paint), cannot be *practically* combined for *house painting* by any convenient mixture or process. The ancient *tempera* work of the days of the Pharaohs was, presumably, painted on in water, and afterwards covered with wax. By the addition of hot oil or Russian tallow, and so on, a mixture, with lime or whiting for its body, can be made to stand rain and weather on outsides, but it is not fit for good interior work. J. Orr & Co., of Charlton, Kent, by chemical and mechanical means, make the best I know of—"Duresco" it is called. There are others in the market, but if you *must* have "washable distemper," write the above firm. As a professional worker, I would advise doing without it.—F. P.

Extracting Sugar from Beetroot. — M. H. W. (*Sale*).—The manufacture of sugar requires a considerable amount of capital; but I will shortly sketch the method used in Europe so that you can see if it is practicable to your friend in Manitoba; it may also interest other readers of WORK. The beetroots used are a white variety, not the red used as a vegetable, and contain about ten or twelve per cent. of sugar. They are well washed in water by mechanical agitation, and then torn to threads in a "beetroot rasp." This consists essentially of a hollow drum, A, about 2 ft. in diameter, and 18 in. in the axis, revolving at the rate of 400 to 600 revolutions a minute, and whose periphery is covered with saw-blades rising about ¾ in. from the surface, against which the roots are pushed by means of a wooden block, B, the pulp being collected in a cistern, C, below. Two such cylinders, revolving 400 times per minute, will grind two and

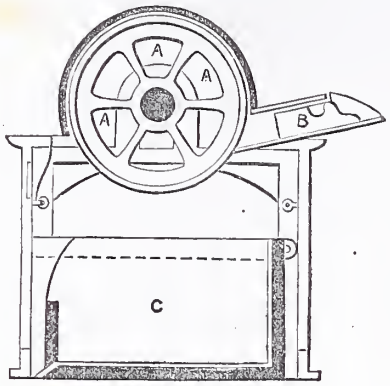


Fig. 1.

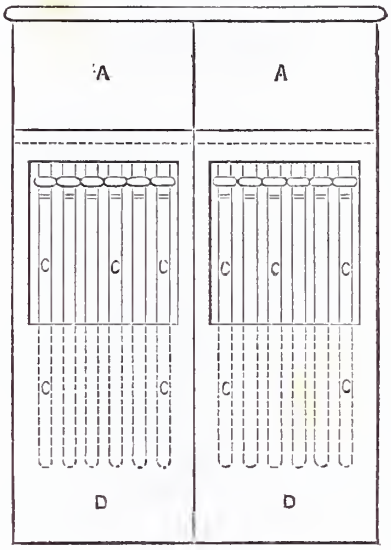
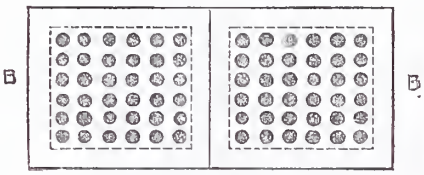


Fig. 2.



Extracting Sugar from Beetroot.

a half tons of roots in two hours. The juice is then forced out of the pulp by hydraulic pressure. Another method is to slice the roots in pieces about the four-hundredth of an inch thick, and to soak these slices in water for some time. In either case, the juice is at once mixed with milk of lime, and boiled by means of a copper coil heated by high-pressure steam. This coagulates and precipitates many albuminous and gummy matters dissolved out with the sugar. The excess of lime is removed by passing a stream of carbonic acid gas through the liquid, which is then run through the bag-filters. This consists of an upper cistern, A, having a perforated bottom, as seen in B. In each hole is fixed a nozzle, to which is tied a cloth bag, C, about 2 feet in diameter, and 6—8 feet long, compressed in a canvas sheath about 5 in. in diameter. Below is another cistern, D, to receive the filtered liquid, which is run off, concentrated to a specific gravity of 25° Baumé, and decolourised by being passed through iron cylinders, 5—10 feet in diameter and 10—50 feet in height, filled with granulated animal charcoal (burnt bones). The clarified syrup is then evaporated down in a vacuum-pan, which consists of a copper or iron vessel, the lower sphere of which is about 2 feet in depth and 7—10 feet in its greatest diameter, and the upper sphere or dome, which is hermetically fastened to the lower sphere, about 3—5 feet in height. The sugar is boiled by means of hot water or high-pressure steam circulating through pipes coiled within the lower sphere of the pan, the steam from the sugar being drawn off by means of pumps and condensation. When the syrup is full of crystals, it is drawn off into the centrifugal machines, which make about 1,000 revolutions per minute, and in which the syrup is forced through the perforated sides of the box, leaving the sugar within. This is washed with liquor without stopping the machine, and then taken out ready for use; the syrup being boiled again, and returned to the machines to get a second crop of sugar, and so on for several times, the remaining syrup being molasses. On an average 100 lbs. of beetroots will contain 10 lbs. of sugar, which is obtained as follows:—

First sugars	5·00 lbs.
Second ,, ...	1·50 ,,
Third ,, ...	0·50 ,,
Molasses	1·50 ,,
Losses—Sugar in pulp	0·50 ,,
,, in scums ..	0·35 ,,
,, lost in filters, etc.	0·59 ,,
Miscellaneous	0·06 ,,
	10·00 ,,

F. B. C.

Gold Lettering.—BONA FIDE.—I do not think any practical worker would answer you otherwise than "Use *japanners' gold size* made by a good firm!" At the outside, half an hour is the longest time it would have to stand before laying on the leaf—some makers' size dries in half that time. It is a good plan to keep a little size—japanners'—in an open vessel; it acquires body, and gives a better gloss when gilded upon. It also gets very thick, but, by the addition of some fresh size, we get working consistency with more body and gloss. Upon such a surface as that you mention, when fine strokes would probably be required, I fancy the fresh article would be best; the "aged" size answers well on black *flatted* surfaces.—F. P.

Imitation Marble.—H. B. (*London, E.*).—I conclude you desire to get a perfectly plain black surface, and not a veined imitation like "black and gold" marble. If you notice a piece of polished marble, or evenly a nicely-enamelled slate imitation, you will find its lustre is more akin to a French-polish gloss than that common to a copal-varnished surface. Ebonising, I am afraid, would not answer by reason of the grain of the wood showing, and, therefore, painting with body colour seems the best course open to you. Your surfaces being nicely glass-papered, give the wood two coats of thin oil paint, made from white lead and common black, with the addition of a little liquid, or paste, driers, and used with *most linseed* oil for *first* coat, but more *turps* for the *second*. Carefully strain the paint each time, and paper with 0 glass-paper between each coat, taking care not to take the colour off the sharp edges of the case. Then when any little places are puttied up and hard, give two more coats, same nature and order as before, but with more body or pigment in them. The grain will now probably be quite hidden; if not, give two more coats—don't stint it, or try and put two coats on at once. You can then finish it with two coats of black *enamel paint*, spread it thinly for first coat, then lightly rub with paper, and give a good flowing coat, but don't "overdo it," and have it "run," or you will get some "veins" of anything but a pleasing kind. Try and get a *method* of doing it—first the recessed and most awkward parts, and finishing with the face or most prominent parts. I hope, for the sake of consistency, your clock case has been *designed* and arranged with a view to finishing as *marble*, and not to look like "carved woodwork" painted! If you have suitable caps to the pillars, I fancy gilding with deep gold leaf would suit them; and if, against the black case, you could finish the pillars imitation "malachite"—a green-veined costly marble—you would get a handsome effect; try it later on, when the marbling papers are published. For the present, bronze them all over, coat with the black enamel, but made to the desired bronze-green shade with raw sienna, or ochre, in oil, so that the metal shows through, and then blow patiently a little of the gold bronze upon them before they are hard. *Finish* the pillars *before* the blackwork.—F. P.

Builders' Measuring Book.—J. R. H. (*Newington*).—There are several different works published annually, dealing with the pricing and measuring of work, and of these I can recommend Atchley's or Laxton's "Builders' Price Book." The *Builder* is the place to look for the latest advertisements of such books. As a worker engaged with one branch of practical building, I can quite agree with you that in plasterers' work there is much that could be beneficially written upon. At present, plastering "pure and simple" appears hardly suitable for WORK, so few readers would care to "rough in" and finish off an ordinary job, even if required, in their own home. Doubtless, our Editor will agree that papers on modelling and fine-casting are branches that would be acceptable to many, and will arrange for their due appearance. If you are young and persevering, I commend *modelling* to you, since many journeymen plasterers have risen to good positions in firms like Doulton's by proficiency and skill in that line. Should you want to thoroughly master "measuring up," you must study mensuration.—F. P.

Tools, Timber, etc.—A. H. W. (*Newcastle*).—(1) A. H. W. will be able to get any tools he requires of any respectable ironmonger in the neighbourhood, and, in most cases, can see the prices marked in plain figures on the goods in the windows. He need not fear being charged 50 per cent. more than the "professional" if he knows what he wants, and goes to a respectable firm. (2) The only timber merchant I know of in Newcastle-on-Tyne is J. Bowman, 67, Quay Side, and if the quantity of timber A. H. W. wants is too small for him to supply, no doubt he will tell him where best to go, but he must be prepared to plane the stuff himself, as few yards have the convenience of being able to plane a little lot of odd sizes. (3) Mouldings, as used by carpenters, etc., can be had at any timber-yard; fancy patterns from most picture-frame makers. If A. H. W. will write me, I will send him a moulding book free. As regards the suggestions, if A. H. W. will refer to No. 33 of WORK, issued November 2nd, he will find full information as to prices of timber, and how to buy it. Nearly every size is mentioned, and should be kept handy for reference. I shall be pleased to give any further information. —A. J. H.

Photographic Ferns.—W. B. R. (*Manchester*).—"Highway Handbook of Photographic Ferns" is published by Piper & Carter, 5, Furnival Street, Holborn, London, price 1s.—F. J. C.

Cleaning Tin Goods.—IRONMONGER (*London, W.*)—There is only one way that I know of to whiten or clean tin goods that have been discoloured by exposure to atmospheric influences, and that is by means of some polishing material and plenty of labour and "elbow grease." I have had some considerable experience in this line, when younger, having had frequently the pleasure (?) of assisting to clean up the old stock of a large tin room of an ironmonger. If the articles are much discoloured, nothing will ever restore their original lustre, whatever the makers of the various and much vaunted polishing pastes and powders may say. But to make them fairly presentable, I have found nothing to beat the following:—Make a paste of fine whiting and olive oil of about the consistency of thick cream; add a few drops of paraffin oil, take a piece of rag as a rubber, and rub the article to be cleaned thoroughly all over, rubbing very hard and briskly. When this is done, take another rag and well rub all the paste off, getting the article as free from it as possible, then take another rag or duster and some fine dry whiting, and commence to polish. You will find a fairly good polish come up, but your duster will get greasy; keep turning the greasy part in, dabbing the duster in the whiting each time till you have polished the article, and then finish with a chamois leather, with just the least dust of whiting. For tarnished copper goods, proceed in exactly the same way, using crocus and oil first, and polishing with dry rottenstone.—R. A.

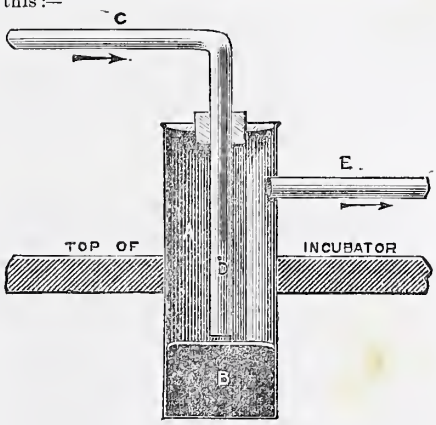
Books on Carpentering.—FROM BURMA (*Kensington*).—The following books may answer your purpose:—Tredgold's "Elementary Principles of Carpentry," 12s. 6d. (Spon); Ashpital's "Carpenter's New Guide," 21s. (Lockwood & Co.); Davidson's "Drawing for Carpenters and Joiners," 3s. 6d. (Cassell); Jewitt's "Manual of Wood Carving," 5s. (Bemrose.)—F. J. C.

Bookbinding.—AN AMATEUR (*Walsall*).—You state in your letter that you have seen from time to time articles and answers on bookbinding. How strange that having seen these you have passed over answers to the two questions which you ask. In No. 17 of WORK, page 269, you will find instructions given for cutting edges of books, which is the best way to make them level. And in No. 24, page 381, you will find a description of one method of marbling edges which is much better than sprinkling. By the way, your method of sprinkling is very handy, but instead of ink use the preparation described on page 269, Vol. I. You might also redden your edges by dipping a sponge in the desired colour (red ink) and drawing it evenly over the edge, taking care not to allow any of the ink to run in to the inside of the book. We are always willing to help querists, but they must be willing to help themselves by looking up their back numbers.—G. C.

Dulcimer Wood.—A. E. G. (*London, W.*)—If A. E. G. will write me through the Editor I will get what he requires for him. Let me know exact sizes and I will get the nearest I can; as I am in the "know," I may succeed better, and forward on through the Parcels Post.—A. J. H.

Bricklaying.—H. G. (*Bow*).—It is not possible within the limited space allotted to "Shop" to give full details of drawing, cutting, and setting arches, but as a general rule, the joints of the arch should be drawn to radiate to the centre from which the arch is struck; a mould is then cut to the shape of the arch bricks, and marked on the face of each brick; the lines are cut in for a short distance by a saw, and the bricks cut by the brick hammer, chisels, and scotch; they are then rubbed on a level stone till they fit the mould. The bricks are set with fine putty, the joints being $\frac{1}{16}$ in. thick, and set to radiate to the centre, by means of a cord fixed to a nail in the centre, or by a template made to fit on the wood centre. A series of articles on bricklayers' work are now appearing, in which the subject is more fully treated. If you want information on any special work, if you send particulars of it, I shall be glad to give you any assistance. I should also advise you to take lessons in geometry and architectural drawing, if you have not done so, as you will then familiarise yourself with plans, and the method of drawing them.—E.

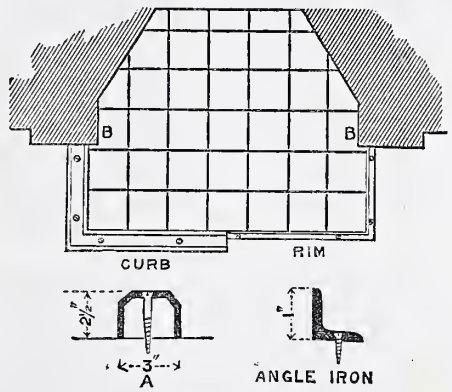
Simple Incubator.—AMATEUR (*St. Helens*).—I should like to say that there is nothing specially new about the incubator, and no patent rights to trouble about. As to the regulator, I believe the arrangement sketched is in principle similar to that in Mr. Hearson's patent. I cannot tell when the patent was obtained, but quite eight years ago. The liquid used is part of the invention, and is, I think, some ether, spirit, or mixture which boils at the required temperature. No doubt AMATEUR is aware that spirit boils at a lower temperature than water, and any intermediate boiling point can be secured by a proper mixture of spirit and water —that is, between the boiling point of strong spirit about 90° and water 212°. If AMATEUR can use gas, he can easily manage the regulator without any bother about patented contrivances; if not, better get an electric bell and a thermometer to make contact at 103°. The gas regulator is something like this:—



A Simple Incubator.

A, air-tight receptacle inserted in the top of incubator near to the eggs; B, mercury; C, gas supply; D, pin-hole, to prevent gas going quite out; E, gas to lamp. When mercury, B, expands gas supply is stopped; C can be adjusted and fixed.—B. A. B.

Fireplace Tiles. — GROCER (*Sunderland*).—Your friend was quite right, the tiles would not keep their place if simply laid on the hearth. When tiles are laid on an existing hearth, it is generally done to save taking up the hearths, etc., and knocking the place about (which would, no doubt, have to be made good at the expiration of your tenancy), and not with the idea of saving the tiles. You would find that the tiles, after having been subjected to the heat of the fire and the wear and tear, were of very little use after being taken up, although the hearth under them could be cleaned and left intact. If you also are not so particular as to saving the tiles, but do not wish to destroy any portion of the house which you might be called upon to make good, the best way to go to work is as follows: —First determine the size you wish the hearth to be (letting the size of tiles influence you as much as possible, so as to avoid more cutting than is absolutely necessary), allow about $\frac{1}{16}$ of an inch for each joint between the tiles, then take a piece of angle iron about 1 in. by 1 in., and bend, or have it bent, to the length your hearth is to be, and



Fireplace Tiles.

the distance out from the jambs. The bottom flange should now be drilled and countersunk for screwing to floor; this will form a strong rim for your hearth. If you wish the tile hearth to be smaller than the existing one, drill small holes in the latter, corresponding to the holes in the iron rim; fill them up with molten lead, and this will give you a strong fixing for your screws. If you think the iron rim would be unsightly, you can buy a japanned cast iron curb or fender to about the section shown at A, and by drilling a few countersunk holes through the top it can be screwed down to the floor as described above. They are very cheap, and can be got to almost any size, and make a very nice finish, for I have no doubt you would find it rather a difficult matter to get anything in the shape of a fender to fit up to the iron rim, and with this latter method you have the fender and rim in one. The small sketch above shows one half of the hearth done with an iron rim, and the other half with a curb. The tiles should be bedded on the old hearth with Portland cement, having at least $\frac{3}{8}$ of an inch bed under them. In cutting the tiles, you simply cut through the glaze on the face of the tile with a small steel chisel about $\frac{1}{4}$ of an inch wide, and then tap them along the line at the back, when you will find they will break quite readily. You must not be disappointed if you break one or two, but try and make them work in for the back. If any of your tiles require a piece taken out of them, as at B, the simplest way is to cut them right through straight across, and then cut the piece off after. You can then replace the piece you want, and the joint will hardly be noticed, if you are careful not to get any cement into it. As you are an amateur, the best way to lay them is to cut and fit all your tiles first; then take them up and lay them in water. Now mix up some neat cement rather soft, and float over the whole of the hearth a little higher than you reckon the bed should be when finished; next lay all the tiles quickly and lightly on the cement, and pat them down evenly to a level surface with a piece of wood, and then any of them that are too low or not low enough, etc., can be picked up with the point of a trowel, and a little bedding added or taken away as the case may be, and the tile relaid. If you now mix up about a handful of stiff cement and with a rag rub it well into the joints, you can then polish the tiles off with a dry cloth.—E. D.

Boat-building.—NOVICE.—Papers on this subject have been already begun in this volume, beginning with canoes.

Taking Out a Patent.—G. W. (*Bournemouth*) does not make the nature of his invention quite clear. If the novelty exists in the shape, pattern, or design, registration, at a cost of 10s., will protect it; but if any mechanical action or principle is involved, it can only (as has been already explained to a previous correspondent) be protected by the more costly patent.—C. C. C.

Camera Bellows. — PHOTOGRAPHER.— Full directions how to make a camera bellows have already been given in WORK. They may be summarised as follows:—Paste together with bookbinders' paste some stout buckram and bookbinders' cloth of sufficient size. The dimensions must be determined by measurement of the frame of the camera to which it is intended to attach it, a little allowance being made for overlap. The length of the material must be two or three inches longer than the required extension to compensate for the folding, and to avoid undue strain. Rule lines, an inch apart, across the width of the material, and from corner to corner, corresponding to the frame, as guides for folding them before the paste becomes absolutely dry, fold the material backwards and forwards according to the lines, and put under pressure so folded till dry. Pull out the material straight and make sharp creases along the lines drawn from corner to corner, the buckram being inside; bend the first creases at right angles with the latter. Pinch up the corners smoothly with the finger and thumb, and glue the overlap to complete the bellows. It is as well to make a paper pattern first to accustom oneself to the folding, as experiments cannot be made on the pasted material without spoiling it.—D.

Electric Lighting.—C. V. M. (*London, S.W.*). —I advise you to have nothing to do with an apparatus for lighting a 55 volt 32 c.p. "Ediswan" lamp. If you want to get a light of 32 c.p. from incandescent lamps, get four 8 c.p. lamps and group them in parallel. Read my articles on "Model Electric Light" when they appear, and then you will be able to judge for yourself respecting the cost of apparatus necessary to light up one 55 volt 32 c.p. lamp, as also how to set about getting the electric light required by you. I may tell you, however, that a 55 volt lamp will not need an E.M.F. of 120 volts to light it properly.—G. E. B.

Pipe-Lighting Plane.—J. P. (*Reigate*).—The plane for making pipe lighters curled up like a twisted paper spill has already been fully described and illustrated in No. 30 of WORK, page 468. This description, written by J. H., and having three illustrations of this particular plane, must have escaped the observation of J. P. If, however, he does not quite understand how to make the plane from the description given, or feels uncertain as to his probable success, he can get a plane for the purpose at Preston's, Pentonville Hill, at a very cheap rate. The plane they sell is made of iron, and is suitable for either amateurs, tobacconists, or others who may desire or require these lighters for themselves or others.—B. A. B.

Copying Apparatus.—J. R. H. (*Newark*).—To use the graph copying apparatus, all you have to do is to write with a special ink in the ordinary way. Allow the ink to dry without using blotting paper. Then lay the paper with the writing in contact with the graph, smoothing it down carefully to avoid smears and wrinkles. Allow the paper to remain for a minute or two. On raising it you will find the jelly has taken an imprint of the writing or drawing, which will be transferred to any sheet

of paper pressed down on it and allowed to remain for a few seconds. As you will have seen elsewhere if you read these columns, it is not possible to give answers in "next week's 'Shop.'"—D. A.

Bevelled Glass.—R. T. H. (*Chatham*).—The price of glass per foot depends on the size of the plates, but unless any of them are very large you may reckon them as costing from 2s. to 3s. per foot super. Cost of bevelling varies according to the width of the bevel; you may reckon it as from 6d. to 1s. per foot run. Price will also be regulated by quality of glass, silvering, and bevelling. You can get the plates by ordering them through any good cabinet maker.—D. D.

Oil Fuel.—J. M. (*Ayr*).—The information you ask for cannot be given in these columns, as so much depends on circumstances. You should consult an engineer who could personally examine the boiler and its fittings.—L. J. P.

Colour Box.—A CONSTANT READER (*Leicester*).—I do not know that I can better help you to make a box to hold oil colours in tubes and other sundries than by describing it as a tray with a lid. The tray is to be divided into compartments by partitions of thin wood. The compartments of course will vary according to the sizes of the tubes, as though you only state one size, I presume you would not think of getting large tubes of the more valuable paints. As you are going in for a quantity, or, perhaps I should say, have got them already, mark out on a sheet of paper the full size of the spaces necessary. You will then have no difficulty in arranging the compartments in your box accordingly. I do not understand the part of your letter referring to palette, brushes, etc. Surely you do not contemplate starting to landscape work without any knowledge of painting. If you already can make use of about forty colours, you must have made some progress in the art, and do not require to be told among other things that brushes are a great deal a matter of custom and fancy, that size depends on the class of work, size of canvas, and so on.—D.A.

Type-Writing Machine.—A. J. M.—I am afraid no directions for making a type-writer are likely to appear in these pages for the simple reason that machines of this class are complicated contrivances, and that any one inventing new or improving on old forms is more likely to patent than to explain how to make. At present all the best machines are protected by patents, but even were this not the case, I am inclined to think that it would not pay you to make a single machine, as they are produced by machinery and require the utmost nicety of construction in every detail. The prices of good machines, that is those with which rapid work can be done, are high. As you do not care to incur the necessary expense for a new machine, why not buy a second-hand one? They are constantly being advertised in the *Bazaar Exchange and Mart*. A cheap rapid writing machine called the "Mercury" is in preparation, and as its price will only be £8 8s., or less than half that of any of the best keyboard writers in the market, it may suit you. Glad to hear you like WORK so much.—D. D.

Modern Beehives.—AN AMATEUR WORKER (*Dorking*) has quite a treat in store for him, for not alone are beehives and their construction to be described, but all the other apparatus necessary for the apiary. Space is the only commodity necessary, as most of the papers are already in the Editor's hands, and the others have appeared already. From the tone of AMATEUR WORKER'S letter, I would recommend him to send eighteen pence to Messrs. Houlston & Sons, Paternoster Row, London, for a copy of Mr. Cowan's "Bee-Keeper's Guide Book," which will reveal a new world in bee-keeping to him. With regard to the label he asks for, I can quite sympathise with him, but, unfortunately, cannot name a publisher. However, such a small thing would scarcely require a "publisher," as any printer would supply a few hundreds for a shilling or two, and then the name could be printed as well as the rest, and perhaps some original verses descriptive of the weakness of those people's memory who do not return books.—APIS.

Milling Cutters.—W. F. (*Manchester*).—Heat the cutters in a clear smith's fire, made hot by the blast, but cease blowing at the time of heating up the cutters. Plunge the cutters, when red hot, into oil to harden them, preferably using sperm oil. Then brighten them all over, and heat in a sand bath. The bath may consist of any fine sand, and should be heated with gas jets underneath. This will impart a very equable and easily graduated temperature to the cutters. When of a straw colour plunge in water to temper. The speed of course depends on the material. Roughly, you can use milling cutters at from two to two and a half times faster than ordinary cutting tools for turning and planing.—J.

Brass Pattern Making.—W. G. R. (*Bilston*).—This is purely a business, not a technical, question. Obviously, the only way to get trade is to canvass personally with samples, or to advertise, or to combine the two methods. And to get the names of leading firms you have only to consult the directory, or to spend a day or two about the town.—J.

Drawing.—J. S. (*Glasgow*).—This subject is one which does not come within the scope of WORK.

Steel Springs.—(NO NAME).—Get a round mandrel of the same diameter as the internal portion of the coil, drill a hole near one end, insert one end of the wire or rod from which the spring is to be made, and then set the bar in the lathe, and turning slowly, coil the wire or rod around the mandrel. To harden, heat to blood red, and quench in water. To temper, heat slowly until tallow or oil placed upon the spring burns or flashes off. At that heat remove from the fire.—J.

Model Locomotive.—H. P. S.—Your boiler dimensions being fixed, your heating surface is fixed also. A force pump of $\frac{3}{16}$ in. diameter, and the same stroke as engine, and cylinders of $1\frac{1}{2}$ in. bore, and from $1\frac{1}{2}$ in. to $1\frac{3}{4}$ in. stroke, would be suitably proportioned for your model.—J.

Linoleum.—J. E. (*Liverpool*).—To give "all particulars" about the manufacture of linoleum in "Shop," or even in the Magazine itself, is out of the question. To do so would probably not be of interest to many, and certainly not useful to any of our readers. There are limits to the things which even the most ambitious amateur could make, and linoleum is outside these limits. It cannot be made profitably without a considerable preliminary outlay, and it would never pay you to attempt to make a small quantity. The "cheapest way" to get linoleum is to buy it. An outline of the process may be given thus. Specially prepared linseed oil is mixed with ground cork. The mixture is then laid on canvas, and evenly distributed by pressure. The back of the canvas is then finished by painting. If you are still disposed to make an attempt to manufacture, you will probably get a very bad substitution for or imitation of the real thing at greater cost than you can buy the best linoleum for.—D. D.

Early English Sideboard.—T. M. (*Glasgow*).—As you will see if you will refer to our back numbers, your wants have been anticipated. Designs for other sideboards will be given in due course. There is nothing special about the Beith work, except that makers there have a reputation for good honest work. As you are a cabinet-maker, though apparently only familiar with common stuff, I may be permitted to suggest that you should try and get into some good shop. If you are a young man go as improver, but if you are too old to do so, you might still manage to get in, though not as a fully-skilled artisan. If you do go as an improver, and really wish to progress, do not make a very common mistake and fancy after a month or two that you are worth as much as any one else, and that you have nothing more to learn. I know a manufacturer who, two or three years ago, having numerous applications from young men wishing to enter his employment as improvers, determined to try the experiment of "improving" them. I regret to say his experience has not been of the most satisfactory character, as so many of the lads think they know much more than older people, and have large ideas of their own value. These remarks may be of use to you in showing what employers do not like. If you are inclined to remove from Scotland and wish to improve, I may be able to tell you of a shop in England where you might get employment. Before I can do so, however, you must let us know full particulars of where you have worked, and what you can make. You need not write a page or two to say that you are sober, honest, and possessed of all the other virtues. If you are not say so. Meanwhile, read all the articles which have appeared in WORK in connection with cabinet-making and joinery.—D. D.

Books on Locks.—A. M.—All the best makers have books descriptive of their particular locks, but I do not know of any book dealing specially on the subject you mention.—T. W.

Coloured Plates.—KNARF (*Lower Broughton*).—We cannot at present go into coloured plates such as you suggest in connection with WORK.

Electro Motors.—PLEASURE AND PROFIT.—Electro motors of different types are described in the text books of electricity and magnetism, and cannot be described in a brief reply. Neither can a model horizontal engine, which can only be properly treated in several articles.—J.

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Wood Mitre Cramp.—J. A. (*Keighley*) writes in reply to J. H. (*Blackburn*) (see page 605, Vol. I.):—"The most easy way to make a cramp of wood is by four half squares. Place them at the corners, and then bind them with a piece of strong twine after your suggestion. You will find it to act well and firm."

Wood Mitre Cramp.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—LONG CRANK; A. O. W. (*Ripon*); F. U. (*Hereford*); QUANDRY; C. F. (*Southsea*); CURLY; TINMAN; J. M. (*Middlesboro'*); G. A. P. (*Stoneycroft*); N. M. (*Norwich*); J. K. (*Market Weighton*); CONSTANT READER (*Hull*); AMERICAN ORGAN; C. H. W. (*Highbury*); PLUMBER; T. W. A. (*East Dulwich*); £ S. D.; IRIS; W. H. O. P. (*Hackney, N.E.*); BREMNER (*Llanelly*); A. W. (*Wakefield*); READER OF "WORK"; A. H. T. (*Brierfield*); V. B. (*Birmingham*); JACK (*Edinburgh*); AMATEUR; T. T. (*Northampton*); S. B. (*Nottingham*); W. S. W. (*Greenock*); A NEW READER OF "WORK"; J. W. (*Holloway, N.*); ANXIOUS ONE; AMATEUR (*Fife*); P. R. (*Sunderland*); WORKIST; F. H. (*Streatham Hill*); H. J. (*Brondesbury, N.W.*); C. A. (*Westbourne Park*); M. E. M. (*Heywood*); J. J. (*Kidderminster*); C. M. G. (*Belfast*); THE BRITANNIA CO.; H. M. (*Bristol*); G. T. P. (*Birmingham*); P. R. P. (*Newcastle-on-Tyne*); OILSTONES; TIMBRE; A. G. (*Newcastle-on-Tyne*); M. E. (*Birkenhead*); E. J. (*Stoke Newington*); AMATEUR CARPENTER (*Dublin*); A. R. (*Sandgate*); W. J. S. (*Paddington*); D. G. T. (*Cornhill*); J. R. W. (*Portsmouth*); W. A. Y. (*Cambridge*); PATIENCE; A CONSTANT READER OF "WORK"; C. E. (*St. Pancras*); A YOUNGSTER; INDEX; FITTER; R. H. (*Bradford*); C. W. (*Kensington*); DIAMOND MOUNTER; T. D. (*Bury*); T. D. B.; J. R. (*Huntley*); HERR VON MUTZ; J. S. (*Aberdeen*); STATIONER.

Trade Note.

THE Vienna correspondent of the *Times* describes the new explosive called ecrasite, which is the invention of two engineers, named Sierseh and Rubin. He says:—"This explosive is impervious to damp, shock, or fire. Its power is to dynamite as 100 to 70, and it can be carried from place to place with the utmost safety. It is not smokeless, but emits a thick black smoke, and the detonating noise is louder than that of gunpowder, but shorter, sharper, and clearer. It can be used for rifle cartridges, or as priming for cannon, and a bomb-shell loaded with it explodes with such terrific results that experiments against palisades representing 100, 250, and 500 men at ranges of 300, 750, and 1,200 metres, recorded marks on every division of the palisade standing for a soldier. The secret of this invention is being closely kept for the Austro-Hungarian War Office."

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [15 R

Complete Fount of Rubber Type.—Two alphabets, to form any word or name, box, pad, ink, and holder, post free, 1s. 6d.; extra alphabets, 6d. per set; figures, 3d. Business, address, and pocket stamps equally cheap.—W. C. PRESTRIDGE, Manufacturer, Cumberland Street, Bristol. Established 1870. [2 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Machinery and Tools.—Largest stock in London. BRITANNIA CO., 100, Houndsditch. Cash or hire purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks, Dies, Forges, etc.; catalogue of new, 6d., or list second-hand, 2d.—BRITANNIA CO., Colchester.

Best Book on Lathe.—Chapters on metal spinning and screw cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [11 R

Stickall Cement (patented).—Will securely stick paper, leather, wood, ivory, marble, iron, earthenware, glass, etc., for which purpose it entirely supersedes paste, gum, glue, and every other substance; made up in self-opening tins, 6d. and 1s. each, per post 3d. extra.—The EVER-CLEAN COLLAR CO., 100, Wood Street, E.C. [12 R

Electric Alarum Clocks, to place in circuit with bell; can be removed at will without having to disconnect wires; carriage paid, 6s. 6d.; Bell Sets from 7s. 6d.; Motors for lathes, circular saws, fret machines, etc., Lighting Sets, etc.—O. OTTLEY, Cannon Street Road, London, E. [14 R

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 sheets, 2s. 6d. All post free. Lists free.—F. COULTHARD, East Cliff Terrace, Bournemouth. [5 S

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

Water Motors!!! 8s. 6d., 12s. 6d., 18s. Photograph, particulars, 2d.—P. PITMAN & Co., Aubrey Road, Withington, Manchester. [1 S

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [17 R

Carpenters and Joiners should buy their tools at Clarke's, Fore Street, Exeter. New Illustrated Catalogue, 4 stamps. [3 S

Model Ships' Fittings, engines, castings, parts, etc. Illustrated Catalogue, 4d.—STIFFIN & CO., 324, Essex Road, Islington, London. [4 S

Safety Bicycle, 1890 make, Diamond Frame. Balls everywhere, including pedals. Must sell. Only £7 15s. Rare bargain. Equally good as new; not scratched; only mounted twice. Perfect condition guaranteed.—GARNHAM, 6, Tower Street, Ipswich. [2 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

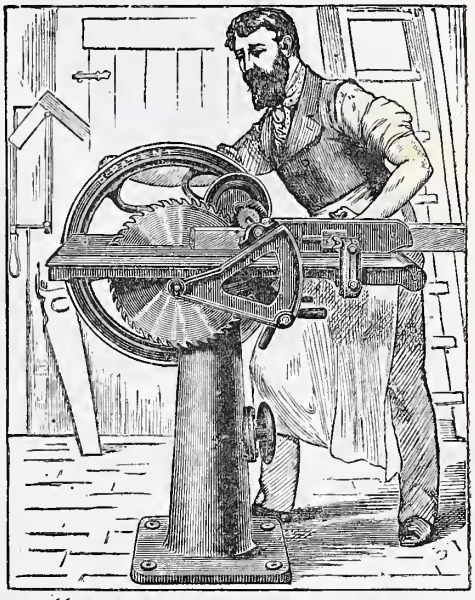
FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*



"THE LEYTON"

New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.
37, CHANCERY LANE, LONDON, E.C.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

ESTABLISHED 1851.

BIRKBECK BANK,
Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

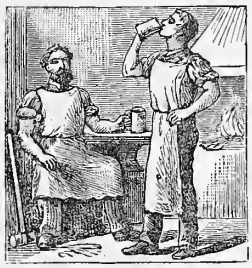
HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

CASSELL'S CLASSIFIED CATALOGUE, containing particulars of upwards of ONE THOUSAND VOLUMES published by Messrs. CASSELL & COMPANY, ranging in price from THREEPENCE TO FIFTY GUINEAS, will be sent on request *post free to any address.*
CASSELL & COMPANY, LIMITED, *Ludgate Hill, London*

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

Three Vols., crown 8vo, cloth, 5s. each.

PRACTICAL BLACKSMITHING,

COMPILED AND EDITED BY

M. T. RICHARDSON.

Vols. 1 and 2 now ready.

Vol. 1.—THE EARLY HISTORY OF BLACKSMITHING: Ancient and Modern Tools, Plans of Shops, &c. With 200 Illustrations.

Vol. 2.—TOOLS AND APPLIANCES: Iron and Steel, &c. With 230 Illustrations.

London: Kegan Paul, Trench, Trübner & Co., Limited.

CASSELL'S TIME TABLES.

MONTHLY *4d.*

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET

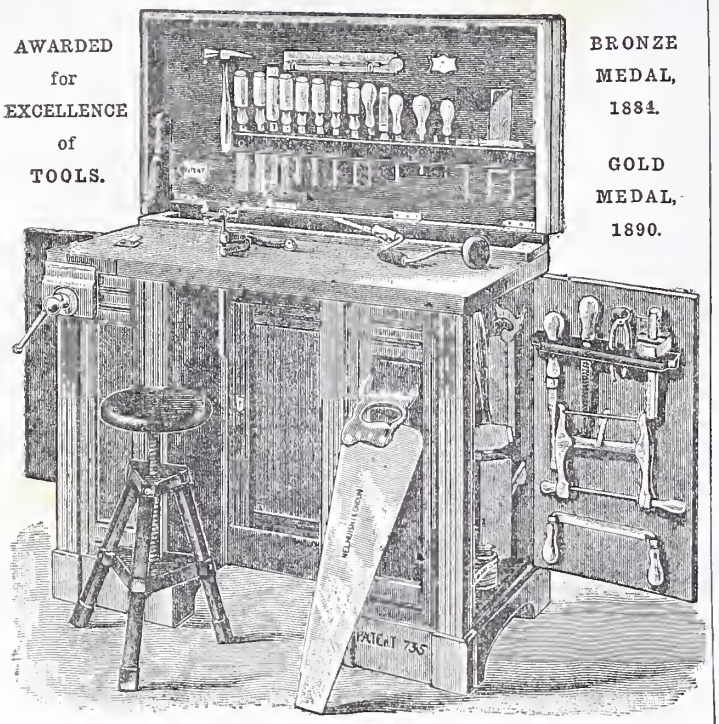
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic **WEAKNESS** speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place),

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

FRETWORK AND CARVING.

Highest Award—Gold Medal for Tools and Patterns.

Machines, Designs, Tools, Wood, Mirrors, Hinges and Fittings, Varnish, etc.

NO. 731

OCCASIONAL TABLE. SIZE 26½ X 15 INS.

NO. 730

FLOWER OR LAMP STAND. SIZE 44 X 12 INS.

T. N. writes:—"I got a First Prize from one of your Designs."

R. W. A.:—"Received your Catalogue today, and consider it the best I have seen."

R. B. M.:—"Machine to hand, am highly pleased with it."

J. A. S.:—"I have taken Eight First and One Second Prize with various patterns of yours."

Illustrated Catalogue of all Tools, Wood, etc., and 500 Miniature Designs, free for Six Stamps.

Harger Brothers,

SETTLE, YORKS.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

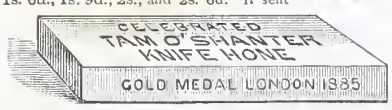
WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

THE TAM O' SHANTER HONES

Are Praised by all Classes.

Try one of these famous Hones. No clammy oil required in sharpening; use water. Prices, uncased, for Knives, Razors, Plane Irons, Axes, &c., from 9d. to 1s. 6d. each. In neat cases, 1s. 6d., 1s. 9d., 2s., and 2s. 6d. If sent



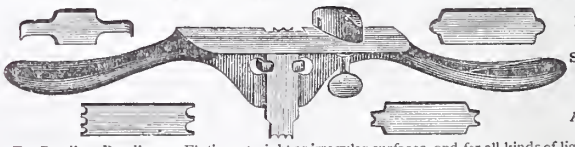
by post 3d. extra, and 4½d. for Joiners and heavy Hones at 1s. 6d., uncased. *To be had at the Ironmongers', Seedsmen, Nurserymen, &c. If they cannot be obtained there, write direct to*

JOHN C. MONTGOMERIE,

Hone Works, Dalmore, Ayrshire.

NOTE.—Our New Illustrated 200-Page Catalogue is now ready, containing 700 Illustrations, of all the Latest Improved Tools for Carpenters, Joiners, Engineers, and all Metal Workers, Carvers, Fretworkers, &c. By post, **6d.** The Polytechnic List of Tools for Students on application.

UNIVERSAL HAND BEADER.



Iron Stock, with Seven Steel Cutters, **5s.** each.

Free by Post.

For Beading, Reeding, or Fluting, straight or irregular surfaces, and for all kinds of light Routering, this Tool is invaluable to Wood-workers. Seven superior Steel Cutters go with each Tool. Both ends are sharpened, thus embracing Six ordinary Sizes of Beads, Four Sets of Reeds, Two Fluters, and a Double Router Iron (⅛ and ¼ inch). The Cutter is firmly clamped to the Stock. A Gauge with long straight bearing surfaces is used in ordinary work; and a Gauge with oval bearing surfaces is used for curved or irregular forms of work. Either Gauge can be shifted from one side of the Cutter to the other, without separating it from the Stock, and can be rigidly set at any required distance from either side of the Cutter.

Note the Address—**MOSELEY & SON, 323, High Holborn, W.C.**

WATERPROOF FLUID GLUE.

(Patent.)

By post, 1s. 3d. *and* 8d.

WATERPROOF GLUE CO.,

62, Dale Street,

LIVERPOOL.

READ

"Between Life and Death."

By FRANK BARRETT,

Now appearing in "CASSELL'S SATURDAY JOURNAL."

24 PAGES ILLUSTRATED. Weekly 1d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NOW READY, price 1s. 6d.

ELEMENTARY CHEMISTRY

For SCIENCE SCHOOLS and CLASSES.

By *ROBERT AVEY WARD.* 128 pp., crown 8vo, cloth.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED. LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 60.] SATURDAY, MAY 10, 1890. [PRICE ONE PENNY.

A KITCHEN DRESSER.

BY DAVID DENNING.

THE homely dresser may not present many attractions to the artistically-minded amateur cabinet-maker, but it is nevertheless more truly a piece of "art" furniture than many of the more pretentious things which are classed as such. It is, however, not so much as an artistic production that we have to regard it at present, for, whatever claims it may have in this respect, they must give way to the more prosaic views of the utilitarian. Still, one feels loth to contemplate the dresser only as a useful piece of furniture; for, however plain and void of decorative detail it may be, and generally is, it so evidently fulfils the purpose for which it is intended that it can hardly be regarded as other than a structure which merits attention. We all know that one of the leading principles of art requires that nothing shall be made which is not adapted for use according to the expressed intention of its existence, and that due regard shall be paid to the manipulation of material, whatever this may be. Now, remembering that the dresser is for one of the inferior rooms, viz., the kitchen, we at once see that fanciful ornamentation would be out of place, and that it would be absurd to employ costly material in its construction. Thus far, therefore, the dresser may claim to be an honest contrivance, which is more than can be said of many things seen in our furniture shops.

Though some forms of dresser may be more convenient than others—or, let it be said, better adapted for the space and circumstances of the user—as the primary object is utility, details of arrangement may vary to a considerable extent. On the whole, however, we shall not go far wrong if we regard the dresser as the kitchen sideboard, and the pattern selected will probably embody the requirements of most people. In size we may take it as follows:—Length, 5 ft. 6 in.; width of top, 2 ft.; and height from floor, 2 ft. 9 in. As will be seen from the illustration, immediately under the top are three drawers. Below them are cupboards with an open space between. The set of plate shelves above the dresser is separate from it, and may be made or not. They form, in fact, no part of the dresser itself, but may be regarded as a very useful adjunct, and not out of place in any kitchen.

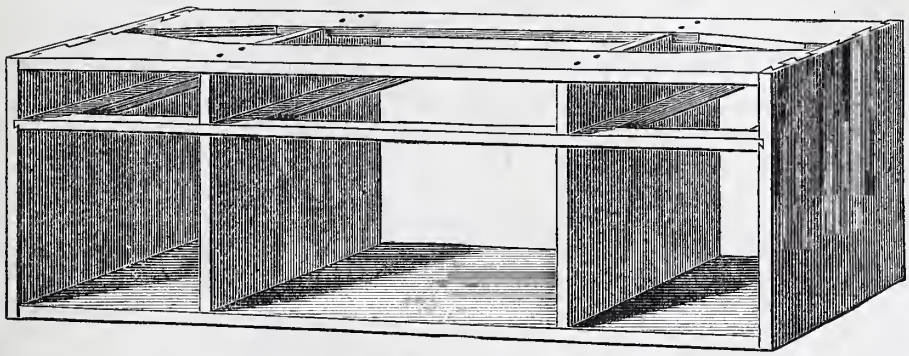


Fig. 2.—Carcase of Dresser without Top, Drawers, Door, or Plinth.

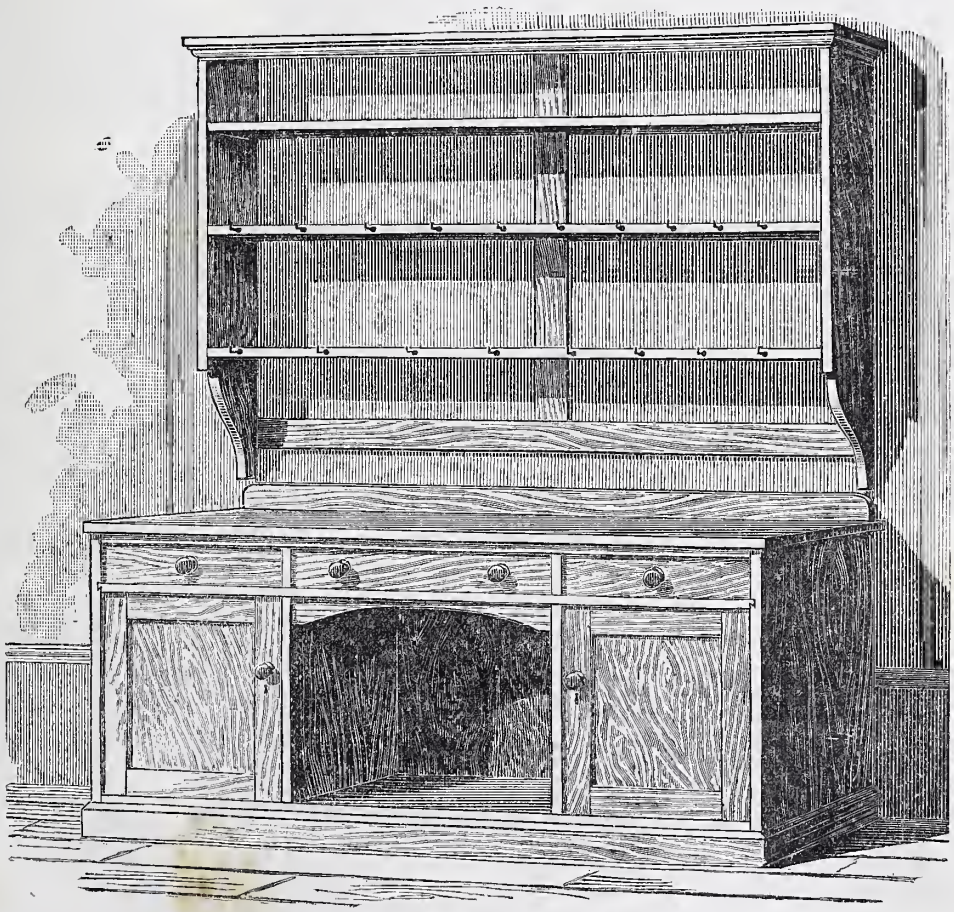


Fig. 1.—Kitchen Dresser and Plate Shelves.

Leaving them, however, for future consideration, a few suggestions to those readers who wish to make a dresser, and yet do not find the pattern portrayed quite what they want, may be welcomed before describing the actual construction.

First, the matter of size may claim attention, though to those who are practically acquainted with dresser-making this may seem unnecessary. The novice, however, is frequently at a loss what to do when any alteration from given figures may seem desirable, and therefore it may be well to say that he should make his sizes suit his—or his customer's—requirements. It is no use adhering closely to measurements simply because they have been "in print," or even because they are those commonly regarded as suitable, when others would clearly render the thing more convenient. Where certain measurements have become associated with furniture, custom is the principal factor, and custom is not as the laws of

the Medes and Persians. When a dresser—or, for that matter, any other piece of furniture—is wanted, the maker should first consider what size will be most convenient for that particular article, and depart from the customary size if any advantage is to be gained by doing so. Now the novice who may prefer making his dresser 6 ft. 6 in. instead of 5 ft. 6 in., or in any other way departing from the sizes given, may be reassured that he will not be doing wrong by studying his own inclinations.

Possibly he may want to know also whether he must keep to any relative proportions between the various parts, such as width of cupboards, and opening between. If so, let me say, "No; again suit your own convenience." As a mere matter of appearance, it will be better to have the open space wider than the cupboards, but even this might be disputed by some.

Another maker may not want to have any open space, but would prefer three cupboards. Well, he can easily gratify his desire, for all he has to do is to fit a door to the opening, or, if the dresser is a large one, say 6 ft. 6 in. long, two doors. If he wants to know why two doors are recommended, it may be said that the only reason is because one would probably be inconveniently large.

But, supposing that only a small dresser is wanted, is there any reason for making three cupboards or doors? No; for two would do very well, and save time in making. Another individual would prefer more drawers, but from the illustration he does not quite see how he can manage to dispose them. Well, our design is sufficiently elastic to allow of adaptation even in this respect, for all that is necessary is to arrange as many drawers as may be required in the central space below the one shown.

Somebody else would like the drawers longer, or, at any rate, one or two of them. Of course, to make those in the centre longer is out of the question, but there is no reason why two long drawers should not take the place of the three comparatively short ones just below the top.

In any of the instances supposed, the principles of construction remain the same, and a little ingenuity and thought ought to enable the most inexperienced to make up almost any kind of enclosed dresser after he understands the following directions, which refer specifically to the dresser which I have shown in Fig. 1.

Before beginning to describe the construction, it should be said that the suggestions are given principally for the benefit of those who want to know how they *may* make a dresser. There is no *must* in the case; so that those who would find any other constructive details more in accordance with their own ideas, need not feel hampered by closely adhering to the methods named. They are, however, reliable, and may be implicitly followed.

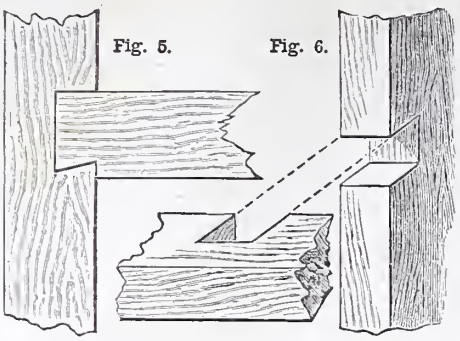


Fig. 5.—Drawer Bearer Joint to End. Fig. 6.—Halved Joint for Inner Ends and Bearer.

The material will naturally demand the first attention. It will suffice to say that good, sound, dry pine, clean and as free from knots as possible, is suitable in every way, and that any of the choicer kinds of furniture timber would be generally considered out of character. If made of mahogany, oak, or such like, our kitchen dresser would almost rank as a sideboard for the dining-room, though in this case better finish and more cunning joinery than is contemplated would be almost a necessity to support the assumption of the superior article. It merely remains to be said that 1 in. stuff is what will be principally required.

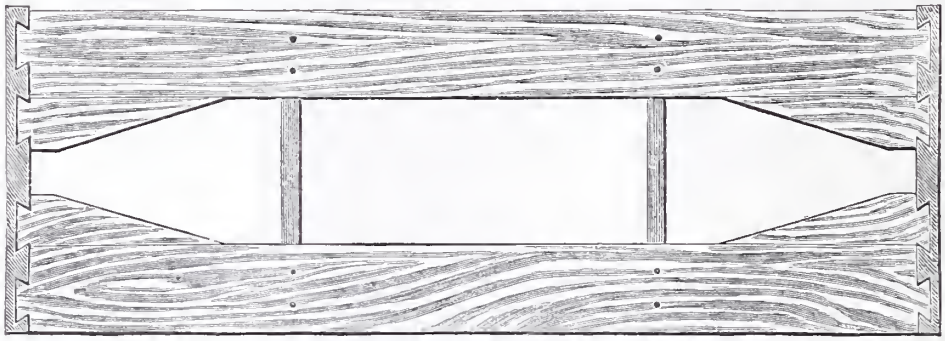


Fig. 4.—Plan of Top.

The top will have to be jointed up to get the necessary width, which should be at least an inch more than the ends of the cupboards, in order to allow of a slight overhang in front, and at the back if necessary. This may be explained by saying that if there is a skirting board, and the top of the dresser is to go close against the wall, the overhang at the back must not be less than the thickness of the skirting board. At the ends the top should overhang to the same extent as in front. This being understood, it matters little in what order the actual work be proceeded with; and, as the formation of the carcase is the principal part of the work, an outline of its construction must be given. It consists of a bottom, which, to all intents, is merely a repetition of the top, but smaller, as will be seen later on. To the bottom the four ends are fastened. On the upper edges of the ends the top may be nailed direct, but it will be better to connect the ends by stretchers or bearers of exactly the same length as the bottom board, and fasten the top to them. This involves more work, but is altogether the superior way. Other bearers—or, rather, one piece serving as bearer for three drawers—are also fronted, the whole, when put together, being as shown in Fig. 2.

We may now consider the mode of fitting and fastening all these parts together, merely premising that, wherever necessary, boards are fastened together to get the requisite width, and that the novice has read the articles on "Jointing Up" which have appeared in the first volume. Although plain glued joints will answer very well, it may be suggested that it will be good practice for the novice to use the dowelled joint. He will be able to "get his hand in," and have more confidence whenever he may have to make up anything in more costly wood than pine. Whatever joint he may use, I would caution him not to work up the parts till the glue is thoroughly set. The old adage of "more haste, less speed" is in nothing more apposite than in cabinet-work where glue is used.

Let us take the two outside ends first of all, and suppose the tyro wants to know all about them and their fastening to the bottom, or perhaps it will be better to say, how to accomplish this in a workmanlike manner. The thickness of the backing will have to be taken into account, for the width of the bottom will have to be that much less than the width of these end pieces. For purposes of explanation, let it be assumed that the back is to be ½ in. thick. The width of the bottom will, therefore, have to be ½ in. less than the ends. These are fitted to the bottom with lap dovetails, the construction of which will be sufficiently understood from Fig. 3. Extreme neatness in finishing these joints is not necessary, but care must be taken to have the front edges of the bottom and ends on the same level, leaving the excess of ½ in. to project at the back. A rabbet should be formed in them for the back to fit in, if a good job be intended; otherwise the boards of which the back is to be formed may just shoulder up against the ends.

The two inner ends of the cupboards must be exactly the same width at the bottom, to which they

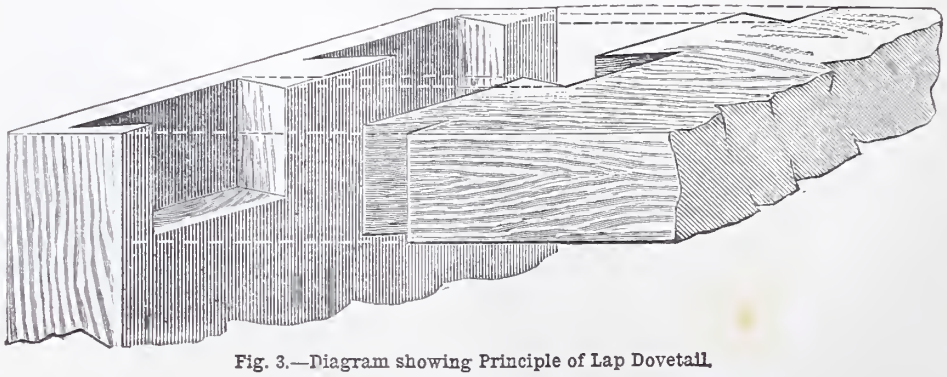


Fig. 3.—Diagram showing Principle of Lap Dovetail.

may either be fastened with mortise and tenon, or by nailing. In cutting these parts, regard must be had to the manner in which they are to be fastened at bottom, as, of course, the length of the tenons must be allowed for if these are to be cut. Much the same applies to fitting and fastening up the bearers for the top. These may be either a solid board exactly the same as the bottom, or the more usual course of making them of two pieces of wood of any convenient width—say, 5 in. By this means it will be seen that there is a saving in the quantity of wood, but the ends being only supported—or connected—by these two narrow pieces, they are not sufficiently bound together. This is managed by gluing pieces on to the ends of the bearers, which are thus widened out sufficiently without unnecessary waste of material. They are then fastened to the outside ends by the lap dovetail. The two inner ends may be treated as at the bottom. Fig. 4 gives a plan of the upper portion of the dresser at this stage, the widened bearers being clearly shown. It will be noted that the hinder one is set back to the same extent as the bottom board.

We have now the framework, so to speak, of the dresser, of which it will be understood that none of the parts are supposed to be permanently fastened together yet; in fact, in making it up, it will probably be convenient to arrange some of the work yet to be described before this stage. For instance, the necessary joints for the drawer bearers, etc., can be—at any rate, partially prepared. The novice, however, may be recommended not to adopt this course, but to fit up the parts so far spoken of, as by so doing he is more likely to secure accuracy. The parts should fit tightly enough to hold together squarely without any glue or nails, and unless they do, the work cannot be regarded as satisfactory. However, taking it for granted that everything is right, it will be an easy job to knock the pieces asunder to complete the work.

The drawer bearer—that is, the long piece immediately under the drawers in front—may now be attended to. Its width may be anything convenient, but about 3 in. is sufficient for all practical purposes; while its length can easily be ascertained exactly by actual measurement. It is fitted to the outer ends, as shown in Fig. 5, from which it will be seen that the dovetail formation of the lower side binds the parts together. The groove is cut in the ends for the whole width of the bearer, which is forced in from the front. At the inner ends the joint is merely formed by cutting spaces in the bearer and in the ends, as shown in Fig. 6. Care should be taken not to remove more stuff than is just sufficient to pass the pieces; in other words, they should fit each other tightly.

The supports for the drawer sides have now to be fitted, and for those who do not understand what they are, it may be explained that they are, as it were, bearers extending from back to front for the lower edges of the drawer sides to run on. It follows that their upper surfaces at any rate must be quite smooth, and on exactly the same level as the front bearer. Beyond repeating the caution that they must not be glued in such a way as to bind the ends, it will be unnecessary to give any minute directions for them, especially as these parts of construction were treated of at some length in the articles entitled "Lessons from an Old Bureau" in Vol. I. The novice who is in doubt will do well to read these, for they fully explain many details which it will be useful for him to know—including the construction of drawers. About the drawers it may be said here that the fronts should be fitted to the places for them, and marked, to prevent confusion afterwards. The sides should be treated in like manner, and not before every attention has been given to make these parts fit tightly should the actual making of the drawers be proceeded with. The sides and back of the drawers need not be more than $\frac{3}{8}$ in. thick, while the bottoms may be less if preferred. The reminder that drawers when first made should fit very tightly may be given, for if loose and easy, they will probably be too easy by-and-by. If they still remain too tight after a short time, a very slight easing-off will reduce them sufficiently.

The doors are made in the usual way. The parts for the frames are got out first, and may be either dowelled or mortised and tenoned together. Both rails and stiles should be of the same width, for which $2\frac{1}{2}$ in. will do very well. As some may not understand the meaning of "rails" and "stiles," I may explain that the former are the horizontal and the latter the upright portions of the frame. It will scarcely be necessary to state, except for the benefit of those quite unaccustomed to joinery, that the rails are to be placed within the stiles.

The panels for the doors should be $\frac{1}{2}$ in. stuff, either fitted into rabbets and beaded in from behind, or the frames may be grooved for them. In the latter case inexperienced workers may be inclined to think that glue should be used to fasten them in with; but they may be reminded that gluing them up would probably cause the panels to split. The grooves alone will hold the panels, which, being unglued at the edges, will be at liberty to shrink without splitting.

A couple of "butt" hinges will be required to hang each door with, and a lock or catch of some kind be requisite to keep them closed. The hinges should be attached to the outer ends of the cupboard, the bolts of the locks of course shooting into the others. One lock accordingly must be got shooting to the left, and the other to the right, unless it be not considered objectionable for one of the keyholes to be upside down.

Inside each cupboard one or more shelves will probably be found convenient. The shelves may be fixed in by simply nailing through the ends; but a better way—not only because no nailing from the outside will be necessary, but because the shelves will be movable—is to support them on strips of wood fastened to the insides of the cupboards. By this means, if at any time it is found convenient to add to or alter the shelves, it can easily be managed. The plinth or framing on which the dresser stands has still to be made and fitted, but no detailed directions for it can be necessary; and it would be merely waste of space to recapitulate what has been stated in connection with plinths in the articles already referred to on the bureau. Naturally, the dresser plinth will be plainer, having the upper edges left square, or slightly bevelled, instead of moulded; but otherwise its construction is much the same.

The top is fastened down to the carcase by screws driven through the top bearers or board from below; and when this has been done, our dresser is practically completed, so far as joinery is concerned, though it may be finished by painting or varnishing if desired. It will be understood that each drawer must have a knob or handle of some kind, the choice of which may be left for the reader's own decision, merely calling his attention to the fact that china knobs, fastening on with a screw, are generally used for the purpose.

Unless the top of the dresser fits against the wall, a small ledge at the back will be a convenience. A mere strip of wood, as shown in the illustration, will do as well as anything. It can either be fastened on behind or above the top with a few screws. Of course, if the plate shelves be made to rest on the dresser-top, and have a solid back, the back-guard will be superfluous; but this will be further considered when I come to treat of the shelves. Meanwhile, though no specific directions have been given for fitting the back to the dresser, the most inexperienced will see how to do this; so that these hints on dresser making may be regarded as complete.

BRICKLAYERS' WORK.

BY MUNIO.

Appliances and Tools used by Bricklayers.

One of the principal appliances used by the bricklayer is the scaffolding, on which the materials are laid while building the walls. Great care should be used in fixing it, as upon its stability depend the lives of the men working upon it, and many serious accidents have occurred from insecure fixing, or from using defeetive materials.

The scaffolding is formed with uprights, ledgers or runners, putlogs, and scaffold boards; the uprights are generally foreign poles, 20 to 30 ft. long, and 7 in. in diameter; at the bottom end, they are fixed about 3 ft. 6 in. from the wall, and 12 to 14 ft. apart; the longest poles should be set at the gables, or at the highest part of the building to save splicing; they are fixed in holes dug about 3 ft. deep, and well rammed round to keep them perpendicular; when too short to reach the top of the building, a second pole is spliced to the top, the large end resting on a runner about 15 ft. below the top of the fixed pole; the top pole is lashed with ropes in three places, and wood wedges driven in to tighten them; diagonal stays are also lashed to the adjacent poles to steady them, and prevent their being blown down.

The runners are lashed to the poles with ropes in a horizontal direction; they are made of poles or deals 7 in. by $2\frac{1}{2}$ in.

The putlogs are laid with one end on the wall, and the other on the runners; they may be of any tough wood 6 ft. long, and $4\frac{1}{2}$ in. by 3 in.

The scaffold boards are 7 in. by 2 or $2\frac{1}{2}$ in., and are laid on the putlogs; when the scaffold is in a street, a board should be laid on its edge at the outside of the scaffold to prevent anything falling off the scaffold, and when the scaffold is very high, a board should be fixed along the outside about 3 ft. above the scaffold to form a handrail.

The materials are carried up ladders, which have a rope at each side hung over the runners, and two or three bricks tied to the end of the rope to keep the ladders from blowing down.

When any extra heavy weight has to come on a scaffold, such as a large stone or an iron girder, vertical struts should be fixed under the runners from the ground.

When a chimney stack has to be carried above the ridge, poles are fixed on the floor joists, and brought through the roof timbers and lashed to them.

When a hole cannot be made for the foot of a pole, it may be fixed in a cask or box 3 ft. deep, and rammed round with sand; when the ground in which poles are to be set is very soft, a flat stone should be put under the foot to prevent its sinking when the scaffold is loaded.

Hoists.

When the walls of a building are very thick, and contain many bricks, a hoist is generally used for lifting the materials. After the first 15 to 20 ft. is built, a large pulley is fixed to a strong support, and a chain or rope put over it, to one end of which is attached a hook; the other end is carried round a pulley fixed on the ground called a "snatch block," a horse is attached to the end of the rope, and by walking outwards, the load is raised in a box attached to the hook. When there is not sufficient length for the horse to walk outwards, a "gin" is used, which consists of a vertical axle, to the upper part of which is fixed a drum 3 ft. or more in diameter; under this is fixed an arm 10 or 12 ft. long, to which the horse is attached, and by walking in a circle in opposite directions, the load is raised, or the empty box lowered. Steam-engines are also used for working hoists. Sometimes the bricks are run to the foot of the hoist in barrows, and the barrows with their loads lifted, three short chains with hooks being used to sling them, one hook being put under each handle and one in the wheel. In this case, a shaft is formed with boards to prevent the barrows turning round.

Trammels.

These are used for cutting the brickwork to in forming the lower half of an inverted arch; they are made to the form of the outside course in the arch, and fixed in the position the arch will occupy, and the wall is built to them; when the wall is thick, one is fixed at each side, and the wall levelled up between them.

Centres.

These are used for turning arches, and are made with ribs, on which are nailed laths or boards; they are made to the exact form of the soffits, or underside, of the arch; they are fixed on proper supports, and if of large size, wedges are fixed under them to slack the centre after the arch is keyed. In building an inverted arch, a board is fixed with a nail in the centre, a cord is attached to the nail, and the courses are made to radiate to the centre.

Templet or Profile.

When the top part of a wall is to be sloped or racked back, a templet or profile is set up, the height of each course marked upon it, and the line strung to these marks while building; if the wall is curved or battering on the face, such as a retaining or wing wall of a bridge, the templet is made to that form.

In turning a range of arches where the quoin or angle cannot be built first, a templet is used; sometimes a temporary pillar or plumbing of brickwork is built for this purpose, called a "deadman," and afterwards taken down.

Tools.

The following tools are used by the bricklayer:—The trowel (Fig. 1), with which the mortar is taken up and spread, and the joints struck; the brick hammer (Fig. 2), with which the bricks are cut; the jointer (Fig. 3), for drawing and marking the joints; the jointing rule is a straightedge, 8 ft. long and 4 in. wide; the plumb rule (Fig. 4), for plumbing the angles or quoins; the level (Fig. 5), for levelling the walls—sometimes a spirit level is used, laid on a straightedge 10 or 12 ft. long, with parallel edges; the camber slip (Fig. 6), for drawing the soffits of camber arches; the hod (Fig. 7), for carrying the bricks and mortar, also squares, bevils, and mortar boards, a gauging rod marked in feet and inches for setting out work, and a line to wall the bricks to. For cutting and gauged work, a bench or banker is required, with a rubbing stone 14 in. in diameter, fixed at one end for rubbing the bricks on; the bedding stone, a slab of marble or York stone, perfectly straight and level, on which the bricks are tried after being rubbed; chisels, scotch, scriber for marking the joints, and tin saw for nicking the beds and joints, after which they are cut by the chisels and scotch.

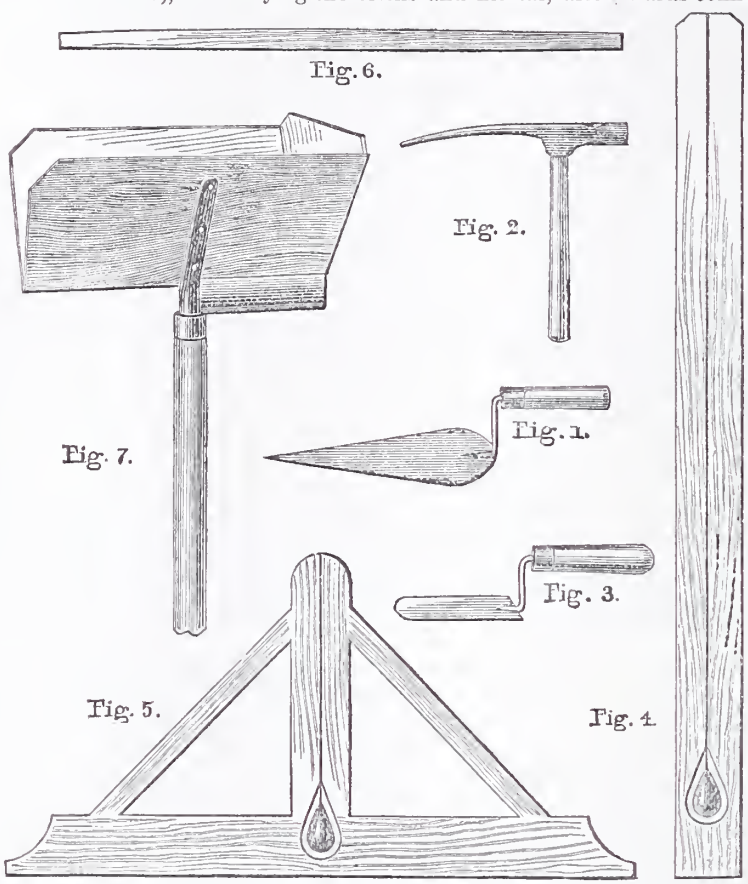


Fig. 1.—Trowel. Fig. 2.—Brick Hammer. Fig. 3.—Jointer. Fig. 4.—Plumb Rule. Fig. 5.—Level. Fig. 6.—Camber Slip. Fig. 7.—Hod.

Foundations.

In commencing to dig the foundations of a building, the outside walls should first be marked out, and pegs driven in at the angles; then dig off all the turf and vegetable soil, and wheel it into a heap if required for future use, or cart it away if not required. Then mark out the front wall of the building, and square the other walls from it; the cross walls should be gauged from a centre line or from one wall, and not from wall to wall, as if there should be any inaccuracy in one wall it is repeated through the rest. The trenches should be neatly squared out and levelled, and if any part of the site is on a slope, the trenches should be "stepped," keeping the bottom level, and making the rise of the steps equal to a certain number of courses of bricks. Where the foundation is of one uniform hardness, the footings of brick or stone may be laid in the trenches; but if some parts are hard, and others yielding, a bed of concrete should be laid in the trenches; and, even if the foundation is good, this method is to be recommended, as it makes a good uniform footing. When there are any wet places on the site, drains should be laid from them, and afterwards connected to the house drain. When the site is clay, it is advisable to cover the site under boarded floors with 6 in. of concrete, to prevent damp being drawn up by the warmth of the rooms when the house is finished. When laying concrete in the trenches, pegs should be driven in at the sides of the trenches, the tops of which are at the level of the concrete, and the concrete is levelled to them. The concrete should not be less than 1 ft. thick, but in soft ground it may be 2 or 3 ft. thick.

In digging cellars, tanks, etc., their position must be accurately marked out from the front line, and kept the full size of the outside of the walls to the bottom. A drain must be dug from the bottom of the cellar.

After the walls are built up to the surface, the whole of the foundations must be filled in at both sides and well rammed down.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

My Cowan Hive.

One of the greatest secrets of success in bee keeping is the careful and comfortable wintering of stocks. Consequently, any hive which secures this object ought to be a favourite with bee keepers.

Few are as good, and none surpass, the Cowan hive in this respect. It is the invention of Mr. T. W. Cowan, the editor of the *British Bee Journal*, and perhaps one of the best apiarists in the world.

I give three views of it, taken from his own book, "The British Bee Keeper's Guide Book;" a work which should be in the possession of everybody who hopes to be a successful bee master. Fig. 1 is a general view of the outside, from which it will be seen that it differs little in appearance from the "Apis" hive; in fact, I took some of the best features from it. In Figs. 2 and 3, it will be seen that the internal arrangements are very different. Instead of double sides, with a dead air space between, the brood-nest consists of two distinct boxes without tops or bottoms, just laid upon the floor board. The inside box, A, is the brood nest proper, in which are hung the frames, while the outer, F, serves only as a case, the space between being filled with chaff.

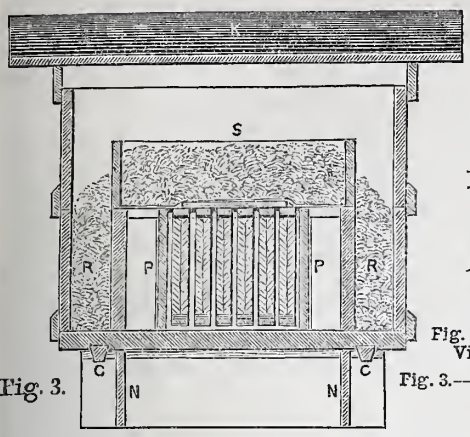


Fig. 3.

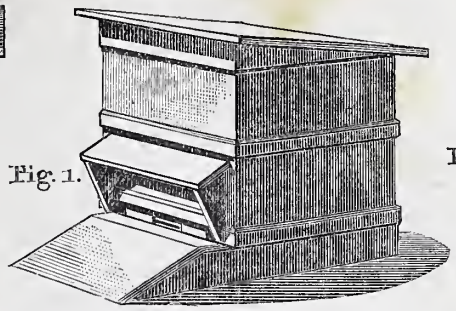


Fig. 1.

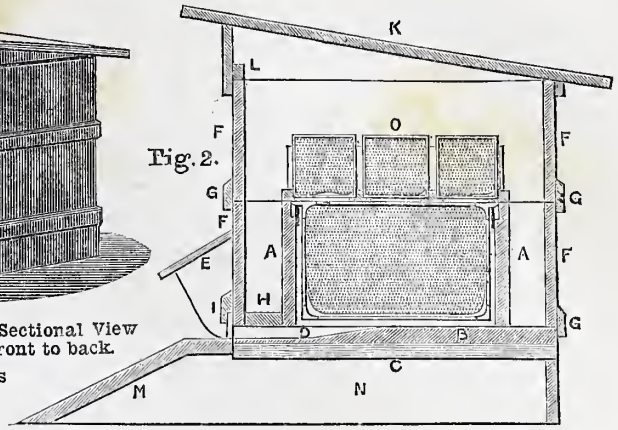


Fig. 2.

Fig. 1.—General External View of Cowan Hive. Fig. 2.—Sectional View from front to back.

Fig. 3.—View of Internal Arrangements as seen from behind.

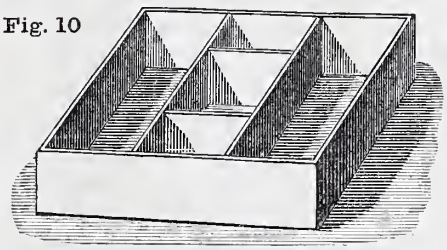
As the doorway, D, is cut out of the solid floor board, a piece of wood, H, must be laid over it to prevent the chaff from stopping it up. It will be seen from Fig. 3 that in the winter this hive forms a very snug habitation for the bees, being surrounded by about 3 in. of cork dust or chaff, which is warm and yet porous enough to allow of free ventilation without draught.

I made my Cowan hive slightly different from that shown in Figs. 2 and 3, because I wished to utilise the ordinary frames which I use with the other hives. In principle, however, it is the same. I can strongly recommend this hive to my amateur friends, as being easy to make and very efficient. Its only drawback is that it is rather unwieldy and takes a good deal of wood.

The first thing to make is the floor board (Fig. 4). This may be of two widths of 11 in. pine, $1\frac{1}{4}$ in. thick. The edges should be shot and ploughed to take a tongue which fits half into each, or else the parts may be dowelled together or counternailed, all of which operations have been already described in WORK. This will produce a board 22 in. square, which should be gone over with the plane at both sides before the next operation comes on. This is to affix a couple of stays, denoted in Fig. 3 by C.

They are made of pine 22 in. long and 2 in. square. They are planed down so that one edge is 1 in. wide, and the space for their reception, $\frac{1}{2}$ in. deep, is carefully cut out of the bottom of the floor with tenon saw and chisel. The entrance space (Fig. 4), 8 in. wide and $\frac{3}{8}$ in. deep, is cut by the same means.

Fig. 10



The top of the floor board should be perfectly flat, and to secure this, it should have been gone over with the trying plane in every direction before the entrance space was cut. The stays underneath will prevent it from warping, and yet allow of the free expansion and contraction of the wood.

Having the floor nicely finished, and the edges planed true and square, we next turn to the stand. Two pieces like Fig. 5 can be cut from a board 5 ft. long, 6 in. wide, and $\frac{3}{4}$ in. thick. They are kept 15 in. apart, just enough to fit inside the stays, C C (Fig. 3), by the alighting board, M, and the piece at the back seen in Fig. 2. The alighting board, which is 19 in. long, is nailed to them, as is also the horizontal piece 3 in. wide, seen in Fig. 5, which is nicely bevelled to fit the angle of the alighting board.

All this part of the work may be of deal $\frac{3}{4}$ in. thick, but the work should be carefully

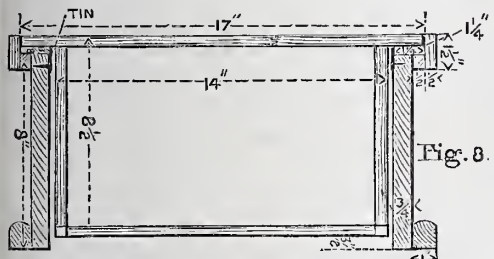


Fig. 8.

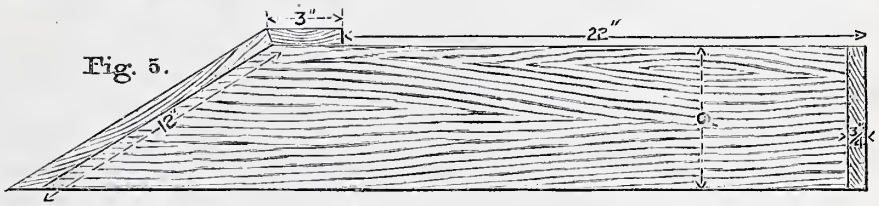


Fig. 5.

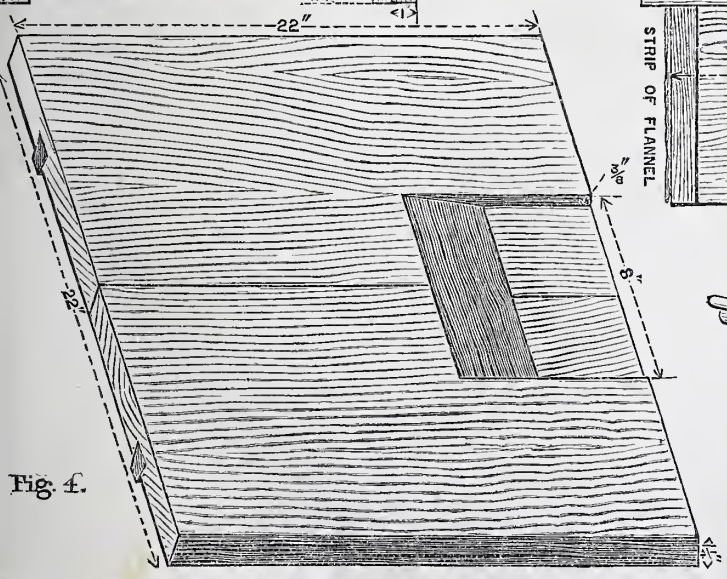


Fig. 4.

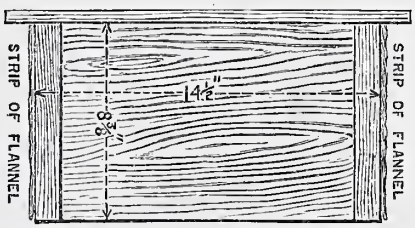


Fig. 11.

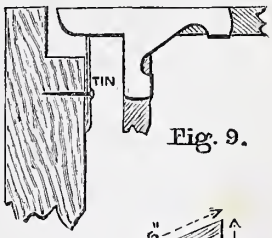


Fig. 9.

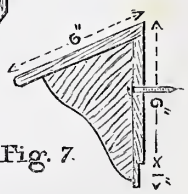


Fig. 7.

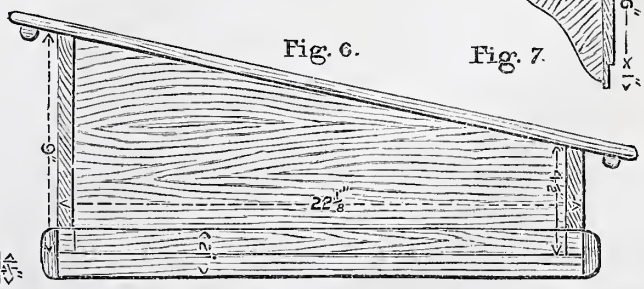


Fig. 6.

Fig. 4.—Floor Board. Fig. 5.—Side View of Stand and Alighting Board. Fig. 6.—Side View of Roof. Fig. 7.—Side View of Porch. Fig. 8.—Section showing Frame resting on Tin Slip. Fig. 9.—Section showing Novice's Metal Corner. Fig. 10.—View of Cushion with Feeding Hole. Fig. 11.—View of Division Board. (All figures to scale of 1 in. to 1 ft., except Fig. 9, which is half size, and Fig. 10, which is not to scale.)

done, and finished nicely with a smoothing plane and sandpaper, if necessary.

A couple of outer cases may now be made of the same wood. It is better to dovetail them together at the corners, but if this is beyond the powers of the manufacturer, ordinary nailing and glue would do very well. They may be further strengthened with triangular pieces at the corners inside. The external length or breadth ought to be 22⅛ in., the ⅛ being to allow of ease in fitting over the bottom. For the same reason, I always take a few shavings off the top of each case, making it, as it were, cone shaped, so that the next storey will fit over it easily. The principal difficulty to be encountered in making these cases is to have them out of winding and square. Both can be successfully overcome by first nailing two sides together, and then the other two; then secure the loose corners by a nail in each, and lay the case flat on the floor board in the position which it is to occupy finally, and while thus laid and held down flat, the remaining nails can be driven home.

Even if it is slightly in winding, it can be planed true afterwards, as it does not require to be quite 9 in. high when finished.

As we are at the outer case, I had better go on to the roof, and here my hive differs from that shown in Figs. 1, 2, and 3. I wished to have sufficient room for three crates of sections, and accordingly made the roof 4½ in. deep at the shallowest part, sloping from that up to 9 in. I also made it to fit on top of the other storeys, with slips nailed on all round to break the joint as at G (Fig. 2). Lest any one should not quite understand this verbal description, I give in Fig. 6 a side view of the roof as I have made it. The top consists of three boards laid edge to edge and nailed firmly to the sides; they are ½ in. thick and 27 in. long, the overlap all round being equal. The edges should be nicely rounded, and a piece of unbleached calico of sufficient size stretched tightly over the top, being turned under and secured by means of a lath nailed all round. The points of the nails should on no account pierce through the top, as they would cause the calico to be eaten away with rust. This top should be painted with several coats of lead colour, and it will then be perfectly watertight and last for generations.

The porch is made of ½ in. wood, as seen in Fig. 7. It is 18 in. long, and extends forward 6 in.; a space is rebated out in which the shutters slide, and I find broken sections act as well as anything for shutters. The strips, G (Fig. 2), are 2 in. wide and ½ in. thick; the top is bevelled to throw off the rain, and the edges all rounded; they are mitred at the corners or simply overlap. Two short pieces are placed at the front to cover the joint as far as the porch.

So much for the outside, which does not differ in any essential particular from those illustrated in Figs. 1, 2, and 3.

Mr. Cowan recommends Novice's metal corners for the frames, but as I wanted to use the ordinary frames with top bar 17 in. long, I had to alter the construction of the brood-nest somewhat.

My brood-nest consists of a box of ¾ in. pine dovetailed together. Its internal dimensions are 17 in. by 14½ in. The long sides are 8⅛ in. high, and the short ones 8⅞ in. Parallel strips of tin are tacked to the inside of the long sides, raising their height by ⅜ of an inch, and strips of wood are nailed to the outside, as seen in the section (Fig. 8), so as to make room for the long ends of the frames. I attach a piece of wood 1 in. wide to the lower edge, so that it would fit flush on the top of a similar brood-nest when used for doubling. If Novice's ends are used, the four sides of the brood-nest will be 8⅞ in. high, and it will be necessary to cut a rebate out of the long sides of the dimensions shown at Fig. 9, which also shows these metal corners.

The frame, L, in Fig. 2, which is used for winter packing, is simply of ½ in. deal, 4½ in. deep, and 17 in. square inside. The bottom is covered with a piece of unbleached calico, which is tacked on at the outside.

Instead of this, I commonly use the feeder cushion made by Mr. Abbott, which is represented by Fig. 10. It is made of ½ in. wood, and fits over the brood-nest like the other. The only difference is that the space in the centre is not covered with calico, the feeding stage occupying that position. It would be advisable to nail strips of wood ⅜ of an inch high round the edges over the calico to permit the bees to run freely on the tops of the frames. The hole in the centre will vary in size according to the kind of feeder used. That in mine is 5 in. square, which I find large enough to hold any feeder, except one, in my possession. In the winter, when feeding is over, I often fill that space with candy, and put a pillow on top to keep in the heat.

It is easy to calculate that, the external dimensions of the outer case being 22⅛ in., its internal measurements will be 20¾ in., for the boards will, when planed, be not quite ¾ in. thick. Then, the brood-nest being 18½ in. long, there will be a space of 1⅛ in. at each end to fill with chaff. This is less than shown in Fig. 3, but it will be enough; the space between the dummies, P P, and the brood-nest could be filled with a similar material if thought necessary. In the other direction, there will be more than 2¼ in. of packing, which is about the quantity shown.

The amateur will find this hive easy to make, and he could not do better than adopt it as the standard in his apiary.

I have now described three hives, which I think enough for the present. In time to come I may treat of twin hives, observatory hives, and the Stewarton. In my next I hope to write about the internal fittings.

NOTES ON GLASS PAINTING.

BY FRED. MILLER.

Ecclesiastical Glass Painting.

Glass painting is one of the foremost art handicrafts of the day. Up to fifty years ago, stained and painted glass was almost a lost art. Indeed, the art of making coloured glass required rediscovering, for the magnificent rubies, blues, yellows, and whites of the old windows that, surviving the ravages of time and the destructive hand of man, are still to be seen in just a few of our old churches could not be obtained of any of the glass workers of the early days in this century. We are greatly indebted to a lawyer, Mr. Charles Winston, for much of the knowledge of old glass, and for having revived the manufacture of it. Winston made drawings of old specimens, procured old fragments of glass that were to be found stowed away in the crypts of the churches, and he had these pieces analysed to see if it was not possible to find out their component parts. Success attended his efforts, and at the present moment some of the most beautiful coloured glass that has ever seen the light is made in London by Messrs. Powell, at Whitefriars. The art of making coloured glass was lost because there ceased to be a demand for it. In the last century a certain amount of glass painting was executed, but it took the form of elaborate engraving-like effects, like the Reynolds' windows in New College, Oxford, in which an attempt is made to produce the effect of a Rembrandt picture. White glass is used almost exclusively throughout, and the colour is painted on it as though the artist were working on a canvas. It follows that little light can enter through such windows, and consequently the effect is gloomy and entirely wanting in brilliancy, the particular charm of old windows. The old painted windows, executed by monkish artists, were put in for a double purpose. The subject of the windows was another of the many forms of picture writing that played so important a function in the education of the people when only the very few could read; and in addition to this didactic object the monks had in view, the painted, coloured glass softened the glare of the light, and produced a mellow quality within, which has been termed the dim religious light. What positive colour was introduced was the result of glass coloured right through its substance—coloured, that is, when the glass was in a molten state in the pot and hence termed pot-metal. What painting was done on the glass was of the simplest character, consisting as it did of outlines executed firmly in a brown colour on the surface of the glass and baked on it in a muffle kiln.

As it may be interesting to many readers to know how an old monkish glass painter set to work to make a coloured window, I will endeavour to make his *modus operandi* clear to my readers, for it is in all essentials the method followed at the present time, though with our modern resources we get over the work easier and less clumsily than he did. A table or board the size of the intended window was prepared and whitened, and upon this the artist drew his figure or composition in charcoal, using a few vigorous touches to produce his effect, but keeping everything severely simple and attempting nothing of a pictorial nature.

We will imagine the figure to be the representation of some saint in his robes of office. These latter would be made of coloured material, so glass of the required colour was taken and shaped to suit the particular part of the garment it was to represent. If it were a chasuble, it would necessitate making it in pieces, for sheets of coloured glass were never very large. The shaping of the glass was the most difficult thing the early painter had to do, for the use of the diamond was not then known. A red-hot iron was drawn over the glass in the hope that the glass would break in the way desired, but frequently it did not, and then the piece had to be filed and chipped down with pincers, a laborious and difficult task. The face, hands, halo, and other portions, such as borders and the architectural enrichments termed canopies, were made of white glass, and these had to be shaped. So that, roughly speaking, a coloured window resembled a mosaic on a large scale, every different colour introduced necessitating the shaping of the required piece, and in large surfaces it meant the joining of several pieces together. When all the various pieces of glass forming the design were shaped, the next thing to be done was to trace the design in a brown colour. The

painting consisted of putting in the features and hands, folds in the garments and patterns on the same, and any ornament on the backgrounds. This colour had probably an iron base with a fusible flux mixed with it, so that when the glass was raised to a cherry heat, the colour was indelibly fused on to the surface of the glass. The next operation was to join the several parts together by means of bands of lead with grooves on both sides to receive the glass. On the completion of the window we have a large glass mosaic, every part of which is strongly outlined by the leads which hold the whole together with the addition of the painted work, which does for each individual piece what the leads do for the general design. The object the glass painter keeps before him is to make the leads, as far as possible, outline the several parts of the design, and though in large surfaces merely arbitrary leads are introduced whose object is merely use, yet if we look at an old window as a whole, we find that the leads, in addition to binding the whole together, serve to outline and emphasise the design, and the skill of the glass painter is shown in the successful way he makes the leads to form an integral part of the design. The earliest specimens of painted windows in existence are to be seen in France, and date from the ninth century. We have some specimens of old glass at York Minster, Fairford, in Gloucestershire, New College, Oxford, and other places, but owing to the great destruction that took place during the Cromwellian wars, our ancient buildings are not rich in old glass, and we possess nothing like so fine a collection as the French. A good deal of modern painted glass is as fine as any of the old in colour, and owing to our increased knowledge and improved appliances we can impart a finish and delicacy to our windows that the earlier men were quite unable to effect. But it is the severe directness and archaic simplicity that gives old glass its charm. Then their means being limited and their resources few, a simplicity was attained which it would be better if we in much of our work strove to reproduce. Modern glass often errs in over-elaboration, and in an attempt to overstep the limits of the art. If we cover the glass with pigments we destroy its transparency, and consequently lose brilliancy and that gem-like quality possessed by old glass. And if we do not keep our designs sculpturesque, the window when seen from a distance looks confused. The Reynolds' windows in New College, Oxford, have a dingy look, so entirely is the glass covered with colour. The leads, too, are not wrought into the design, but as far as possible are hidden. In fact the chief aim was to produce the effect of an oil painting, and that is not the way to treat glass, for however successfully it be done, we only feel how impossible it is to paint a picture on glass.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

FIRST WORK IN MODELLING.

THE BEST SUBJECTS FOR BEGINNERS—NECESSARY APPLIANCES, MODELLING STOOLS, ETC.—BUILDING UP AND ROUGHING-OUT—WORKING ON THE MODEL—FLESH MODELLING—TOOLS OF VARIOUS KINDS, AND ADVICE REGARDING THEM—FINISHING.

IT might be inferred that the most suitable subject for first lessons in modelling would be some simple piece of ornament, and, indeed, the art is often taught thus. The best teachers, however, take a different course, and for this reason—in mere ornament there is comparatively little which can be done without tools, whereas it is important that the novice should first learn to model with his thumbs only as much as possible; and it will be in some portion of the human figure that he will find those large forms and broad surfaces which will give freest scope for the use of these. They therefore recommend that early practice should be chiefly from the figure, even though the ultimate aim of the student should be to become a modeller of ornament. Whatever is modelled, there will always be ample opportunities for working with tools.

The most approved practice is to copy from casts of the antique statues. Apart from any benefit to be derived from thus familiarising the eye to fine form, casts are the best things for the learner to copy from. They are rigid, and do not change, and do not therefore perplex a novice, as does the living subject. Also the lights and shadows on them are clear and decided, which is a great point, for it must be remembered that it is wholly through the shadows cast by it that the modeller is able to recognise and reproduce form

When sculptured figures are of a size only slightly larger than life, they are termed "heroic;" but if they greatly exceed life-size, they are termed "colossal." The best subject on which the aspirant to modelling can make his first essay in the art will be some portion of a colossal statue. He should procure a cast of the hand, or foot, or mask (that is, merely the face) of such a statue, and copy it in clay as closely as he is able, availing himself of the use of callipers and compasses to get all his dimensions accurate.

But before he sets about this he should have some knowledge as to the necessary accessories to his work. He must have some sort of modelling stool, and he should have one which will not only serve for matters like the present, but also for the busts, statuettes, etc., on which he will exercise his skill by-and-by. A useful stool will be one some 3 ft. 3 in. high, and with a top some 15 in. square. The stool should be stoutly made, for models are heavy; the legs should incline slightly outwards, to give greater firmness; and the top should have a turn-table. This latter arrangement is necessary in order that all parts of the work may be readily brought under the eye, and into different lights. Fig. 1 is a diagram of a turn-table. The top, it will be seen, is double. In the middle of the lower part is a round hole, through which passes a pin or peg, A, fixed in the middle of the upper part; on this the latter revolves. In the upper face of the lower part are fixed four little metal wheels or rollers, B B B B, and on the lower face of the upper part is a circle of iron, C C, which runs on these rollers. This enables the top to be easily turned, however heavy the weight upon it.

A useful form of top which may be made to fit on the same stool as the last is shown in Fig. 2. It is one that comes in handy for reliefs, etc. The board, D, is fitted to the upper half of the stool-top with hinges, and may be adjusted to any desired angle by means of the tongue of iron, E, which, being pierced with a series of holes, hasps over the pin, F. The tongue has, of course, a hinge attachment to D. This arrangement not only allows a relief to be readily turned to get new lights, but also enables the model to be most easily laid on its back for wrapping in wet cloths.

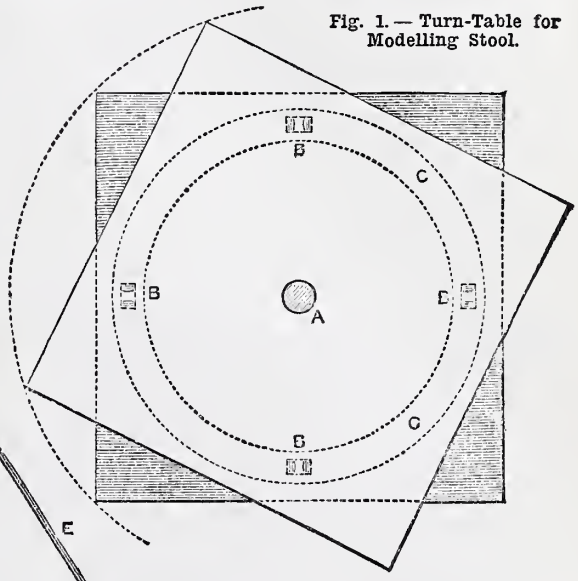


Fig. 1.—Turn-Table for Modelling Stool.

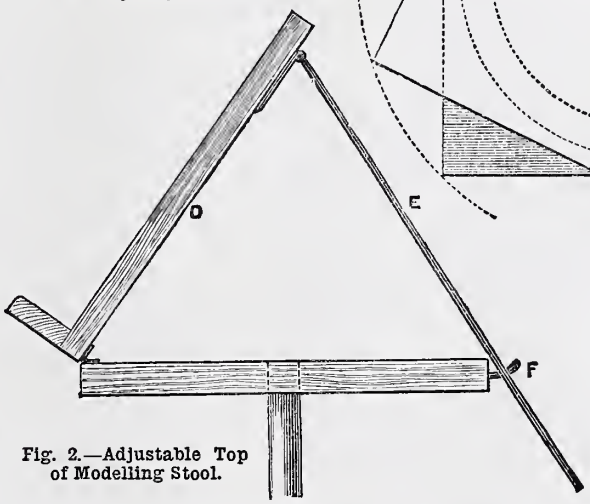


Fig. 2.—Adjustable Top of Modelling Stool.

Modelling stools, like music stools, are sometimes made with a screw, which allows them to be adjusted to different heights. Theoretically, this is a convenient arrangement, but it does not always work well in practice. Such stools are apt to be the reverse of firm, whereas a firm stool is essential to satisfactory modelling. Without any screw, it is always possible, if the model is too low, to pack under it; and if too high, the modeller can readily find something on which to stand. The modeller, it should be observed, commonly works in a standing posture. He may sometimes sit whilst working on small reliefs, or whilst finishing details; but on anything of size and importance, especially whilst roughing-out—whilst determining general forms and throwing in action and expression—he needs to put forth that energetic labour, and to assume those varieties of position, which are compatible with standing only.

Placing his cast as near as is convenient, and on a level with the top of his modelling stool, the worker proceeds to build up his model in clay. As a foundation for it he

will have laid a piece of board or slate on his stool. Taking a lump of the prepared clay, say of the size of a couple of fingers, he will slightly roll it between his hands so as to form it into a kind of rude cylinder, and lay it in what is to be the middle of his model. With his thumb he will press it down closely to the board beneath, which will have been previously damped. Then he will take another roll of clay, and lay it beside the first, and by drawing his thumb along it will so work it down as to make it adhere closely to that already laid. This is to be done firmly and quickly with a single motion of the thumb. It is desirable that the clay forming a model should be made into one compact mass, with no air spaces left within it, which if left are liable to be a source of future trouble; for if in the course of working the air is gradually pressed out from these, the clay will sink in, and depressions on the surface will result.

And with this process the modeller goes on, adding rolls of clay and working them down till he has built up the bulk of his model. He will do this almost entirely with his hands, only using a large roughing-out tool occasionally. Figs. 3, 4, 5, are roughing-out tools; for his present purpose he will find No. 5 of most service.

When clay is thus first put together, it is highly plastic; it yields readily to every touch, and may with ease be bent, or moved, or altered at will, and in a model of no great size like the present, it is therefore well to get the roughing-out pretty much done in the first day's work. It is less easy to make considerable alterations after the clay has had time to stiffen and set, though the firmer state is necessary for the putting in of details and for finish.

In roughing-out the model the beginner is apt to feel tempted to make the masses unnecessarily large, and to cut them to shape with his tools. As far as possible he should avoid doing this. I do not say that he should never do it, for it is among the advantages of the modeller's art that he can freely add to, take from, or alter any part at his pleasure. But building up is the proper method, and the way to a good style of modelling. He will, therefore, as he roughs-out—with a view to the additions to be made in finishing—keep everything somewhat smaller, and especially somewhat narrower, than his cast. He will also do well, instead of curves and rounded surfaces, to make angles and planes serve to represent the forms he sees before him, leaving the softening of these into curvatures to be the result of his after-work. In modelling, as in drawing, the most masterly sketching-out is always angular.

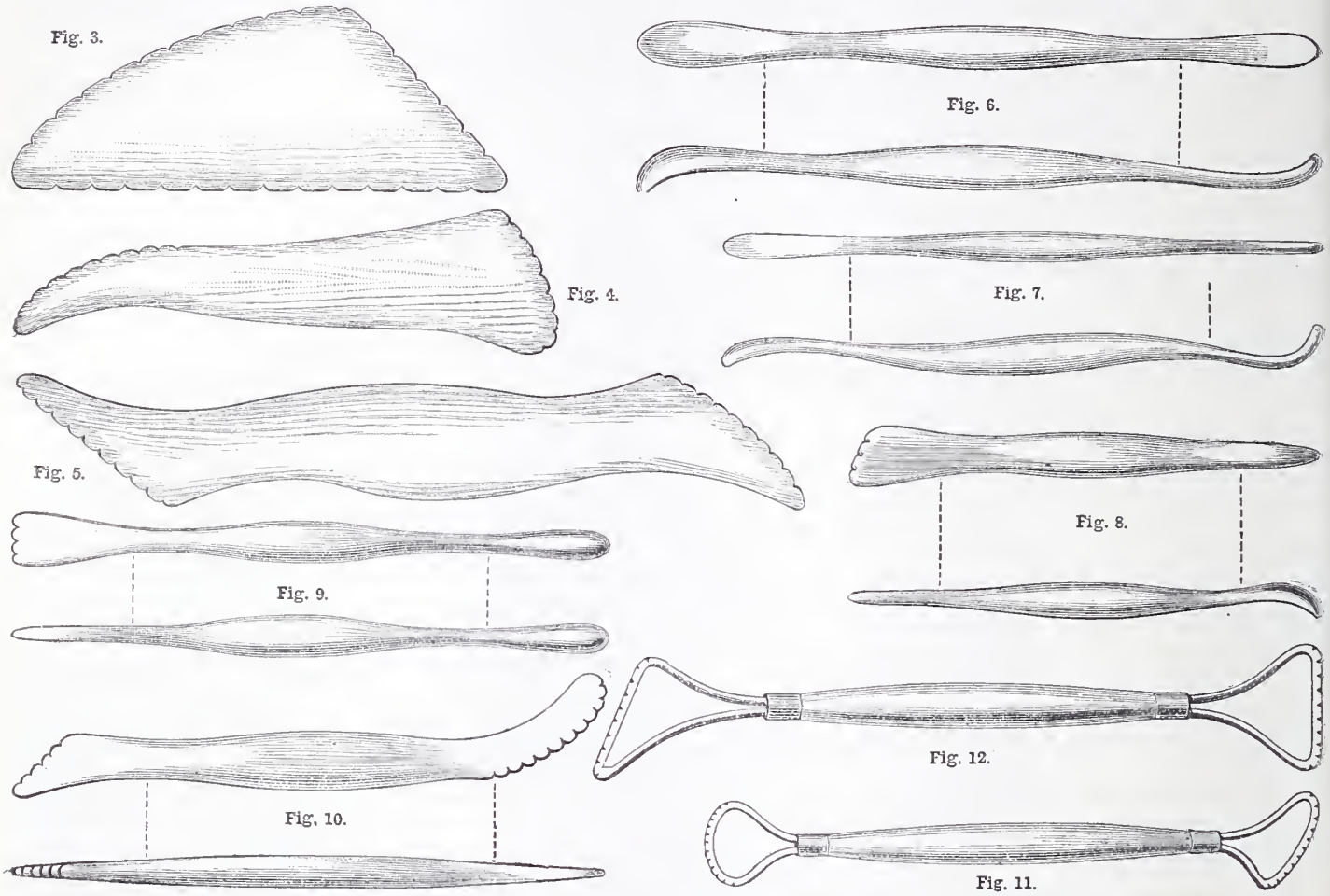
A few hours serve to stiffen a small mass of clay sufficiently to fit it for more careful work. The clay has now to be laid on in much smaller pieces, which the worker generally rolls with his thumb and finger into little pellets as he goes on; this more thoroughly tempers the clay, and makes it work more smoothly. Going on in this way, he gradually copies upon his model every form that he sees in the plaster cast. He occasionally turns both cast and model, that he may see them under different lights; for it is easy to be deceived as to any delicate form if it is seen in one light only. It is better to work by turns on all parts of the model and to keep every part pretty equally advanced, rather than to work on and advance any one part to the neglect of the rest; for thus only can the modeller see whether his work generally is progressing properly. In his anxiety to see the effect of what he is doing, the beginner is sometimes tempted to build up parts too hastily, without blending and working down his clay properly as he goes on; this he will find in the long run to be making more haste than good speed.

In modelling flesh it is quite possible to give a good finished surface in the broader parts with the thumb alone, and the learner should try to do this; but in the smaller parts, for which the thumb is too large, there will be a necessity for using tools to shape and smooth; and about tools a word or two should now be said.

The modeller's first and best instrument is that of Nature's providing, the thumb; and next to it come those artificial tools which most closely resemble the thumb in shape. Of this class of tools, Fig. 6 may be taken as a type. These are sometimes called "spoon-shaped tools," but they ought to be less pointed than an ordinary spoon, and more nearly to resemble the thumb in the breadth of their ends. In the illustrations given, all the tools are drawn to half their actual size; and all, except the wire tools and flat roughing-out tools, are drawn in profile as well as in front, in order that they may be worked from.

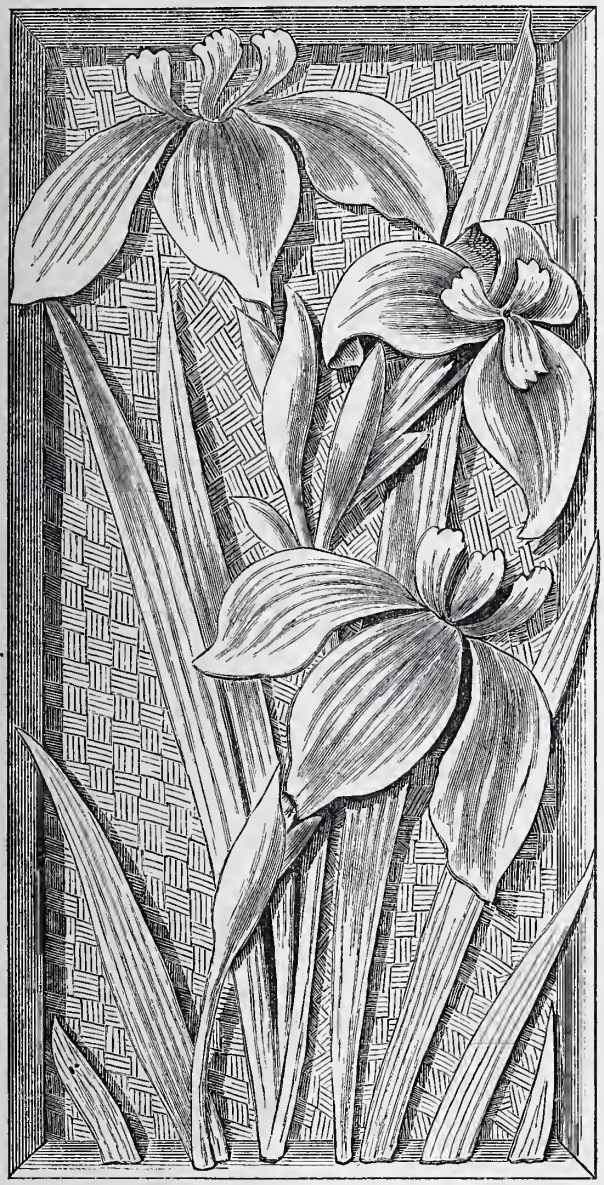
The material for tools is some hard, smooth-grained kind of wood, commonly box. The modeller can buy tools, if he chooses,

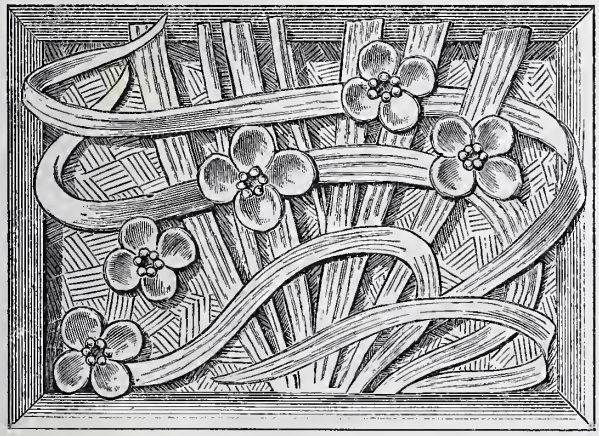
[*For continuation, see page* 126.]



Figs. 3, 4, 5.—Roughing-Out Tools. Figs. 6, 7, 8, 9, 10.—Modelling Tools. Figs. 11, 12.—Wire Modelling Tools.

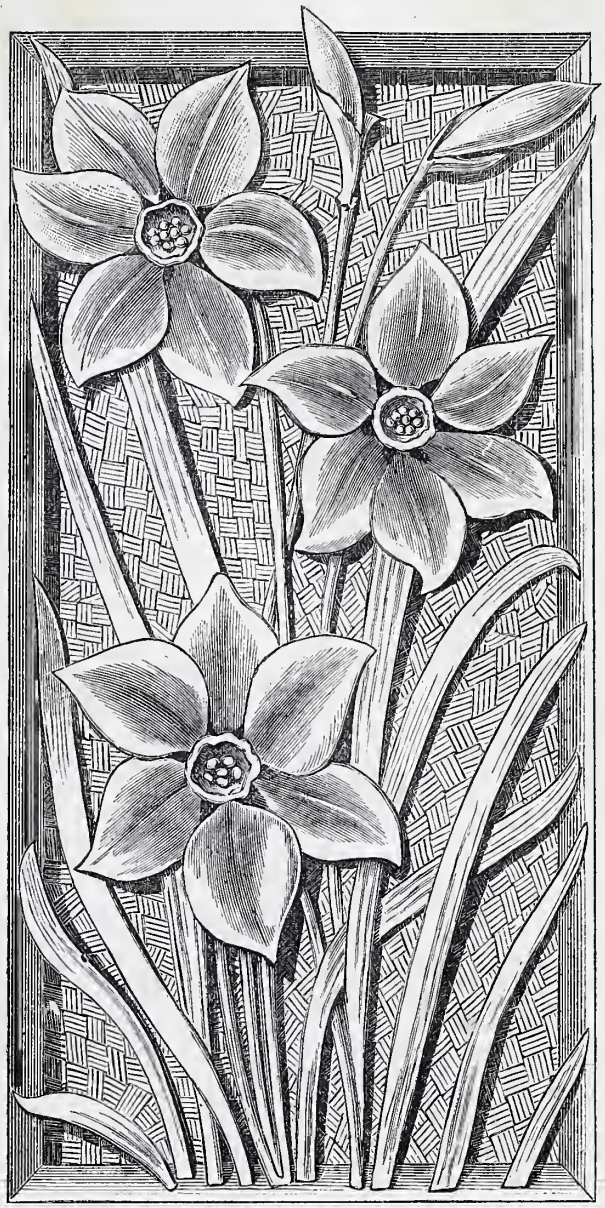
Carved Panel for Cabinet.

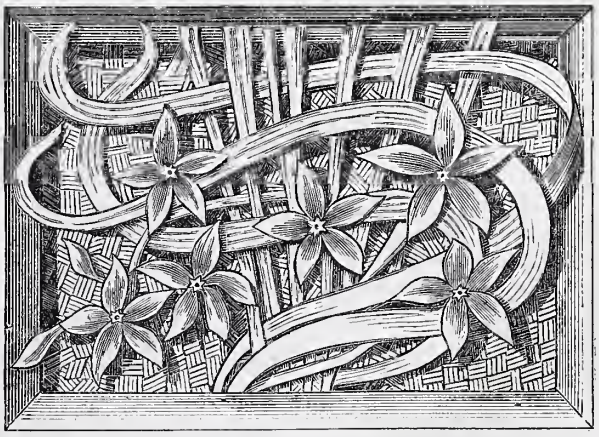




Subject—THE YELLOW IRIS. (Scale, Half Size.)

Carved Panel for Cabinet.





Subject—THE POET'S NARCISSUS. (Scale, Half Size.)

at shops at about 6d. each; but those sold are rarely of good forms, and are often useless. Instead of wasting money on them, the worker is advised to make his own from the drawings given. With a chisel, a knife, a file, and sandpaper, he will find no difficulty in so doing; and he may then be sure that he has forms of proved value. At the beginning he is advised to content himself with merely three or four tools, and he will soon find out what others he requires, and what forms suit him (for different modellers fancy different tools), and he can make such as he requires.

Whenever tools are intended for scraping (as in Fig. 10), their edges should be notched so as to form a tooth, as they are in that example: with a toothed edge they make better work in every way. Fig. 8 is a tool which will be found especially useful in working hair. It will be observed that about none of the examples given is there anything sharp or angular, and this is a thing to be noted. Not sharpness and harshness, but softness and breadth, are the qualities which an artistic modeller desires to gain.

Small tools are made of bone or ivory. For fine work a bone tool resembling Fig. 6, only with two-thirds of its length and one-third of its bulk, would be found most useful.

Figs. 11 and 12 are wire tools, of which one or two are desirable, since no others serve so well to scoop out or to scrape down when the clay model has become somewhat hard. They are made of brass wire fitted to a handle, and in its working part the wire is somewhat flattened and notched on one side with a file, so as to give teeth. These tools are not so easily made, and though some modellers make them for themselves, most persons prefer to buy them. They cost about 8d. each.

As the first work approaches its finish, some difficulty will be found about the broad flesh surfaces. Instead of being even and regular, they will be "lumpy;" they will have hills and hollows where such things ought not to be. This will be caused by a want of firmness in modelling with the thumb, a fault which can only be corrected by practice. There are, indeed, dodges by which the difficulty may be partly overcome, and a passable surface produced by mechanical means, and of these mention will be made by-and-by; but of these the novice will be better to know nothing for the present. As yet, let him practise to get good firm surfaces with his thumb, for thus only can the more delicate curvatures be expressed with due tenderness—thus only will he be able to attain to what is called "feeling" in his modelling.

The tyro is generally hasty in pronouncing his work finished. Let him be warned against this. Instead of speedily resting content with his work, let him look over it again and again with care, and he will be sure to find many things which may be improved. High finish may not be of high importance in this his first effort, but he should discipline himself for his after-labours. A habit of thorough care in finishing is most desirable. As a rule, which it is desirable to observe, everything ought to be well finished in the clay, and nothing left to be done in the plaster.

When really finished, the young modeller will doubtless be so well pleased with his work as to wish to preserve it by casting. It will be well that this should be done, not that the cast will be of any value whatever, but that, by future reference to it, he may see what progress he is making.

CARVED PANELS FOR CABINET.

BY J. W. GLEESON-WHITE.

Iris and Narcissus.

These designs for carved panels were intended for the folding doors of a small cabinet, but can be adapted to a variety of purposes, since an oblong upright panel is frequently useful.

The pattern is so arranged that for those who wish to shirk the labour of carving out of the solid, the design may be traced and cut out with a fret saw, in wood about $\frac{1}{4}$ in. thick, and then mounted on a block of the same wood for carving. When practicable, it would be best, in working this way, to saw the thin section for fret cutting off the solid block, so that when replaced, the grain of the wood should correspond exactly in each instance.

The idea of each panel is a single group of the plant, with some lesser flower nestling about its foot-stalks. The stalks and the leaves of the principal flowers are planned so that they appear to grow up through the dividing bar of the panels.

In carving all natural objects, no design can give the suggestion that an actual flower supplies. Yet it must not be forgotten that in conventional carved work, a broad effect, whereby the more salient points of the flower are seized and treated boldly, is preferable to a painfully minute and laborious imitation of every detail.

The yellow iris and the poet's narcissus are both adapted for this treatment, as the simple masses of their form can be expressed with comparatively little detail.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

15.—Moseley and Son's Wood-Carver's Router.

Wood-carvers have long been in want of a handy little tool such as this for clearing away the bottom of wood that has to be removed in relief carving, and producing an even and level surface. Similar appliances, it is true, have been made by handy workmen for their own use, and have been supplied, I believe, to pupils connected directly and indirectly with the School of Wood Carving, South Kensington, but this is the first tool of the kind that has been made and put into the market by a tool maker, and can, therefore, be obtained by any one who wishes to have it without favour or affection, as the saying goes. Its form and nature may be gathered from Figs. 1, 2, and 3, which represent the front elevation, end elevation, and plan, or, rather, view of the bottom of the Wood-Carver's Router recently introduced by Messrs. Moseley & Son, and sent by them to any address, post free, for 1s. 3d. The iron is $2\frac{1}{4}$ in. long and $\frac{3}{16}$ in. full wide. The stock or body of the router is $3\frac{7}{8}$ in. long, 1 in. wide, and $\frac{5}{8}$ in. deep. The bottom in front of the iron is slightly grooved, as will be seen on reference to Fig. 3, to admit of ready clearance of the bits of wood cut away by the iron. The tool, which is made of beech, is nicely finished. The iron is easily and quickly regulated to suit the depth required.

16.—Plane Iron, Chisel, and Tool Sharpening Machine.

This excellent adjunct to the carpenter's bench has been recently introduced by Messrs. Moseley & Son, 323, Holborn, London, W.C., who are selling great numbers of them to professional workmen as well as to amateurs. The machine itself is made on Plested's patent, taken out in 1888, and is sold at 8s. 6d. Its principle and action will be easily understood from Fig. 4, in which a plane iron is shown in the proper position for sharpening from a base, which is screwed

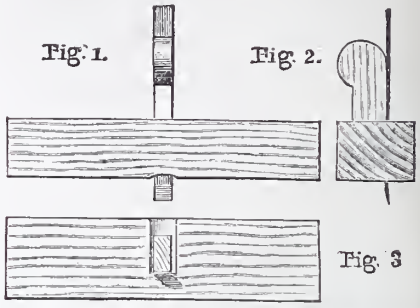


Fig. 1.—Wood-Carver's Router: Front Elevation. Fig. 2.—End Elevation. Fig. 3.—Plan.

down to the bench or any convenient stand, rises two standards, which carry a steel cylinder about $1\frac{3}{4}$ in. in diameter, flanged at the ends like a cotton reel, and an adjustable back, which affords the means of increasing or diminishing the distance between the cylinder and the back, according to the thickness of the iron to be sharpened. The cylinder is turned by the handle with one hand while the iron is held in place with the other. It must be borne in mind that the machine is intended to take the place of the oilstone, not the grindstone, which must be used to take out deep notches, etc. It is claimed that the work done has a better finish, and that a boy can sharpen a plane iron and get a better, truer edge in less time than an experienced workman could with an oilstone. The roller must be

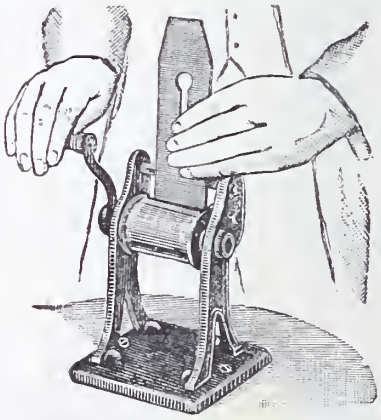


Fig. 4.—Plane Iron, Chisel, and Tool Sharpening Machine: Plested's Patent.

coated all over with oil—the same as is used for the oilstone—and then sprinkled with flour emery or knife polish. The iron should be held as shown in Fig. 4, gently pressing it against the roller, and, at the same time, keeping it against the rest on back of machine. Very little, if any, emery is required after the iron or chisel is once well sharpened, and the finer the edge required, the less emery is wanted. A slight burr will be found on the face of the tool sharpened, but this is removed by a slight rub on the roller. If there is too much burr, it shows that the back of the machine is too far over the roller, and requires adjustment. It is a nice handy tool to use, and certainly saves much of the labour expended in rubbing down a chisel or plane iron on the oilstone. The only thing it does not do is to take off the corners of a plane iron in the orthodox way.

The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Slide Valve. — A CORRESPONDENT writes:—"There seems to be a somewhat serious error in the paper on the slide valve on page 810, Vol. I., top of middle column. 'Next the total lead is ¼ in.; set the dividers to that radius, etc.' The lead was previously stated to be ⅛, and that is the distance to set off. Again, 'Having done this we take the total lap, which is 1½ in.,' but the lap was stated to be ¾, and that is the proper distance to set off—or altogether, ⅛ + ¾ = ⅞. ⅞ is the proper distance to set off from *o* to *b*. The expressions 'total' lead and lap are quite new to me. Lap is not 'the distance the slide valve overlaps the opening edge of the steam-port (port?) at the end of its travel.' It is the distance by which the valve overlaps the port when the valve is in the middle of its stroke."

[To avoid any mistake the best plan is to lay down a working plan upon a board full size, get the angle required by the lead, plus the lap, or make a templet. Lap may be taken in the following manner: take a lathe or straight-edge, place it upon the slide face, mark the length of it on the lathe; then put it on to the cylinder's face; the distance between the marks of the slide face and the outside edges of steam ports, when centrical, is the lap of the slide. —T. R. B.]

Paint for Blackboards.—J. H. (*Leicester*) writes:—"I have noticed several inquiries for paint for blackboards. The following will be found of great service:—One pint of methylated spirits; 2 oz. shellac; 1 oz. best ivory black; ½ oz. fine emery flour; ½ oz. ultramarine blue. Dissolve the shellac in the spirits before adding the other ingredients; mix well, and keep in a corked bottle. To apply, see that the board is free from grease, and only pour out as much as required. Any one using this paint will not complain of the chalk not hiting."

Trade Usages, Oilstone, etc.—H. B. (*Jarrow-on-Tyne*) writes:—"In reply to B. A. B. (*Hampstead*) (page 27, Vol. II.) in *re* bore *v.* drill, he says, 'I can assure him no competent instructor ever taught him that the distinction depends on the material operated on.' I don't think I said any competent instructor ever taught me the distinction, and I don't see why he should aver that I 'evolved the information out of my inner consciousness.' I went by the general usage of the trade; for instance, I am working on board ship, if I were to ask one of the drillers to come and bore me some holes in an iron beam or bulkhead, I fancy he would look at me; or if a chap asked me to lend him a gimlet to drill a hole I should rather look at him. In reference to the word munting, I rather looked when I found you had made me to say that the outer vertical parts of a piece of framing were called mullions. I can scarcely think I wrote outer, but as I did not keep a copy of the letter, I would not like to be positive; anyway, I meant inner, and I did not write sooner to correct it thinking that any one with half an eye would see that it was palpably a mistake. Would B. A. B. kindly inform us if the distinction between bore and drill does not depend on the material operated on, what it does depend on? I beg to thank BRASS (*Wolverhampton*) for noticing my inquiry. Would you kindly inform him that my name and address is H. Berry, 50, Lord Street, Jarrow-on-Tyne. If any wood-worker has an oilstone that is too hard to be of any use, let him not discard it, but try a pinch of flour-emery with the oil he uses, and, I think, he will open his eyes at the difference it will make. I keep it in a pepperbox, and just dust a little on each time I put some oil on."

Erratum.—W. D. writes:—"Telephone Transmitter (see page 45, Vol. II.). In line twenty-four from bottom centre column for "shown in Fig. 3," read "shown at A A, Fig. 1."

China Riveting.—W. W. (*Westminster, S.W.*) writes:—"I have found by personal inquiry and practice that the best place to get all the tools, and also the cheapest, is Woods & Toussaint, 54, Spencer Street, Clerkenwell, London, E.C. I write this for the benefit of your readers, and to save them what it cost me to get the information—much time and experience."

Water Motor.—J. M. (*Stockport*) and several correspondents write in reply to MOTOR (see page 30, Vol. II.) expressing their satisfaction with the "Demon" Water Motor. Other correspondents have written in an opposite strain.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Books on Alloys.—A. B.—As your son is learning the silversmith's art, he will get some good useful information on silver and its alloys from the "Silversmith's Handbook," by G. E. Gee, and also the "Goldsmith's Handbook," by the same author, both published at 3s. 6d. each. Bloxam's "Book on Metals," price 3s. 6d., will be also useful. For the analysis of metals, he should get Mitchell's "Manual of Assaying," price 12s. 6d. He will also find much information on the treatment of metals in Cassell's "Technical Educator."—G. E. B.

Electric Bell.—W. S.—Get Nos. 12, 18, and 20 of WORK, and read therein all that is printed on the subject of burglar alarums. You will then know how to make an electric bell.—G. E. B.

Burglar Proof Sash Fastener.—R. W. (*Manchester*).—Send to Rd. Melhuish & Son, Fetter Lane, Holborn Circus, E.C., and state your requirements. I think they can be met by that firm, at a cost of 1s. 6d. each sash fastener.—G. E. B.

Lithographic Transfers. — W. E. (*Nottingham*).—As the face side of any lithograph is, when transferred to glass, the undermost, the colours should be printed exact the inverse way, *i.e.*, the key should be printed first instead of last, and the other colours in exactly the opposite order to that in which they would be printed for ordinary chromos. The paper may be prepared with any composition which is soluble in water, if coated with albumen (white of egg), dextrine, or ordinary lithographic transfer paper composition; so long as it is soluble in water it will answer the purpose. To cause it to adhere to glass, either use as a last printing any composition containing Canada balsam, gold size and terebine, Venice turpentine or other ingredients which soften and adhere with the application of slight heat under pressure, or use tacky varnish on the glass itself. We point out the theory in preference to giving any particular formula. After paper and print are fixed to the glass surface by means of gentle heat, cold water soaking will bring the paper off. Use the ordinary litho inks, as strong and stiff as they can be used, to lift, and be sure to let them thoroughly dry between one working and another; they will keep for years. Another useful process is to have a roller in contact with the printing cylinder of the machine covered with soft flannel, and with light springs. The cylinder is to be tightly covered with indiarubber blanket, on which the colours one after the other "set off," and are again "set off" on to sheets of glass, tin, etc., as they pass between the printing cylinder and its soft-covered pressure roller. Note that in this method the drawing on stone must not be reversed but be drawn right way about, so that when reversed on the rubber it may be re-reversed and come right way about on the glass or tin. W. E. must, however, be careful he does not infringe somebody's patent rights, as those matters are the subject of numerous patents. See also answers to YOUNG CABINET MAKER and KESSIE (*Bristol*).—J. W. H.

Dynamo Construction.—H. S. (*Bebington*).—Your friends have anticipated the articles, and I have anticipated your wish for them. When you wrote, we had not then published a series of articles on dynamo construction, but I had written one on this subject as part of a short series dealing with "Model Electric Lights." In this series, when it appears, I think you will find all the information required by you.—G. E. B.

Water-Glass.—C. T. T. (*London, E.C.*).—The manufacture of water-glass is not suitable for amateurs, as you will see by the following extract from a standard work:—"It is usually prepared by boiling silica with caustic alkali under pressure about 60 lbs. to the square inch in a digester."—L. J. P.

Papier-Mâché, Moulding in Low-Relief.—W. D. G. (*Roehampton, S.W.*)—This I have never seen done, but it appears to me that the plan proposed by W. D. G. would be satisfactory, though tedious. Adopting his idea, I should suggest that the sharpness of edge resulting from the successive layers of paper should be softened down with fine sandpaper before the final coat of *thin* paper is pasted over the whole. And I would offer another suggestion, that before applying the gold, a little finely powdered rotten-stone should be mixed with the oil of the priming. The slight roughness thus attained would help the effect of the gilding. From the letter of W. D. G. it would appear that he either wishes to mend an antique carved frame, or to make an imitation of one. Might not his better plan be to make a model of a single "reheat" of his ornament in any ordinary modelling material? Get a cast (intaglio) of this in iron—a most inexpensive matter—and press the papier-mâché or stereo pulp into it. Then, when his deal board is well seasoned, glue this to the wood, and gild as before, though a papier-mâché panel would be better. If the design reheats he will see that this will save much labour. Any porous paper of medium thickness is suited for pasted papier-mâché. Messrs. McCallum & Hodgson, Summer Row, Birmingham, get a special papier-mâché paper made to order; and they supply wood pulp, but for the present purpose probably stereo pulp would be better. For the work proposed special tools could scarcely be needed; and W. D. G. should be warned that in making a compound article of wood and papier-mâché there will be risk unless he can thoroughly depend on his board, for it is probable that the two will not expand and contract equally together.—S. W.

Printers' Ink.—P. N. (*Keighley*) wishes to know how to make printers' ink to use with a cyclostyle. If I were to advise P. N. it would be to buy what he requires, for at any rate it is a messy compound, and I think he could buy it cheaper than he could make it, unless he requires it in larger quantities than I suppose. Boil the best linseed oil in an iron pot. When boiling set it on fire for a short time; this increases its drying qualities. When it is extinguished boil again, and dissolve resin in it to give body to it. Lamphlack is then mixed with it whilst hot. It must then be poured out and ground to a smooth uniform paste. Perhaps the following will be better:—9 oz. balsam of capivi, 3 oz. lamp-black, 1 oz. Prussian blue or indigo, 3 oz. Indian red, and 3 oz. dried turpentine soap. Mix together and grind up with varnish made of boiled linseed oil prepared as before described. This, if properly ground with a muller, will give a good ink; but I would repeat that I do not think it will pay P. N. in any way to make it in small quantities; it would be better to buy it of a dealer.—O. B.

Barbotine Modelling.—W. D. G. (*Roehampton, S.W.*) asks for suggestions for this work. The following is the method of procedure adopted by a friend of mine who is clever at it. For tools he uses the same as for modelling in leather, but depends chiefly on the fingers. The material used by him is gutta-percha, such as that employed and sold for soling boots. This being too thick for his purpose, he puts it into a saucepan of hot water, and boils it till soft enough to be rolled out to the required thinness with a *wet* rolling pin. From the thin sheet thus produced he cuts out his petals, leaves, etc.; and after softening them in hot water, bends and twists them with his fingers as he sees fit, using where necessary the leather tools, the round-nosed one and the fibring tools being most in requisition. The leaf or petal being made to his satisfaction, he chills it by plunging it into the coldest water he can get, which makes it surprisingly rigid. Berries he rolls round in the hands, or sometimes forms them in a bullet mould; stems can also be rolled between the hands. The principle of the modelling is, it will be seen, to shape by softening the gutta-percha with hot water, and then to make the part shaped rigid by chilling with cold. When all his parts are ready for joining together, he takes gutta-percha solution (*i.e.*, gutta-percha dissolved in naphtha), puts a little of this on the parts to be joined, warms them at a gas jet or candle, sticks them together, and lets them cool. For applying the ornaments thus made to a jar, this also has to be warmed, and the decorations fixed on by the same means; after which he paints the whole. The jars, vases, etc., which he decorates are of a porous or semi-porous ware.—S. W.

Steel Springs.—SANCHO PANZA.—The reply to STEEL SPRINGS will be correct as regards hardening and tempering. To temper in quantity use a sand bath, or an iron box.—J.

Patent Medicine.—W. H. (*London, N.*).—We must take this long string of queries *seriatim*. (1) To quote from an official circular of the Patent Office, "Many medicines are vended under the Government stamp as 'patent medicines' which have not been made the subjects of patents;' and again, "The use of appropriated medicine stamps does not have the effect of letters patent, but such stamps are only supplied to the person for whose use and at whose cost the plate from which they are printed was prepared, or to his authorised agent." We presume, therefore, that the mere Government stamp will not give to W. H. the security he requires with a view to selling his prescription or forming a company for its production, and that he will need a patent. (2) Acting on the instructions given in our article he should procure provisional protection. He can then safely treat for its sale to an individual or company. (3) To give any opinion as to the probable success of his undertaking is beyond our province or power. (4) We have in our article pointed out the method of proceeding when securing a trade mark. It is highly important to make choice of one about which no mistake can be possible—one which a child could recognise. A monogram or any involved subject is bad. But protection will be needed before the trade mark. (5) Probably no more widely-spread mediums for advertising can be found than Messrs. Cassell's publications. (6) We are not aware that any medical qualification is needed before patenting a medicine. (7) If W. H. proposes to act as his own patent agent he will, perhaps, do well to get (for a few pence from the Patent Office) the specification of some medicine already patented to serve as a guide. In selling the medicine, a Government stamp will under any circumstances have to be used. Communications respecting the preparation and supply of such stamps must be addressed to the Secretary Stamps and Taxes, Somerset House, London, W.C.—C. C. C.

International Patent Rights.—F. L. (*London*) should get a copy of the "Text of the Convention," which may be had for 2d. through any bookseller. This will give him authoritative information as to advantages which are secured to the inventor by the International Convention for the Protection of Industrial Property. His remaining queries he will find solved if he reads the answers to other correspondents on Patent matters.—C. C. C.

Taking Out a Patent. — C. E. M. (*Wisbech*) asks how he should proceed with regard to an invention which he wishes to sell. He should first

secure provisional protection according to instructions given in our article. As regards the selling, there are established commission agents who transact business between patentees and manufacturers, and are paid by a percentage on the purchase money. C. E. M. will probably receive circulars from some of these agents directly his application is accepted. If not he can consult a London directory.—C. C. C.

Patent Rights.—H. B. C. (*Glasgow*) is warned that the law does not allow him either to "make or vend" an article patented by another person. He lays himself open to an action. Many persons have an impression that they have a right to make a patented article for their own private use, but this would appear to be a popular error. His only legitimate course is to purchase the right to make and sell from the patentee.—C. C. C.

Index to WORK, Vol. I.—J. R. (*Skerries*) and numerous other querists are informed that an Index is prepared, and is on sale, by the publishers, Messrs. Cassell & Co., London, E.C., or any bookseller, as announced on page 828, Vol. I., of WORK.

Japanese Screen—to Imitate.—F. C. (*London, S.W.*).—To imitate a Japanese screen, the specially notable product of an artistic nation, is, I confess, to me a superfluity of naughtiness. For when the originals are to be bought for a few shillings, why produce a mockery of one? However, perhaps my business is to reply not to criticise. Now there are at least three broad divisions of these things: a lattice-work variety interspersed with fret-cut panels; a lacquered sort; and the ordinary folding screen with panels of painted paper or silk, or of embroidery. Probably your idea is to make a folding screen ornamented in Anglo-Japanese style. If so, you might take a groundwork of American cloth, say a bright red or dull blue, and paste on it genuine Japanese scraps—the crape pictures sold at the Oriental warehouses—but I doubt the result. Of course, if your idea of Japanese art is that it is anything one-sided and "quaint," you might choose the ordinary *olla podrida* of coloured prints and stick them just as unlike the European way as possible, and label the whole Japanese. Forgive my suspicions, people have done thus, and gloried in their artistic depravity. Or with a ground of crêpe lincrusta you might paint sprays of hawthorn and other graceful branches, and obtain a very fair equivalent to the genuine thing. Or you might take a plain self-coloured ground and cut out from some of the really beautiful wall papers and chintzes of the period, certain branches, flowers, and birds, and having varnished the whole obtain a pleasing *rococo* effect. But remembering that ten or twelve shillings purchase a real one, you would hardly save money, and you would certainly fail to obtain a thing better than the originals. If, notwithstanding my raillery, you will tell me more definitely your idea, I shall be pleased to do all in my power to assist you. Knowing personally, I think, almost every shop, retail and wholesale, where the products of the land of the Rising Sun are to be had, and with a valuable collection of many hundreds of Japanese books of pictures and patterns, I speak with knowledge, and shall be delighted to pass on any of it if it suits your ends.—E. B. S.

German Silver Wires.—C. D. R. (*London, S.E.*).

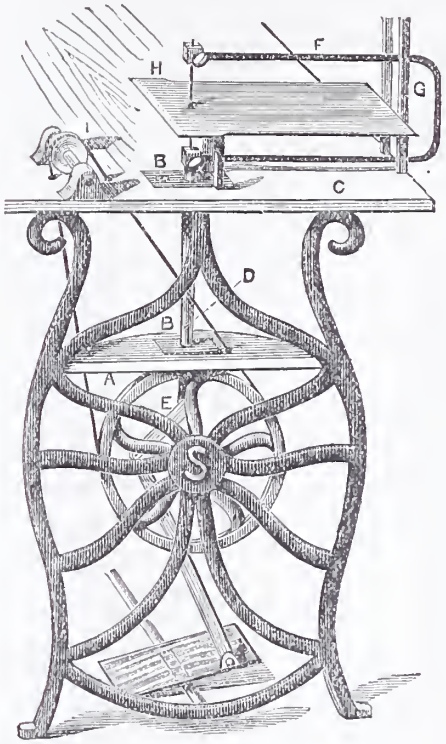
TABLE SHOWING APPROXIMATE RESISTANCE AND LENGTH PER LB. OF GERMAN SILVER WIRES.

B.W.G.	*Decimal parts of inch.*	*Lengths in yards per lb.*	*Resistance in Ohms per lb.*
No. 8	·165	4	0·0617
10	·135	6	0·1417
12	·109	9	0·3237
14	·083	16	0·9633
16	·065	26	2·562
18	·048	48	8·618
20	·036	87	27·23
22	·029	130	64·69
24	·025	195	117·1
26	·019	308	351·1
28	·016	440	698·3
30	·014	568	1191·
32	·012	782	2207·
34	·010	1177	4575·
36	·008	1777	11745·
38	·006	2550	24110·
40	·0058	3450	40125·

As German silver alloys vary considerably in their composition and hardness, no definite statement can be given of their length and resistance per lb. apart from actual measurement of each sample.—G. E. B.

Staining.—C. M. K. (*Chiswick*).—If you want to stain your table a very dark, or, as it is often considered, "antique" oak colour, you cannot do better than use the vandyke brown stain, which has several times been referred to in these columns. Should you prefer a lighter colour use a solution of bichromate of potash in water. By modifying this with vandyke brown you may get almost any shade of brown you require. By itself it gives the wood rather too much of an orange hue. Any good spirit varnish will do to finish with. You can easily make one if you wish to do so by thickening ordinary French polish with resin. All you have to do is to put some of each in a bottle. The spirit gradually dissolves the resin. As you live where varnish can easily be procured, I should, however, advise you to buy it ready made.—D. A.

How to Convert a Sewing Machine Stand into a Fret Machine.—AHNUS (*Sydenham*) says that he has a sewing machine the sawing part of which is past work, and that he would be glad to know how to convert it into an inexpensive fret machine; he also asks what the approximate cost would be. I would suggest that he should get a piece of mahogany 1 in. thick and wide enough to form a bracket, A, to project slightly over the wheel when placed horizontally against the standard and mark where it touches the standard; then cut it out so that it will come level with the outside and screw another piece of wood on to the right-hand side so as to keep it firm. He must now get two pieces of bar iron, B, 8 by 1 by ½; bore a ½ in. hole through the centre of each, screw one on the bracket, A, above the wheel, and the other on to the top of the table, C. A piece of ½ in. brass gas pipe, D, must then be passed through these bearings so that it will work easily and firmly. He must be particularly careful to see that the bottom of the pipe falls exactly over the centre of the wheel. Then connect the treadle with the pipe, D, saw a slot out of the



Converting Sewing Machine into Fret Machine.

bottom end, and bolt a piece of flat bar iron, E, in it; a hole must then be drilled in the bottom end of the iron to allow a screw to go through into the centre of the bolt that connects the treadle with the wheel—the top of the pipe must have a piece of hard wood driven into it. Now having got an ordinary iron fret-saw frame, F, he should knock off the handle; he will then find that it has a sharp point about 3 in. long; this point must be firmly fixed in the pipe, and care must be taken that the underside of the frame is square with it. This is most important, otherwise if it is not accurately done the machine will always have a slanting stroke. Some pieces of mahogany, G, must now be mortised into the top of the table, and the insides of these pieces ought to be faced with a strip of brass plate; if this is done the frame will be found to work easy. Two of these slides should be made, one at the front and one at the back; the one in front must be as high as the table, and that at the back should be a little higher than the frame when at its greatest height. The table, H, should be made out of a thin piece of mahogany and carried back as far as the slide, G. It will be seen that a small drill is figured in the illustration, I; this will be found to be well worth making. The drill is driven from the fly wheel by a round leather belt which comes up through the table a short distance in front of the frame. If the fly wheel is made heavier, which can be done by casting some lead inside it, the drill spindle can be lengthened, and a screw with a nut and collar on it can be fixed so as to hold emery wheel and circular saws; the last named will be found to be a very useful accessory for cutting straight edges in fretwood, but it is not advisable to do this unless a very heavy wheel is provided with the machine, or he can, as mentioned above, make it heavier. As to what it will cost it is rather hard to say, as it will depend on whether he intends to make all the parts himself, or whether he gets some made for him; but in either case he is recommended to have the bar iron for the bearings bored by a competent man, because the success of the machine depends entirely upon the accurate working of the pipe. On the whole the cost should not exceed a few shillings. Any further details will be supplied by W. R. S.

Easel.—AMATEUR PAINTER.—An article on the construction of an easel is in hand. No doubt it will appear as soon as the Editor can find space for it.—D. D.

Deal Staining.—H. T.—I must trouble you to repeat your question, and give more particulars of what you want than you do. As one kind of chestnut wood is perfectly white, you cannot "stain" any pine to resemble it. The other chestnut wood varies in colour, and so does deal. Without knowing more precisely the present colour of the latter and what you want to stain it to, it is impossible to give you the desired information. I am also unable to understand what you mean by "stopper." Kindly explain.—D. D.

Etching Tools.—T. L. T. (*Chester*).—Mr. Rhind, chemist, Gloucester Road, Regent's Park, London, N.W., supplies plates ready grounded and all materials. Roberson, artist's colourman, Long Acre, W.C., also supplies materials. Hughes & Kimber, Fetter Lane, London, E.C., make plates and supply tools.—F. M.

Gas Matters.—KNARF (*Manchester*).—(1) It depends on the kind and make of the engine how much gas it consumes, but, speaking generally, the average consumption of gas in a gas-engine of the Otto type per effective horse-power per hour, including igniting flames, is about thirty cubic feet. (2) By "igniting" a gas is meant setting it alight, and gas can hardly be said to expand when consumed. I presume you mean "heating" the gas, when it and all gases, including air, expand $1\frac{1}{491}$ of their volume for each degree of temperature above 0° Fahr. The simplest way to reckon this out is as follows:—if 1 c. ft. of gas at 0° F. increases to $1\frac{1}{491}$ c. ft. at 1° F., to $1\frac{2}{491}$ c. ft. at 2° F., to $1\frac{3}{491}$ c. ft. at 3° F., and so on; then conversely 1 c. ft. at 0° F. will decrease to $(1-\frac{1}{491})$ c. ft. at—1° F., to $(1-\frac{2}{491})$ c. ft. at —2° F., and so on, till at—491° F. the gas will theoretically occupy no space at all. This is called the "absolute zero," and it is by far the easier plan to reckon the volume of gas from it. By adding 491 to the temperature of the gas as it stands, and 491 to that to which you intend heating the gas, the question becomes a mere matter of proportion. Suppose the 1 c. ft. of gas is at the ordinary temperature (60° F.), and you wish to know to what it will expand if heated to 300° F., then

$$(491 + 60) : (491 + 300) :: 1 : x.$$

$$x = \frac{(491 + 300) \times 1}{(491 + 60)} = \frac{791}{551} = \text{nearly } 1\tfrac{1}{3} \text{ c. ft.}$$

In this you should be able to substitute your own figures. Of course this assumes that the gas is free to expand, but if enclosed the pressure it exerts will increase in direct proportion to the expansion the gas would otherwise undergo. For instance, if the 1 c. ft. of gas be in a vessel only holding 1 c. ft., it exerts only the ordinary atmospheric pressure of 15lbs. to the square inch; but if it be heated in that same vessel to a temperature at which it would, if free, occupy two cubic feet, the pressure it exerts will be doubled to 30lbs. to the square inch. (3) Petroleum, being inflammable, acts in the same way as gas by generating heat when consumed. The petroleum can be directly sucked in from the barrel by a pump connected with the engine, or be pumped into a reservoir above the engine; in the latter case the engine requires no attention, as it stops as soon as the supply of petroleum is consumed. From the reservoir the petroleum is conducted by a pipe to the above-mentioned pump, by which small quantities are injected into the cylinder of the engine. The oil is supplied at the rate of four drops per revolution, and, at a given point, is ignited by means of a small spirit lamp. The *modus operandi* is as follows:—On its outstroke the piston draws in a charge of air and petroleum, and on the return stroke it compresses the mixture, which is exploded as the crank passes the back centre. The combustion and expansion of the charge take place at the third stroke, the products of combustion being driven out at the fourth stroke. (4) Vaporisation of the petroleum, previous to use, does not take place, the engine using it in its fluid condition. (5) The consumption of petroleum is 1·32 lbs per horse-power per hour. (6) Gunpowder expands about 3,000 times its bulk on being ignited, and exerts a pressure of about 40 tons per square inch. (7) Yes; all models and drawings you may send for inspection and advice will be treated as strictly private and confidential.—F. B. C.

Maize Treatment.—MAIZE.—To obtain the starch from maize, soak the corn in water for about twenty-four hours, crush or grind it to a paste, put it in to a fine sieve, and wash well with water. The fine granules of starch are carried through the sieve by the water forming "starch-milk," and are deposited on standing at the bottom of the vessel used. The water washes out nitrogenous matters as well, but these do not settle so rapidly as the starch, and can be drawn off. By repeatedly stirring up the starch with fresh water, allowing it to settle, and drawing off the water, the starch can be obtained practically pure. The nitrogenous matters can be mixed with the husks, etc., and used for cattle food. A modification of this method is to steep the maize at a temperature of 77° to 140° (Fahr.) until a slight fermentation sets in; by this means some lactic acid is formed which disintegrates and partly dissolves the nitrogenous matters and thus facilitates the mechanical separation of the starch. Another method is to soak the

grain in water containing caustic soda (200 grains of alkali to a gallon of water) for twenty-four hours, wash, grind to flour, and again soak it for two or three days in fresh alkaline solution. The alkali dissolves a good part of the gluten and can be drawn off from the deposited starch, which is then shaken with clean water, run off from the heavy woody fibre, and purified as already described. In each case care should be taken to keep out dust and insects, and plenty of clear and fresh water should be used. These methods can be used on any scale from grains to tons, although on a large scale machinery is necessary to save time and labour and prevent waste.—F. B. C.

Glue and Gelatine.—F. M. P. (*Muswell Hill*).—I am not aware that there is any method by which these can be made from horns. They are prepared from cuttings of skins and other gelatinous portions of animals, but the process is quite unsuitable for amateur work. In case there may be an easy method of preparing glue in the way you inquire about, I give your question, hoping that some reader may be able to enlighten us: "How can gelatine be obtained from (*a*) bullock's horns, (*b*) the cores of horns?"—L. P. L.

Cutting Bracket Pieces.—F. D. (*Liverpool*).—A joiner would probably mark out the bracket, full size, on any board of sufficient size he had handy. All that is necessary is a straightedge to the board, and a square, rule, and pencil, for the upright part of the bracket, lines drawn parallel to the edge, and for the horizontal part the lines can be drawn with the square; fixing upon the position of the stay, the length and the angles can be easily marked, and the bracket made strictly to the drawing. If this is thought troublesome, then the two pieces can be joined at right angles and the recesses cut, and the stay marked to them, or the stay cut to the shape desired, and used as a pattern to cut the recesses; but the plan of setting out the bracket on a board and working to the drawing is not only the best, but the quickest way, effectually avoiding "taking off a slice here and there and failing in the end."—B. A. B.

Adhesive Paste.—W. J. (*Ireland*).—The paste you used, composed of half glue and half paste, is the proper thing for sticking up lincrusta. The best way to make it is to make the paste as if it were for ordinary paperhanging, and the glue as if it were for woodwork, and then mix them together. The paste should be put on the lincrusta nearly boiling, in a warm room, but not too thick, taking care that all possible fitting, etc., has been done before pasting. It is most essential that the paste should be hot and the lincrusta as warm and pliable as it can be made. It is very likely the fact of the glue chilling, and the lincrusta being hard and stiff in places, which cause the bulges you complain of. Sometimes it is found advantageous to tear off the canvas back; but most of it is now made with paper backing—in fact, I think I may say all, unless otherwise ordered—it being found that the paper backing greatly facilitates the hanging. If, even after the above precautions have been taken, you notice any bulged places, they can be got rid of by slitting them with a sharp knife, and holding a very hot iron in front, and dabbing it back with a cloth dipped in hot water and wrung out. I have seen nearly every pattern made by the company hung from time to time, and the method adopted has always been as described. The only case of failure was when the plaster on the walls was not of sufficient strength to carry the weight, etc. Most paperhangers hold that it is absolutely necessary to line the walls with brown or white lining paper before hanging the lincrusta. I do not say it is not, but if your failure has taken place on a lined wall, try it without. For whatever lining paper will stick to with ordinary paste, lincrusta with paper backing with glue paste will stick to stronger, providing the room and consequently the wall is warm, also that the wall has been sized. Always warm the lincrusta before unrolling in cold weather.—E. D.

Non-Conducting Packing.—J. R. (*Keighley*).—I should think a wood packing with perforations bored through parallel to the face, and vertically if possible, with a layer of asbestos between it and the metal, should serve your purpose. The wood might be held by sungs to the steam jacket and the bracket fixed to the wood by screws, but these details must depend upon the purpose for which the bracket is required; with more definite information I could better advise on the matter.—F. C.

Piano Materials. — JACK OF ALL TRADES (*Liverpool*).—I believe you could purchase the wrest plank and bent-side in your own town. Try Owen's, St. Anne Street, or Roberts', Camden Street. If you get the beech the size you require, with the flower of the wood on the flat side, it will suit your purpose. Perhaps a local pianoforte maker, such as W. H. Davies, Irvine Street, Edge Hill, or W. Latham, Soho Street, Islington, would oblige you by supplying you with materials. You will probably have to pay 2s. 6d. for wrest plank, and 1s. 6d. for bent-side.—T. E.

Piano Frame, Bronzing.—BRONZIST (*London, E.*).—To bronze cast iron frame of piano it will be necessary to first fill up the minute holes that are frequently found in cast iron. To do this, mix whiting with patent size and give the frames a few coats, allowing it to dry after each coat, and rubbing level with glass-paper until you get a smooth surface. Now give a coat of japanners' gold size, and when nearly dry, "but still tacky," take a piece of wadding, and dip well into some bronze powder, then dab it over the frame until it is covered. When all is dry, dissolve some parchment cuttings in warm water until it forms a size. If you give it a coating of this size, it will protect it. You may obtain the materials at any large colour merchants' at a reasonable price. There are several shops in Old Street, E.—T. E.

Small Steel Casting.—A. L. (*Ripon*).—Samuel Osborne & Co., Clyde Steel Works, Sheffield, will supply the casting you require.—J.

Ear Drums.—F. J. B. (*Reading*).—I regret I cannot open a correspondence as you request.—ED.

Squeaking Piano Keys. — JAY BEE (*Edinburgh*).—I cannot tell from your letter what kind of action is in your piano. If you could have given a sketch of one note, however rough, I might have answered your letter with more certainty. I presume it is what is known as a "sticker action;" if so, at the end of the key is an upright piece of wood with a spring in front; this is a hopper. If you raise the key off the centre pin, and take it out of the piano, you will find that the blacklead on the top of the hopper has been worn off and wants replenishing. Blacklead or French chalk is the lubricant used for wood; do not use oil or grease, as this swells the wood and makes the parts tight. Mix the blacklead into a thin paste and apply it, then polish with a piece of leather or steel.—T. E.

Piano Making.—W. H. M. (*Sussex*).—You ask is it possible to obtain answers to your questions; I may say it is possible to obtain an answer to any question which comes within the scope of WORK. If you read the third paper on "How to Make a Piano," you will find that the screws go through the wrest plank and bent-side from the front, the heads of the screws showing in the front. I may say here that the gluing is most important, for if the glue gave way, the screws would not hold it, but the screws prevent the glue starting. As to the bent-side, it is covered with an iron plate, as you will read also. The veneering is necessary, as it prevents the wrest plank splitting, as the wrest pins are so close together. But you would not find much difficulty in veneering it. It is much more simple than you would imagine. The veneered side of wrest plank is the front side. As the wrest pins do not pierce entirely through the plank, a veneer on the side which is glued to the bracings would be useless for the purpose of preventing the splitting of the plank.—T. E.

Printing and Lithography.—A. R. (*Brighton*).—In answer to your query as to these subjects having appeared in WORK, I have to say that papers are under consideration, but have not yet been decided upon. We shall always, however, in "Shop" be glad to help you in any difficulty that may crop up, if you will send us full details, sufficient in fact to enable us to see the true cause of any failures you may encounter, and if you enclose specimens of paper, ink, or other materials, it would materially help us to condense our reply. Above all do not ask us more than one question in one letter; if you have several queries write on separate paper for each. If you have no special printers' broker in Brighton, you might apply to some lithographer, who would oblige you with what you require; failing that, write to Messrs. Stoer Bros., Queen Victoria Street, E.C., or to Messrs. Hughes & Kimber, Limited, West Harding Street, E.C., or B. Winston & Sons, Shoe Lane, E.C., who will send you price lists. Litho-stone is sold by weight at from 1½d. to 4d. per lb., according to size and quality. For chalk drawing, the stone requires to be grained after it is polished, and for this purpose "grey" or "blue" stones should be used, as this quality gives a sharper and cleaner tooth than the yellow qualities, and any "chalk-pits" are more readily seen. For circulars, plate transfers, etc., yellow stones are quite good enough, are cheaper at per lb., and weigh less in proportion. The etching solution should, however, be weaker than for the grey stones. Write us again if you do not succeed.—J. W. H.

Flat-Bottomed Punt.—F. H. (*Exeter*).—We think that the dimensions given, viz., 14 ft. from stem to stern, 13 ft. 4 in. (over all) length at bottom, width at gunwale amidships 3 ft. 8 in., width at bottom 3 ft., spring of floor, about 1 in. (we should advise 2½ in.), are pretty good proportions, but suggest that for single-handed work the length is too great, as it would entail using something very much thicker than ½ in. stuff, which, when planed and finished off, would barely stand up to full ¼ in.—we should not much exceed 18 ft. 6 in. length over all. To arrive at the depth, first roughly calculate the cubical contents of the punt at say a unit of one foot in depth, and get at the approximate weight of the material plus the cargo (*i.e.*, yourself and traps). You will find plenty of tables of the weight per inch of various kinds of wood and iron rails, etc.; from these data you can readily arrive at the displacement of water which this weight acting on it produces—that is, what depth it will sink to in the water. You can then decide how much free board you would have above this water-line. Before you commence the actual building you should draw out a "sheer" plan as shipbuilders call it, full size, on a smooth floor rubbed over with chalk, exactly to your dimensions, and draw in *full*, and also in *section* every rib, knee, and timber in her, which will give you exactly the flare or curvature to which her side planks must be cut. If you could manage to watch a barge-builder at work, details too numerous to mention, and how they are carried out, would be apparent to you. Meanwhile make your full-size drawings, and if you are uncertain, send us small scale drawing of the part in which the difficulty occurs and it shall be corrected and engraved in "Shop," and our advice given you. We have in preparation an article and drawings of a similar very light and portable boat, though hardly a punt, which may find its way into WORK later on. We hope to hear from you again if we can be of any assistance to you.—J. W. H.

Indiarubber Stamp Making. — A. D. X. (*Leeds*).—The proportion of rubber and sulphur varies with the purpose to which the compound, when vulcanised, is to be applied, and is, to some extent, a trade secret. Properly prepared rubber compound (unvulcanised) can readily be obtained commercially, and it is far better for an amateur to purchase it ready for use than to attempt its preparation—a process quite beyond the reach of ordinary appliances.—QUI VIVE.

Battery for Telephone.—C. W. J. (*Clapham Common*).—The action of a telephone made as described in WORK would not be improved by the use of a battery unless a microphone was included in the circuit. See former replies to similar queries, and read the article over again.—W. D.

Opalestic Topas.—L. J. P. (*Wellingborough*).—In jewellery that we get at the West End of London there is no stone, as far as I know, with a name like that. I, therefore, feel disposed to reply almost positively that it belongs to the same class as sapphirines, that is, it is a production of the chemist's, not of Nature's. I should say that it is, in all probability, not even an imitation of a real stone, but some coloured glass that looks nice when cut to represent stones. There is a rough-and-ready way of judging if stones are genuine, and that is, are they mounted in good settings? for if a manufacturer goes to any expense, the chances are that the stone is a real one. If the price of the article is a matter of shillings only, then my verdict will be that the stones are not real. You will understand that I cannot give a clear decision without seeing the stone, for the name alone is not to be depended on. Things do get called by any name but the right ones. And besides that, you have not sent any description of its appearance.—H. S. G.

Ornamenting a Fireplace.—PLEASURE AND PROFIT (*London, W.*).—Your query requires an illustrated article to do the subject justice, and your pseudonym foreshadows what a reader might hope to gain from its perusal; so in place of saying that the best ornament to a plain fireplace is a pretty wife, or recommending you to buy so many yards of art fabric at ⅜d. a yard, to bandage it with, I have cast the reply in the form of an article, for which the Editor in due season will, no doubt, find place. One item, for instance, you do not say, *i.e.*, whether it be your own freehold, or merely in tenancy. Yet this is most important, for while I could advise you to paint or otherwise ill-treat your own property, if it were a landlord's, future compensation upon quitting the house might lead you to regret having meddled with it.—E. B. S.

Pattern Tracing.—MANIFOLD.—Your letter was unfortunately mislaid by the churl whose duty it is to answer the Editor by return, and he humbly apologises. For tracing there is a special transfer paper sold at most fancy-work shops. One alternative is to prick the design on fairly thick paper and rub French chalk through the holes. This is sufficient for bold, easy patterns, but for small scale or elaborate work, the transfer paper, sold in various colours, is the only adequate thing.—E. B. S.

Wood Turners.—T. H. (*Radcliffe*).—You inquire for a London firm of wood turners. I can recommend Messrs. M. C. Duffy & Co., 66, Storks Road, E.C., for inexpensive and good work; Messrs. J. Eberhard & Co., Edward St., Hampstead Road, N.W., are also, I believe, entirely capable and satisfactory.—E. B. S.

Galvanising.—BLACKSMITH (*Dukinfield*).—Iron is galvanised by first pickling in muriatic acid, diluted, and then plunging it into a bath of molten zinc (which, to save waste, should be covered with a layer of sal-ammoniac) until it is the same temperature as the bath, when it is lifted out and drained. If there are galvanising works near you, it will probably, for such small quantities, be cheaper to get them done than do them yourself.—F. C.

Bookbinding Tools.—T. E. T. (*Brixton*).—I am exceedingly sorry that I cannot help this querist in any way. I can answer his questions, but the answers must be in the negative, hence my expression of sorrow. Bookbinders' finishing tools are dear; it is impossible to get over that; they are seldom to be had second-hand; I have seen them for sale in Edinburgh, but not anywhere else, not even in London. The leaden type used by printers would be useless in the hands of an amateur, and as this is made in founts, *i.e.*, a certain number of alphabets to the fount, it would be almost as difficult to get a few letters, for type founders would hardly break a fount by selling a few. I could give you a list of addresses of bookbinders' tool cutters, but that would not help you much, as the prices of the various firms are pretty much alike; however, you might try Messrs. Nix & Gray, 103, Fleet Street, London, E.C.—G. C.

Artificial Leg.—J. G. T. (*Dowlais*).—We cannot give sketches of artificial limbs, nor deal with surgical or medical questions. Upon an artificial leg matter you had better apply to Mr. James Gillingham, surgeon machinist, Chard, Somerset.

Steam Launch.—Will B. F. (*Birkenhead*), who sent, some weeks ago, a small MS. on the above

subject for "Shop," kindly send his full name and address to the Editor of WORK?

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

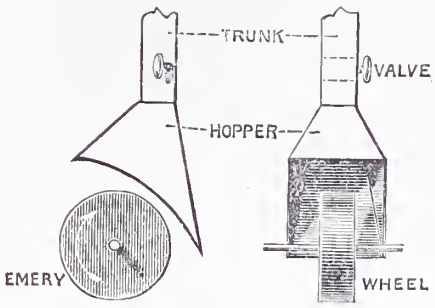
Rubbing down Oilstones.—W. M. (*Birmingham*) writes in reply to E. P. (see p. 619, Vol. I.):—"I made inquiry, but the glass was unknown here in Birmingham; it was suggested was it 'P. R. P?' I took a piece about 18 in. square, costing a shilling, to try it. It is the thick roofing plate roughed on one side (not 'fluted'), and it is cheap. No directions were given by A. G., but I cleaned the oilstone and used it dry. It answered admirably, nothing could be better. In half an hour an oilstone badly hollow was made flat and true. Of course I rubbed every way all over the glass to keep that flat. I should say the glass would do any number in moderation; it is far better than emery or 'grindstone.'"

Colouring Ceiling.—MEUX QUE CA writes in reply to BOATHOOK (see page 30, Vol. II.):—"I will help you over the stile. Wash off that ceiling, and as you go scrape out all cracks, wet well, and stop with either Keen's or Peran's; and if any of the cracks have dropped on one side, flush them with some thin stuff with your broad knife or stripping knife. Buck's is the best for this job. Remember, all your stopping must be used neat, neither size nor whiting being added to cool it. Make up a little at a time. Now get a pail of well-washed whiting, and ask them to let you have the lump instead of the loose. Now get 1½ lbs. of Cannon's best concentrated size; remember, none of your rubbish. See that the signature is there in full; it will cost you 1s. 6d. Now twopenny worth of best Venetian red; if you use any other you will be sure to leave blemishes somehow or other. Now get a tin and put your Venetian red in it, with enough water to cover it; put it on one side to soak. Now get two clean pails and a stirring stick. Break open the size packets and tip them into one of the pails. Put about three pints of water to it, and stir up well with stick; stand that on one side. Now put on a kettle of water to boil. Now tuck up your sleeves, and don't be frightened. Half fill your other empty pail with water, and get a small hammer, and hold each lump of whiting over the pail with water and tap it gently so that it falls floury. Keep on at this until the broken whiting mounts well above the water. Now see if the kettle boils. If so, pour it in on top of size, stirring it well as you do so. Now stand that away to cool, for you must not make use of it in this hot state, as you may have another Red Sea. Nor must you let it chill or jelly as you would call it. Now in with your hand into your pail of whiting and break it up thoroughly. Your whiting ought to be as round as thin glazing putty, so that you find it very hard to stir your hand in it; if it is not so, make it so. Put a little of it on a piece of paper just to check your eyes when tinting. Now put in a little of your Venetian red, which ought to be well soaked. You can give it a rub up if you have any doubts of it. And remember, let no size go near any of the stuff until you have got your required tint, or there is sure to be a Red Sea. Keep adding little bits of your Venetian red to your pail of distemper until you think you have got it, comparing it with that little bit of white you took out. Then dry a little on a piece of paper in front of the fire, keeping the distemper side away from the fire and clean side of paper to it. Now first stick a pin in it, and place it on your ceiling. Don't look at it just then, go out and have a look at anything green (the grass) for a minute or two. Come back and look suddenly at it, and decide yes or no. When you have got it to the tint, add your size, which ought to be nice and cool by this time, and stir round with your hand. You will find it become so very stiff for a minute or two that you will hardly be able to stir it, but add more size to it until it becomes like good round oil paint in appearance. Now strain it carefully into another clean pail. Put about a quarter of it back into the first pail, and add the rest of your size to it, which ought to make it very thin and strong. I mean for you to put the rest of the size to the quarter you have poured back! Now into this also add about a table-spoonful of ground alum; stir well, and this is now what is termed in the trade 'clear coll,' or preparation. Put one cupful of cold water gently on top of your pail of distemper, so as to prevent a skin from coming on as it chills. Cover it up, and put it away in the cool to chill, which will be next day most likely. Now, if your ceiling be dry, you can go over it nicely with the 'clear coll,' so that it will be dry for next morning to distemper. Get your mate to help you, and do not attempt it by yourself. Begin at the light, and work from it—centre ornament first, bed of ceiling next, and cornice last. Do your bed in two feet strips, and, when you make a shift, go along the edge of the strip of distemper you have put on and soften it well into it. Throw open your windows when finished if the day be fine; if wet, no. It would take a book to tell all even in a trifling job as this is, for there is not a tithe of the knowledge given here that ought to be given. However, let us know how it goes off, please."

Leather Laces.—W. W. (*Northampton*) writes in answer to G. L. (*Gainsboro'*) (see page 41, Vol. II.), that Messrs. Mobbs & Co., Cow Lane, Northampton, sell a machine for cutting laces. It will cut a lace, I think, about three feet long, and its cost is about 30s.

Book on Sheet Metal Work.—J. J. M. (*Woolwich*) (see page 782, Vol. I.) writes in reply to L. P. (*Deal*):—"I have to inform L. P. (*Deal*) that all the remaining copies of Warne's book on metal plate work were sold by subscription to the members of the Amalgamated Society of Tinplate Workers for the benefit of his widow. The published price of the book was 10s. 6d."

Exhaust Fan or Ventilator.—H. B. P. (*Hendon*) writes in reply to D. B. S. (*Ferns*) (see page 750, Vol. I.):—"You give such very meagre details about the number and position of grindstones and emery wheels that your question cannot be answered very satisfactorily. The dust from the grindstones, I think you will find, is much too heavy to be drawn off by an exhaust fan, as it is wet with water. The dust from the emery wheels, being dry, can be more easily managed, provided the hopper (shown in sketch) can be got near the wheel. This will be found difficult, as it will, if too near, interfere with the work. Above each wheel, and in about the proportion shown in sketch, place a wooden hopper, and from the top of this carry upwards a rectangular wooden trunk, fitted with valve as shown, to shut when wheel is not in use, so that the suction may be stronger in the wheels at



Exhaust Fan or Ventilator.

work. These trunks must be connected to one running longitudinally under the floor of the loft, and in such a position from the wall that the greatest number of hoppers can be connected with it without any superfluous bends, as these materially interfere with the draught. Midway in this longitudinal trunk a connection must be made to the exhaust fan. This connection should be of the same sectional area, or slightly larger, than the combined areas of exhaust passages in fan. The longitudinal trunk under loft, from its connection with the fan, should decrease in section in both directions, after each connecting trunk to emery wheel is passed, till at the ends it may be of the same sectional area as the upright trunk connecting the hopper to it. The size of the fan must be determined by the amount of work to be done, and cannot be settled satisfactorily till more particulars are given. The loft, if vacant, is a good place to put it, as it could be easily driven by means of a counter-shaft from the line shaft, which I assume is below the flooring."

Deposit in Pipes.—H. B. S. (*Liverpool*) writes in reply to ADALIA (*Asia Minor*) (see page 30, Vol. II.):—"ADALIA inquires whether there is any method by which he can get rid of a deposit in the water pipes. I am very pleased to hear from this out-of-the-way locality, and will give what information I can. Judging from the description your correspondent gave, I should say that the deposit is carbonate of lime which, originally in solution in the water, has deposited. Now, if your correspondent can get an acid—hydrochloric would be the best, diluted with water—and can manage to disconnect the pipes in some way so as to allow some of the acid to pass through the pipes, he will effectually clean the pipes if they are of lead or of earthenware and the deposit is of carbonate of lime; run a quantity of water through to clean afterwards. If he can get at the source of supply, then a definite quantity of lime, or of carbonate of soda, may be added to it before it enters the pipes. The quantity required can only be got at by an analysis of the water. If your correspondent wishes to do anything effectually, I will help him if I can. Let him send over some of the substances filling the pipes, and I will analyse it for him. That is the way to get at the remedy. Also let him give us particulars of the method of water supply and kind of pipes."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—FOREMAN BRICKLAYER; W. G. C. (*Rochester*); BAR FRAME; P. V. S. (*West Hackney*); TRYING (*Oswestry*); J. G. (*Stockport*); T. T. (*Sheffield*); ASMODEUS; H. G. (*Dewsbury*); J. V. C. R. (*Pendleton*); S. W. R. S.; L. F. (*Shaftesbury*); T. B. (*Manchester*); H. S. G. (*Battersea*); F. W. B. (*Golcar*); H. B. (*Jarrow*); F. S. C. (*Durham*); A. W. A. (*Waltham Cross*); C. H. W. (*Hampstead*); DITTONIAN; W. B. (*Highgate*); C. W. B. (*Plymouth*); IGNORAMUS; G. B. (*Liverpool*); H. G. L.; W. R. L. (*Glasgow*); A. H. H. (*Birmingham*); A. F. W. (*Oldham*); S. D. (*Heeley*); J. E. H. & Co. (*Birmingham*); J. G. W. (*Birkenhead*); H. M. (*Leeds*); FELLOWS (*Kent*); H. K. (*Stamford Hill*); A. W. P. (*Leytonstone*); E. R. D. (*Sherborne*); F. S.; G. R. D. (*Shipley*); TINY TIN (*Sheffield*); GLASS; CHOPSTICKS; J. M. (*Suffolk*); YOUNG WHEELER; R. L. (*Edinburgh*); TOY MAKER; E. N. (*Herne Hill*); CURIOUS (*Belfast*); C. W. B. (*Plymouth*); LEWIS (*Forest Gate*); DUNCOMBE (*London, E.C.*); C. A. (*Hackney, E.*); D. McD. (*Inverness*); C. E. S. (*Stoke Newington*); H. C. (*Suffolk*); S. G. V. (*Battersea*); TINKER; P. T. (*Kazan, Russia*); F. McC. (*Birmingham*); R. H. W. (*Lewisham*); PAINTER; A. N. (*London, E.C.*); S. J. A. (*London, N.*); BOAT; R. J. (*Edinburgh*); WOOD CARVER; F. L. (*Islington*); W. B. (*Newcastle-on-Tyne*); W. T. (*Highbury*); A CONSTANT READER; C. B. (*Durham*); L. N. (*Carlisle*); WOOD WORKER; R. T. (*Norwich*); S. V. (*Devon*); A. O. N. (*London, W.*); D. G. (*Hereford*); E. H. (*Camden Town*); A READER OF "WORK".

Trade Note.

ADMIRAL OF THE FLEET, THOMAS SYMONDS, takes a very gloomy view of the big guns in our navy. Were there no defects such as have arisen in the 110-ton and 67-ton gun, the duration of these weapons is so limited that, in his view, they would be useless by the time a ship is usually put out of commission. The best practical gunnery officer he knows wrote to him that no 110-ton gun yet made would be safe after ten rounds of rapid firing on service, nor 67-ton gun after twenty rounds. He put the life of a 110-ton gun at thirty rounds, and a 67-ton gun at about fifty. No gun of the largest calibre has ever fired ninety-six rounds, and Admiral Symonds is clearly not of opinion that that test could be passed. The slowness with which firing can be maintained from heavy ordnance places a vessel relying on it at great disadvantage, especially when smaller guns can be fired with extraordinary rapidity.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [15 R

Complete Fount of Rubber Type.—Two alphabets, to form any word or name, box, pad, ink, and holder, post free, 1s. 6d.; extra alphabets, 6d. per set; figures, 3d. Business, address, and pocket stamps equally cheap.—W. C. PRESTRIDGE, Manufacturer, Cumberland Street, Bristol. Established 1870. [2 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Machinery and Tools.—Largest stock in London. BRITANNIA Co., 100, Houndsditch. Cash or hire purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks, Dies, Forges, etc.; catalogue of new, 6d., or list second-hand, 2d.—BRITANNIA Co., Colchester.

Best Book on Lathe.—Chapters on metal spinning and screw cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [11 R

Stickall Cement (patented).—Will securely stick paper, leather, wood, ivory, marble, iron, earthenware, glass, etc., for which purpose it entirely supersedes paste, gum, glue, and every other substance; made up in self-opening tins, 6d. and 1s. each, per post 3d. extra.—The EVER-CLEAN COLLAR Co., 100, Wood Street, E.C. [12 R

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 sheets, 2s. 6d. All post free. Lists free.—F. COULTHARD, East Cliff Terrace, Bournemouth. [6 S

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [17 R

Water Motors! Drive your machinery from house tap; no noise, dirt, or expense!

Water Motors! Finished complete by Britannia ...'s machinery; half man, 8s. 6d.; one man, 12s. 6d.; ⅛ horse, 18s. Photo stamp.—P. PITMAN & Co., Aubrey Road, Withington, Manchester. [1 S

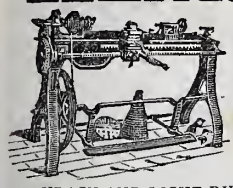
Leclanchè Cells, 1s. 6d.; Terminals, 1d.; Contact Pillars, 2½d.—BARNETT & Co., Manufacturing Electricians, Elswick Court, Newcastle-on-Tyne. [4 S

Microscope Slides.—Gorgeous polarising, brilliant opaque, and entertaining slides for exhibition or study. Microscopes, object cabinets, mounting requisites.—HENRY EBBAGE, 344, Caledonian Road, London. [3 S

Exchange for anything useful, 320 organ pipes (paper).—CHARLES EWEN, Forest of Glentana, Aboyne, Aberdeenshire. [5 S

Glass Silverer and Beveller.—EDWIN HAMMOND, Junction Road, Romford, Essex. Please state requirements. [19 R

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

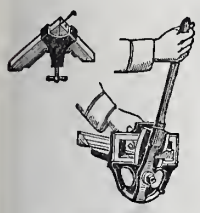
FOR

SCREW-CUTTING & ORNAMENTAL TURNING,

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd. Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1853.**



PROFITABLE HOME WORK.

With Booth Brothers' **Registered Mitre-Cutting Machine,** any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,

TOOL MAKERS, DUBLIN.

SPRING CLEANING.

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

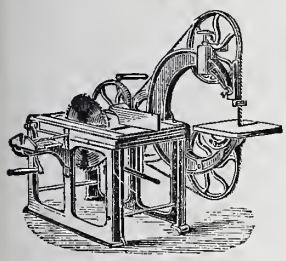
Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

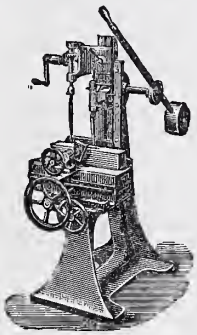
LEWIS & LEWIS,



ENGINEERS,

CAMBRIDGE HEATH,

LONDON, N.E.



THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,

For Hand or Power, will take in 22 in. Circular Saw, and will cut by hand-power up to 5 in. deep

THE "HACKNEY" MORTISING & BORING MACHINE,

With 8 Chisels, 1 Coredriver, Key, 3 Augers, and 3 Drills.

NOTE.—Our New Illustrated 200-Page Catalogue is now ready, containing 700 Illustrations, of all the Latest Improved Tools for Carpenters, Joiners, Engineers, and all Metal Workers, Carvers, Fretworkers, &c. By post, **6d.** The Polytechnic List of Tools for Students on application

UNIVERSAL HAND BEADER.

Iron Stock, with Seven Steel Cutters, **5s.** each.

Free by Post.

For Beading, Reeding, or Fluting, straight or irregular surfaces, and for all kinds of light Routering, this Tool is invaluable to Wood-workers. Seven superior Steel Cutters go with each Tool. Both ends are sharpened, thus embracing Six ordinary Sizes of Beads, Four Sets of Reeds, Two Fluters, and a Double Router Iron ($\frac{1}{8}$ and $\frac{1}{4}$ inch). The Cutter is firmly clamped to the Stock. A Gauge with long straight bearing surfaces is used in ordinary work; and a Gauge with oval bearing surfaces is used for curved or irregular forms of work. Either Gauge can be shifted from one side of the Cutter to the other, without separating it from the Stock, and can be rigidly set at any required distance from either side of the Cutter.

Note the Address—**MOSELEY & SON, 323, High Holborn, W.C.**

CASSELL'S CLASSIFIED CATALOGUE, containing particulars of upwards of One Thousand Volumes published by Messrs. Cassell & Company, ranging in price from

THREEPENCE TO FIFTY GUINEAS,

will be sent on request *post free to any address.*

Cassell & Company, Limited, *Ludgate Hill, London.*

PICTURE FRAME MAKING.

Fourth Edition, Enlarged and Revised.

THE FRAME MAKER'S INSTRUCTION BOOK.

150 *Diagrams, Designs, and Patterns.*

Instructions in Joining, Fitting, Mount Cutting, &c. Also Prices of Mouldings, and every Requisite for the Trade. Post Free, **6 Stamps.**

GEO. REES, 115, Strand (Corner of Savoy St.);

Moulding Dept., 41, 42, 43, Russell St., Covent Garden, London.

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.

37, CHANCERY LANE, LONDON, E.C.

Rd. MELHUISH & SONS,

FETTER LANE, LONDON, E.C.

Gold Medal for Excellence of

For all Workers in Metals, also Joiners, Wood Carvers, etc.

WE HOLD THE MOST COMPLETE STOCK IN THIS COUNTRY,

And all Orders have Immediate Dispatch.

Orders for Hardware and Tools over 10s. in Value, Carriage Free.

ASPINALL'S

INCOMPARABLE,

COLOURS

BEWILDERING,

BEAUTIFUL.

PRINCESS.

TO AMATEURS.

The roughest proscenium, or fittings, knocked up for the occasion in Hall, School, or Country House, may be made not only beautiful, but very like the real thing by a pot or two of ASPINALL'S ENAMEL at the cost of a few shillings, and the success of a show is frequently enhanced by bright surroundings. *Verb.sap.*

SOLD EVERYWHERE,

In Tins, or post free, 7d., 1s. 6d., and 3s.; For Baths, 9d., 1s. 9d., and 3s. 6d.,

FROM

WORKS, LONDON, S.E.

ASPINALL'S EBONICA,

A JET BRILLIANT BLACK, FOR

Cycles, Basket Carriages, Bedsteads, &c.

Sample Tin, 9d., post free.

ENAMEL.

Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6P. OR FOR 7 STAMPS BIRMINGHAM. [33

GRATEFUL—COMFORTING.

EPPS'S COCOA

BOILING WATER OR MILK.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

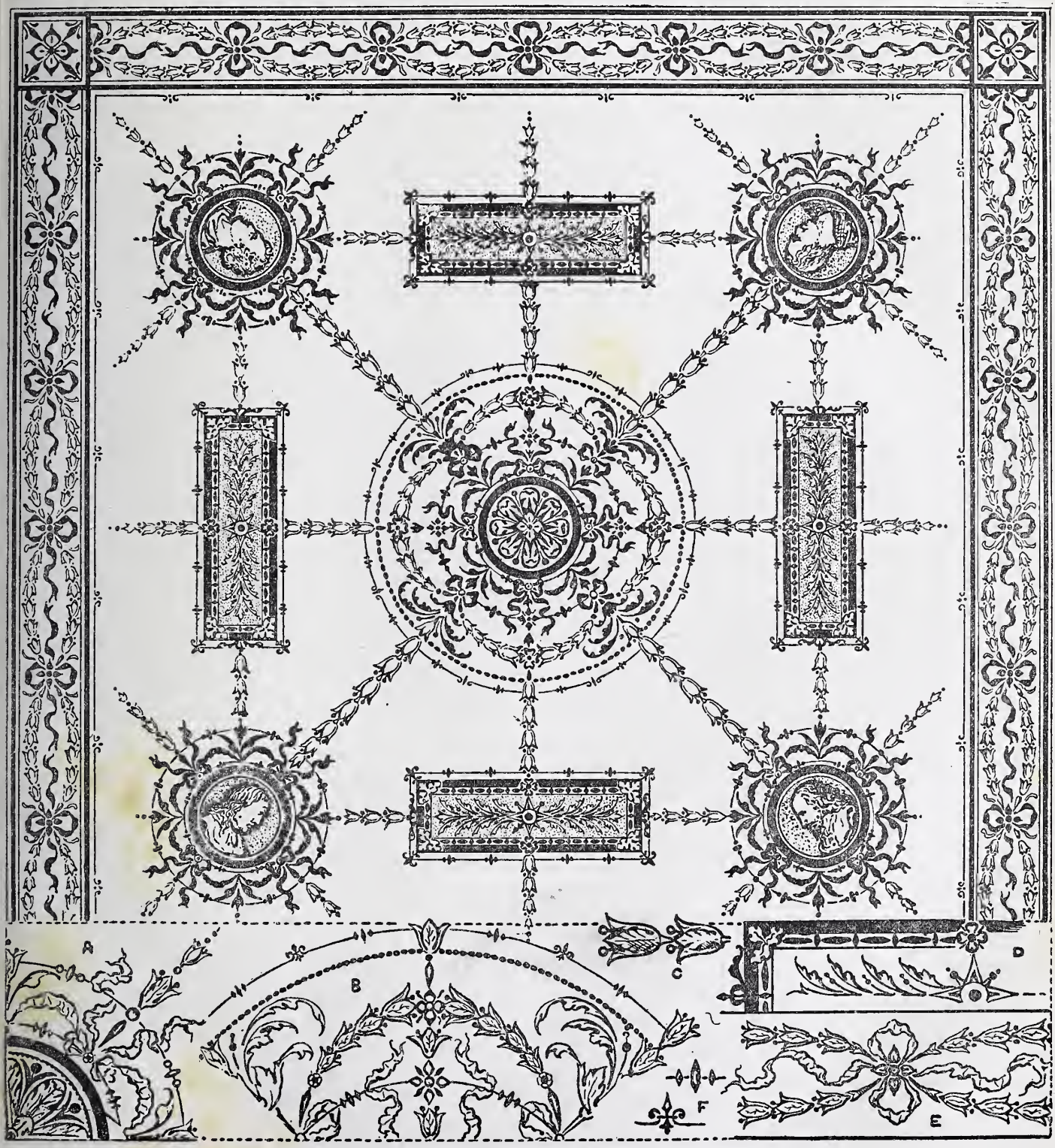
WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 61.] SATURDAY, MAY 17, 1890. [PRICE ONE PENNY.



Example of Decoration in Stencil for a Sitting-Room Ceiling.

STENCILLED DECORATION FOR A SITTING-ROOM CEILING.

BY A LONDON DECORATOR.

In placing before the readers of Work a design for the embellishment of a ceiling, I have endeavoured to keep in my mind the necessity of such decoration being so arranged as to be readily adaptable to various conditions and circumstances. In the first place, it must be mentioned that ornament which has to be executed by the stencil process must necessarily be of a somewhat disconnected nature, so that the "ties" which hold the stencil together may not appear as so many *patches*, but really help in the formation of the design. Ties in a stencil, which have afterwards to be made good by hand, are scarcely ever a necessity; more often a sign that the ornament is not specially drawn for the purpose, or else that a style of decoration is attempted which is outside the province of flat ornament. This will explain my reason for adopting ornament of the "Adams" type. It is seldom we find two ceilings, in different situations, of precisely the same size and shape, and therefore—the better to meet the probable requirements of the individual reader—the rearrangement of the panels will prove to be a comparatively simple matter. Again, many sitting-rooms are decorated (?) with a plaster centre-flower, and this article, irrespective of its suitability in design, would quickly upset any ornamental arrangement of an arbitrary nature or a more classic style. Lastly, I have endeavoured to meet the majority of readers with a decoration capable of giving a very pleasing effect, and that without making any extreme demand upon them for skilled draughtsmanship.

Some useful information on stencil cutting having been published in an earlier paper, I must refer the worker, who has not previously attempted such, to this for help and guidance, as I can only deal here with the execution of the design.

My drawing assumes a square ceiling—flat, without a centre-flower, fourteen feet each way, the scale being half-inch to the foot. Whatever may be the size and shape of the ceiling, it is advisable to make a plan of it, drawn to scale, from which to set out the ceiling and mark the position of each panel and ornament. The size the stencils have to be enlarged to will then be readily apparent. For a ceiling 14 ft. square, the diameter of the corner panels, measured within the fine, outer line, will therefore be 30 in. This would also be the average size of a plaster centre-flower for a room of such dimensions. Stencil A forms one quarter-section of the corner ornaments, the rosette in my complete drawing being replaced by a medallion in these four circular panels. Upon careful inspection of the large central ornament, it will be noticed that the inner portion is identical with the corners, and therefore is executed with the same pattern—stencil A. From this it follows that, given a ceiling with a centre-flower of equal diameter to the corner panels, the former will take the place of the inner stencil work. The majority of such plaster ornaments will be found to terminate at their outer edge in pointed forms at regular intervals apart. Stencil B, omitting the ends of ribbons shown, is of a nature that could be connected with such a plaster-centre, without any ugly break or false notion being conveyed to the eye.

The reader who has now carefully followed me will see that I have explained how to adapt the decoration to a ceiling *with* and *without* a centre-flower. In the event of the latter, however, being either larger or smaller, stencil B can be drawn to fit the plaster quite as easily as to the exact proportions of my drawing. The stencil C indicates an enlarged drawing of the clusters of conventional leaves which connect each portion. Of these the worker will require two lengths, one to reach from large panel to the outer ones, and a shorter length, as shown, of four clusters. The stencils for this are best made upon a long, narrow length of cartridge paper, drawn between two converging lines, and smaller, if anything, in proportion to those of my drawing. Each cluster should be quite intact and unconnected with the succeeding one.

Stencil D will require to be first used for making the diagonally opposite quarters of the oblong panels. It must then be cleaned, turned over, and thus complete the design. The border E should be drawn and cut upon a piece of paper 9 in. in width, the design being 8 in., and leaving a clear half inch at its widest parts. When this is applied to the border, a space on either side of 1½ in. is left, which is devoted to the fine line, a half-inch space, and then a half-inch line on either side of the border. F represents the simple forms which are used to relieve the fine lines within the border and surrounding the circular and oblong ornaments.

Supposing, therefore, the ceiling plan to be drawn according to the arrangement best suited thereto, and the stencils cut upon cartridge paper and coated once with patent knotting, I will give a few lines upon the groundwork.

If a comparatively new plaster ceiling and free from cracks, all old whiting having been washed off, it should be given a preparatory coat of warm, patent size. A decided "ivory white," so termed, or *cream* grounding is then applied. This should be jellied distemper, made strong with patent size, and the whiting stained to the required tint (determined by drying the same) with Raw Sienna ground in water—a ¼ lb. being ample for the half-pail required to ground the ceiling. If the ceiling is badly cracked, pay a paperhanger to fix a stout lining paper all over, first sizing the ceiling and stopping the cracks. The distemper is then coated directly on the lining paper.

The tools and material required to complete the decoration are a length of stout crochet cotton, about six yards, one piece of soft willow charcoal, a rule, a wooden straightedge with bevelled edge, about 30 in. in length, a stencil tool, a lining fitch (both of medium size), about a pound of thin flatting paint (made from white lead, Japan gold size, and "turps"), a little blue pigment ground in oil (Antwerp or Prussian), and, lastly, which need hardly be specified, a pair of tall steps, a hammer, and tacks.

With these at hand, I will now describe how, single-handed, the decoration may be executed. A start is made by marking a point 12 in. (the width of border) from the cornice on two adjacent sides, at both ends. A tack is fixed at the point where the ends of our lines will cross each other; the crochet cotton—the best "chalk line" for decorators—is now tied to the tack, and the line is strained to the mark at the other end with the left hand and snapped with our right. Still from the tack in the same place, a diagonal line across the ceiling is marked, rubbing the charcoal each time along the chalk line so that the mark is plainly visible. The tack is now removed to the diagonally opposite corner, and thus the border space and diagonals are set out. By the same means the ceiling is divided into four equal parts; and finally, lines are struck from the diagonals at a point which marks the position of corner panels and gives us the centre line of the oblong ones. All these lines of the plan are plainly indicated by the design itself, and are, indeed, easier to discover than to describe by the pen. No reader who can enlarge and cut the stencils can fail to succeed in adapting them to his own exigencies if my directions are followed. Although, if accurately drawn, the ornament is bound to fit in and form correct outlines, it is advisable to mark out the circumference of the circular corners and the lines dividing same into quarter-sections. To obtain the circles, a wire nail is fixed at centre-point, and a lath cut with two holes, the distance apart corresponding with the radius of circle. One hole is put over the nail and a lead pencil in the other, and thus the circle is drawn.

In stencilling it is necessary to fix the pattern to the ceiling with a few tacks, holding each part close to the work as we go over it to ensure clean, sharp ornament. The square pateras at each angle of the border are simple in character, and these, with the border lines, are executed at the last, the latter with the straightedge and lining fitch.

Now, as to *colour*. The decoration is intended to be stencilled solely in one contrasting colour upon the decided cream ground. The flatting paint is stained to a light "Cambridge" or "electric" blue, the design stencilled, and the lines run with one and the same colour. The paint will dry quickly and with no practical alteration in depth; so we know, without trying and drying, the finished effect. If the distemper ground is made quite *strong* with patent size, the turps-colour will stencil clean, and without a dark edge or sign of the colour running upon it. Distemper stencil work upon distemper ground makes coarse, rough work, and the stencils are soon affected by the water. The "flatting" is really more a blue stain than a paint, and is to every practical purpose far superior for stencilling upon distemper. My object in making the drawing chiefly black upon white has been to show the ornament plainly for copying. The effect of a light, "greeny" blue upon cream is so much the more chaste, delicate, and harmonious that the drawing gives no true notion of the finished effect.

For a room without a centre-flower, the average worker may content himself with using the rosette—placed in centre of large panel only, in illustration—for the corner panels also. If the cameo heads are used, they may be painted in blue monochrome of oils against a background of gold. Prepared canvas, coarsely stippled, should be cut to fit the position, and fixed with a paste of white lead and varnish after they are painted, due care being taken as to the relief and lighting implied. If without the gilded background, "old ivory" colour heads in monochrome on blue ground, and wide margin line of gold, would suit equally well. The introduction of such heads, as my illustration suggests, of British poets—Scott, Byron, Shakespeare, and Milton—if properly painted, would raise the art status of the ceiling decoration from the purely *æsthetic* sphere—which pleases the senses chiefly—to the higher grade of *phonetic*

decoration—that which appeals to the mind and understanding also.

I should add that the "ivory and blue" scheme will accord with nearly all wall hangings of a *conventional* design suitable for drawing-rooms, excepting the papers which contain very much red or any green. With a wall in terra-cotta shades, the ground might be a faint warm tint, and the stencil of a darker tone to correspond with the walls. Green for a drawing-room is not worth considering here. For the benefit of readers who may desire to possess a room in character throughout, I may state that "Adams" designs of good wall hangings are now both fashionable and easily procurable; whilst for those who may prefer the equally modern plain-colour filling with frieze decoration, I venture to hope the ornamental treatment of door and walls may, in the future, be added to this ceiling design.

PRACTICAL DETAILS OF BOOKBINDING.

BY GILBERT CLARKSON.

FOLDING AND STITCHING—SIZES OF PAPER, ETC. —MACHINES FOR FOLDING AND STITCHING.

THE first operation in bookbinding is that of folding. It is one which requires great care if the book is wanted to have a decent appearance when bound. It is usual for printers to leave more margin to the outsides of the sheet, so that, when they have been folded, the margin will be broader at the fore-edge and tail than at the head and back. The head and back are always at the fold, the tail and fore-edge being towards the outside of the sheet. If the paper presents any little difference in size, these two latter edges being cut first in the process of binding, it will then be taken off, and the margin will be the same all round.

There is nothing more offensive to a careful reader than a badly-folded book. The best plan, therefore, and the one adopted, is to fold to the pages, and not to the edge of the paper, for the least variation in the size of the sheet would result in a spoiled book.

Papers are made in various sizes, and are known by the following terms: Imperial, royal, demy, crown, foolscap, and pot; and the sizes of books are denominated according to the number of leaves into which the sheet is folded. The ordinary sizes are folio, 4to, 8vo, 12mo, 16mo, 24mo, and 32mo. A sheet, when folded up, has twice as many pages as leaves, for the simple reason that it is printed on both sides. In speaking of the size of *The Quiver*, for example, we would say that it is a royal 8vo, because the sheet has been folded one-eighth its original size, and has 16 pages. The octavo is the most general size of a book, and the type matter is so imposed that, when the sheet is folded, the sixteen pages will follow consecutively.

Figs. 2 and 3 will show what I mean. Fig. 2 is the outside of the sheet, and Fig. 3 is the inside.

In commencing the operation of folding, lay the sheet out flat on the table, as in Fig. 3—*i.e.*, with the inside uppermost, page 3 at the bottom right-hand corner. Take the folder in the right hand and, with the left, take up the sheet at page 3, and bring it over to the left, adjusting pages 3 and 6 evenly on the top of pages 2 and 7, and draw the folder over the sheet, thus making the first fold.

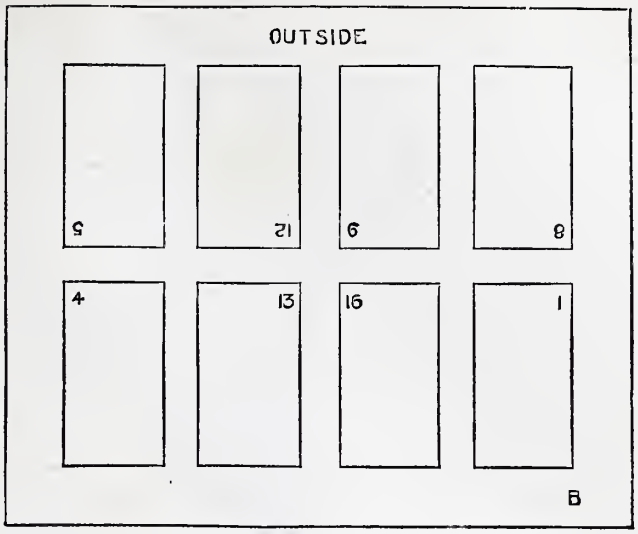


Fig. 2.—Octavo Sheet of Sixteen Pages, Outside Forme, showing Imposition of Pages and Signature.

The sheet will now be half the original size, and will have the appearance of Fig. 4—*i.e.*, pages 4 and 13 and 5 and 12 will be uppermost. Now take hold of the sheet by the top right-hand corner—*i.e.*, at the bottom of page 12—with the left-hand, and bring it over so that the type matter at the bottom of page 12 will fall exactly on the matter on page 13. Draw the folder over the sheet again, reducing it to one-fourth its original size. The sheet will now have the appearance of Fig. 5, and pages 8 and 9 will now be uppermost. For the last fold take hold of the sheet at the left-hand corner (page 8), give it a half-turn on the table, place page 8 over page 9, and draw the folder again over it. The sheet will now be one-eighth its original size, having been folded three times, and it will now have the appearance of Fig. 6, and will have been correctly folded, and the pages will follow consecutively from 1 to 16. I have selected the 8vo sheet for description because it is the one most generally used, and all the others are folded somewhat on the same principle.

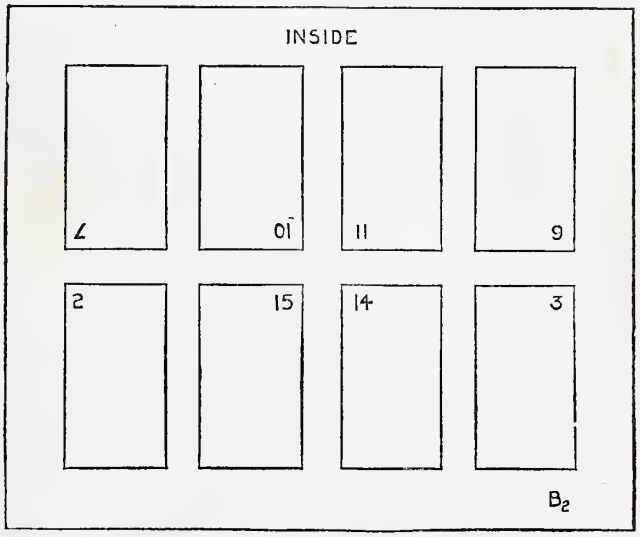


Fig. 3.—Octavo Sheet of Sixteen Pages, Inside Forme, showing Imposition of Pages and Signature.

A 12mo sheet is the same as the 8vo with other 8 pages added. The first and last pages form the 8vo portion, and is folded as already described. The other 8 pages is cut off and folded by itself and *inset* into the other portion—*i.e.*, put into the centre of it. A little more care will be necessary to ensure the figures and head-lines falling upon each other.

An 18mo sheet consists of a 12mo and a half, and forms 36 pages.

Attention to the signatures, which will always be found on the first page of the sheet, will keep the operator right.

The sheets of a book are all folded in the same manner and laid together—*i.e.*, all sheets bearing the same signature are knocked up and tied in 50's or 100's, and put carefully away until the entire edition is folded.

In large establishments, folding is executed by machinery. These machines are very useful, for without their aid it would be impossible for binders to turn out such a large amount of work as they are called upon to do in the given time. There are a great many machines in the market, and it would be difficult to say which is best.

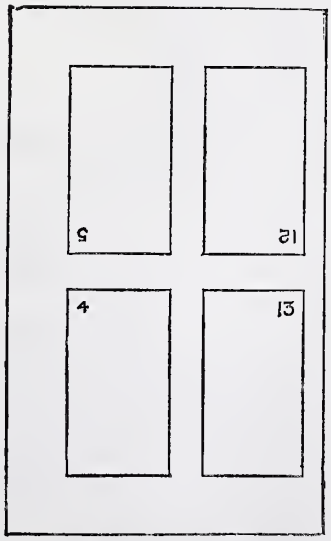


Fig. 4.

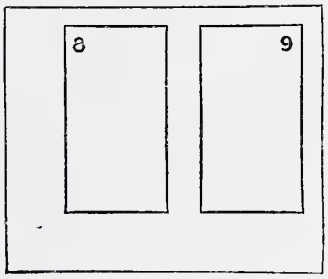


Fig. 5.

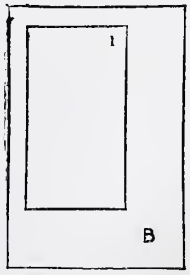


Fig. 6.

Fig. 4.—Sixteen-Page Sheet in Process of Folding: First Fold. Fig. 5.—Ditto: Second Fold. Fig. 6.—Third and Last Fold.

Nearly all bookbinders' engineers manufacture a folding machine, and some are manufactured with special features to suit certain requirements. A very good machine, which does its work well without any special attention, is manufactured by Messrs. R. Cundall and Sons, Ashley Works, Shipley, near Bradford, Yorkshire. It will do two, three, or four folds. It has a nice tidy delivery, and is easily set from one size to another. Its speed is close on 1,700 per hour, so that, with a very ordinary feeder, it will fold 1,500 sheets per hour.

Mr. James Salmon, of Blackfriars Bridge, Manchester, makes a machine which acts much on the same principle as the one already referred to.

The desideratum in mechanical folders has been reached in the Martini Single and Duplex Folding Machine (Fig. 7). The name of Martini is well known in England in connection with the rifle called the Martini-Henry.

On the Continent his name is still more famous for the invention of the folding machine, and a wonderful machine it is, folding sheets of paper by means of a series of cross metal knives, folding true to register, and delivering in a trough already knocked up.

It seems strange now, when one reflects how many are at work, that binders in this country were so slow in adopting this class of machine. With the tape family of machines there are always a large number of re-folds at the end of the day's work, and when a tape or two breaks in the middle of a large job, I pity the poor foreman, for I know what it means. Both of these evils are entirely obviated by the Martini folders, for there is not an inch of moving tape used to carry the sheet from fold to fold.

How interesting it is to watch one of these machines at work. Two girls are standing, each with a pile of sheets below her hand, at the ends of the machine, feeding them one by one, without the slightest trace of exertion, to the points or gauges. The sheet is immediately carried to the centre of the table, first from one side, then from the other, the knife going up and down away from where the girls are standing, causing the sheet to disappear. It is impossible to keep the eyes fixed on any one sheet passing through the machine, as, being fed so quickly, they come so fast one upon another. Although I am pretty well familiar with the sight now, many a time in the course of a day I discover myself standing gazing open-mouthed like a schoolboy.

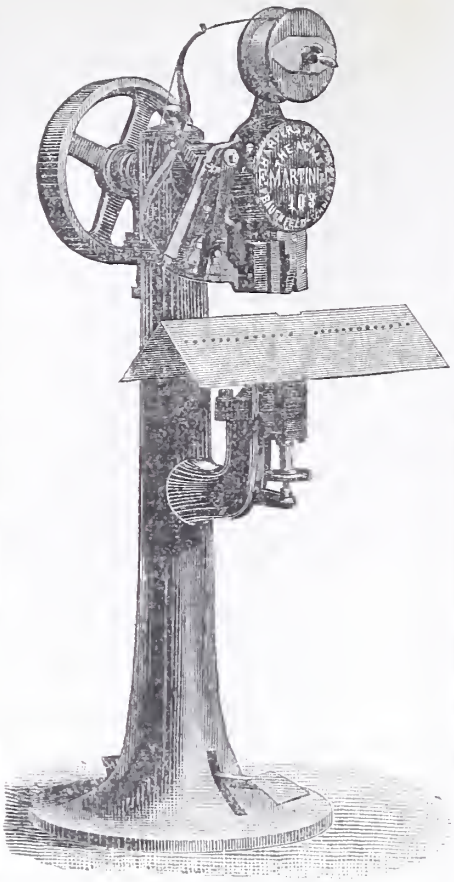


Fig. 8.—Harper's Patent Acme Wire-Stitching Machine.

These folders have for many years folded *Chambers's Journal*, and such fine work as "Hymns, Ancient and Modern," besides doing heavy work like the journal *Engineering*. The Martini machines do their work so well it is no wonder they are so highly esteemed. The London agent is Mr. W. C. Horne, 6, Dowgate Hill, E.C.

There are other machines of a much larger type in use for newspaper work, but these I will pass over, as they hardly come within the scope of our present subject.

Most of the monthly magazines, periodicals, and pamphlets are sent out stitched with wire staples. I never liked wire stitching from the first time I saw it. Of course, it does well enough for pamphlets—in fact, it is all that is wanted for them; but when it comes to magazines—especially magazines of a high-class nature—it is a pity that wire machines were ever invented. Many a time I have been vexed to see that excellent monthly of Harper's torn and mutilated by the frantic efforts of girls in their vain endeavours to get the wires out when preparing them for binding, and this can hardly be avoided, for the wire with which they are stitched is so thick that, unless there is a special appliance in the binding shop for taking out the wires, the sheets are sure to get torn.

I am pleased to see that there is a thread-stitcher in the market now, which will do side-stitching as well as through the back, and as it turns out the work as quick as the wire machines, I hope that those publishers who have not time to sew their magazines

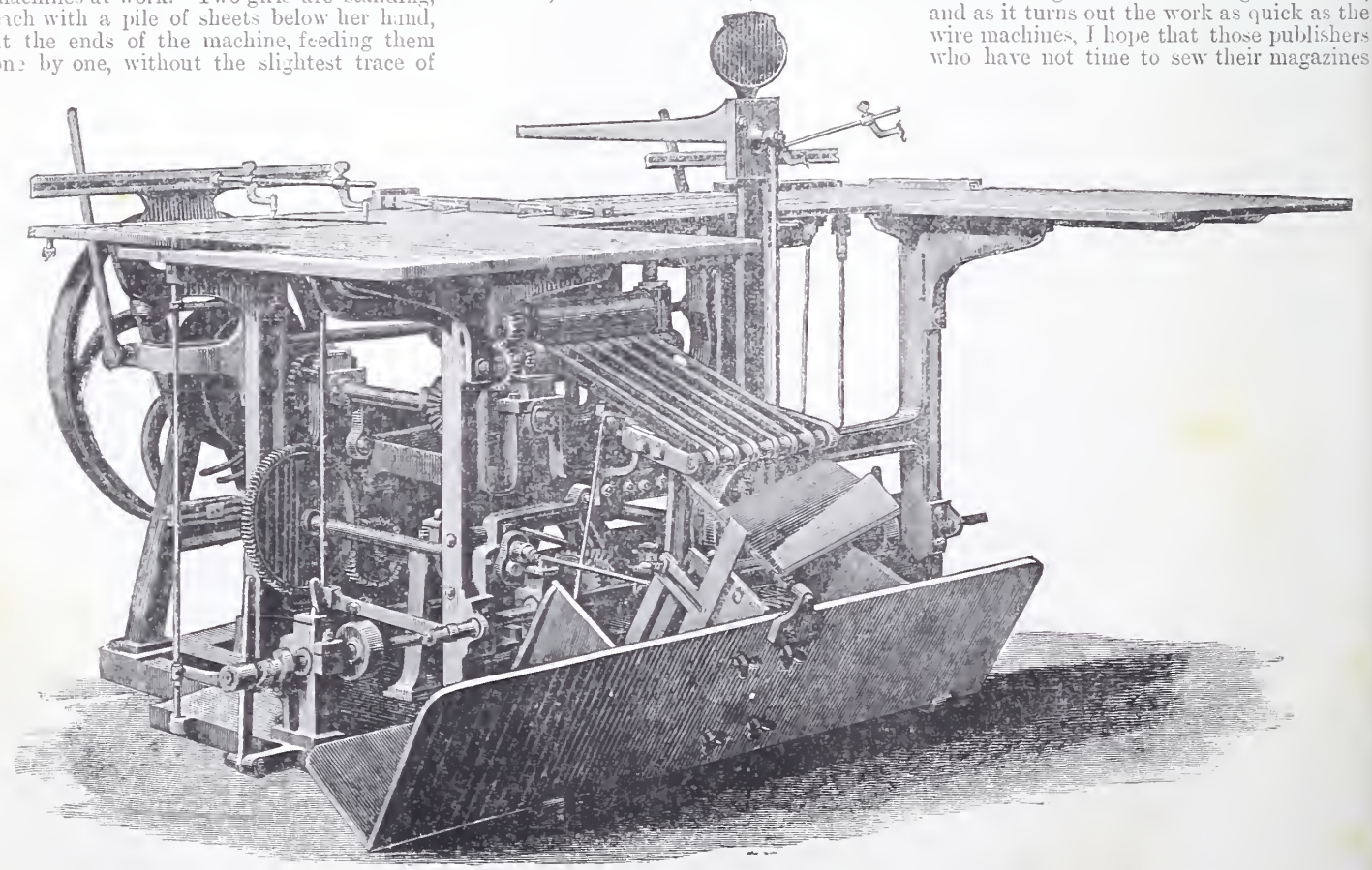


Fig. 7.—Martini Duplex Folding Machine.

will at least stitch them with thread. I had the pleasure of seeing this machine at the Glasgow Exhibition, but as I have not yet had any personal experience with it, I cannot speak of its capabilities. I am sure Mr. W. C. Horne will be pleased to answer any inquiries that may be made regarding it.

But I must say a word in passing about the wire machines, for, now that they are in the binding shop, we must use them.

If I were asked the name of these wire-stitching machines I would answer "Legion," for you can get them in all sizes and shapes, from the puny wee thing that has to be fed with ready-made staples to the high-sounding Patent Automatic Wire-stitching and Binding Machine, that makes its own staple and takes the wire direct from the reel.

Mr. August Brehmer, 33 and 35, Moor Lane, London, E.C., has a long range of these machines, and those sent out by that firm are about as good as any that I have seen. The machine styled No. 6 in Mr. Brehmer's list for treadle-power does its work very efficiently. But it takes a considerable time to change it from one size of stitch to another.

Harper's Patent Acme Wire-stitching Machine (Fig. 8) takes the palm, inasmuch as it will stitch a greater thickness of work with thinner wire than any other machine that I know; and besides, it has only two adjustments, and can be changed from the thinnest pamphlet to work one inch in thickness in a few seconds of time.

The Acme forms, drives, and clinches at the rate of eighty or one hundred stitches per minute.

A CHILD'S WOODEN COT.

BY B. R. CONDER.

The writer, having made a child's wooden cot, which has successfully stood the test of four years' constant use, purposes endeavouring, in the following paper, to show how any one possessing but a moderate amount of skill in joinery may make a similar one.

The cost of the cot will, of course, depend entirely upon the kind of wood used in its construction; and here there is almost unlimited room for choice. Hard wood, such as oak, ash, or beech, would be best; but almost any wood may be used, provided it be sound and thoroughly dry.

If cheapness is a chief consideration, deal may be used throughout, in which case the whole cost, including stain and varnish, polish or paint, used for decorating, would hardly exceed five shillings. The writer's is of deal, with the exception of the four posts, which are of beech. Much time and many an arm ache may be saved by having the wood chosen sawn into strips of the

Fig. 3.—Plan in Part, showing Method of fixing Support for Mattress—H H, Bottom Side Rails; R R, Cross Tie; S S, Bearers; A B, Posts.

required widths at the yard; this would add but a very few pence to its cost. The dimensions chosen are: Extreme length, 4 ft. 3 in.; breadth, 2 ft. 3 in.; and height to the top of the posts, 2 ft. 10 in. This is a very usual and convenient size, but it may be varied to meet individual requirements or tastes without altering the method of construction. Now we will set to work.

First cut out and square up the four posts (three of which only are shown in the drawings, as the one lettered B in Fig. 1 is identical with that also lettered B in Fig. 2). These posts should be $1\frac{1}{2}$ in. square and 2 ft. 10 in. long; if castors are to be used, they must be the depth of a castor shorter. It would be well to leave them an inch or so longer at first, and cut them down to their exact length when they are finished in every other respect. The appearance of these posts will be improved if the edges are slightly chamfered and the tops bevelled off, as shown in the drawings; this, however, had better not be done until the various mortises are cut in them. Having squared the posts, next cut out and plane up the rails, D E F, for the ends and G H for the sides. As there are two sides and ends to the cot, all the rails shown in the drawings must be made in duplicate.

These rails are now to be mortised into the posts, and, except in the case of the top ones, the tenon should be carried right through the post, and when glued up wedged from the outer side. This greatly strengthens the joint, and though rather unsightly in a prominent position, is not here conspicuous enough to be noticeable.

Now carefully mark with the mortise gauge, and cut the tenons at the ends of each rail and corresponding mortises in the posts. The respective heights of the tops of these rails from the floor are as follows:—D and G, 2 ft. 9 in.; E, 1 ft. 8 in.; F, 10 in.; and H, 1 ft. $3\frac{1}{2}$ in. Having made these joints, fit rails and posts together, and test all angles with the square, taking great care to ensure having the posts perpendicular and the rails at exact right angles with them.

Next prepare the uprights, K and L (Fig. 2), and mortise them $\frac{3}{4}$ in. into G and H at a distance of $4\frac{1}{8}$ in. from the posts, B and C, respectively; then the rail, M, which is in turn mortised into K and L on the same level as E in Fig. 1. All these pieces, with the exception of H, should be $1\frac{1}{4}$ in. deep, and cut out of 1 in. stuff, which will leave them when cleaned up $\frac{3}{4}$ in. thick, or a trifle over. As H has to support the weight of the bed and occupant it must be stouter—$1\frac{3}{4}$ in. deep and $1\frac{1}{4}$ in. thick. Now fit all the parts so far prepared together, and test the work with the square as before described. This should be done from time to time as the cot grows, as it is a very necessary operation, and, indeed, one which can hardly be too frequently repeated. Having done this, and rectified any mistakes discovered in so doing, prepare out of $\frac{3}{4}$ in. stuff the small uprights that connect the top and middle rails of sides and ends; they should be $\frac{3}{4}$ in. wide, and 1 in. longer than the distance between D and E and G and M, as they are to be mortised $\frac{1}{2}$ in. into these rails. Great care is necessary to space them evenly and keep them perpendicular. The arris or sharp edge should be removed with the plane from all the rails higher than H, for the sake of the tender hands of the intended occupants of the cot. The various parts of the sides and ends are now complete, but before joining them finally together, we must provide a support for the bed. For this purpose, two pieces of wood, $2\frac{1}{2}$ in. wide and

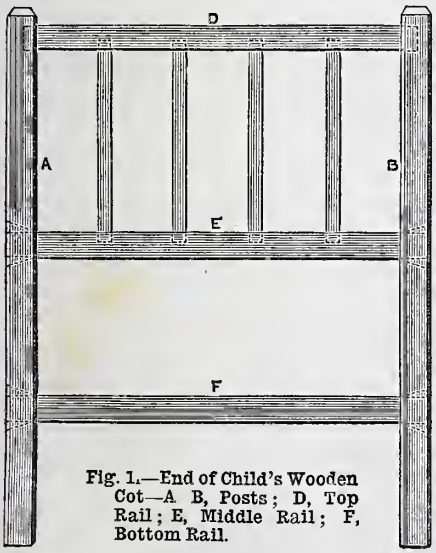


Fig. 1.—End of Child's Wooden Cot—A B, Posts; D, Top Rail; E, Middle Rail; F, Bottom Rail.

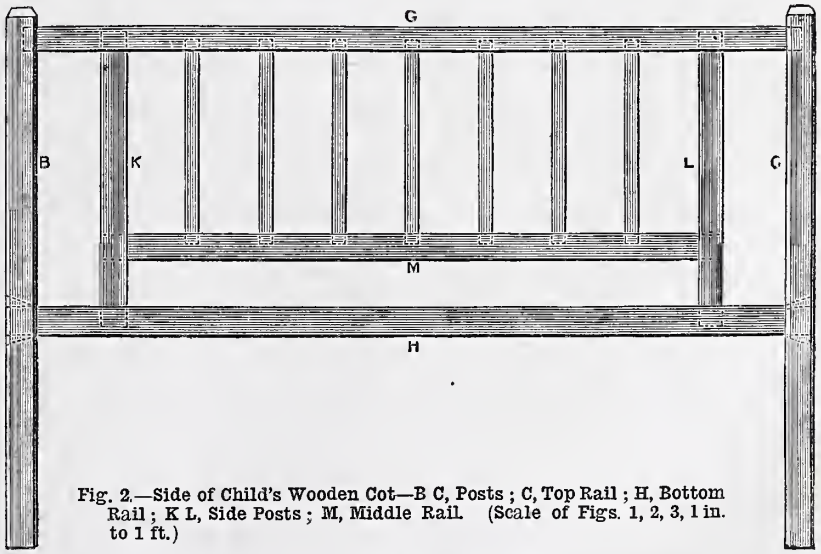


Fig. 2.—Side of Child's Wooden Cot—B C, Posts; C, Top Rail; H, Bottom Rail; K L, Side Posts; M, Middle Rail. (Scale of Figs. 1, 2, 3, 1 in. to 1 ft.)

¾ in. thick, are notched, as shown in Fig. 3 (R), into the rails, H: one 7 in. from the head, the other the same distance from the foot, of the cot, and sunk sufficiently to bring the surfaces of the narrow strips, S, when placed across them, exactly on a level with the top of H. These strips, five in number, which act as bearers, must now be got ready. They should be ½ in. thick, 2½ in. wide, and 3 in. shorter than the extreme length of the cot. They are to be placed 2 in. apart on the cross ties, R, parallel with the rails, H, and screwed down to R, after the framework is glued together. Do not use thicker than ½ in. wood for these bearers, as that is ample for strength, and gives a certain amount of spring. We have now to join these various parts of the cot firmly together. This is a somewhat delicate operation; and on the care bestowed upon it depends, in great measure, the strength and appearance of the cot. During its progress, every angle should be tested with the all-important square. It will be best first to frame the ends, which will give us two separate parts like Fig. 1; next the rails and uprights of the sides, which will give us two separate parts, like Fig. 2, without the posts, B and C; then ends and sides together, and wedge up where necessary. The wedges are indicated by dotted lines in Figs. 1 and 2. Finally glue in their places the cross pieces, R, and when the glue is set, screw the narrow bearers, S, to them.

The cot, as far as its construction is concerned, is now finished. Some of the details might, doubtless, be varied with advantage; that is a matter for individual taste. The posts and rails might be turned, or, again, the small uprights might be rather differently arranged, or dispensed with altogether by those who object to the labour of cutting so many small tenons and mortises, and panels substituted. If this latter plan is adopted, care should be taken to avoid imparting to the cot too much the appearance of a box on legs.

If, however, the directions set down are followed, the worker will be well repaid for his labour, by becoming the possessor of a strong, useful, and not altogether unornamental piece of furniture at a very trifling cost.

CIRCULAR SAWS: THEIR ADJUSTMENT AND MANAGEMENT.

BY M. POWIS BALE, M.I.M.E., A.M.I.C.E.

Author of "Wood-working Machinery," "Stone-working Machinery," "Saw-mills," etc.

As good saws cannot run properly in a bad machine, it may be as well to consider briefly, in the first place, what points of construction are to be desired in a really efficient saw bench. In the most advanced practice the main frame is invariably made on the "box" system, and cast in one piece, and there is little doubt that the strains and vibrations of working are thus more readily absorbed than is the case where the frame is put together in sections. The face and edges of the table must be truly planed.

We now come to a very important matter in all wood-working machines, viz., the bearings; and we cannot help thinking that, having in mind the constant and severe strains to which they are subjected, the majority of them in this country are made much too short: the bearing surface is thus limited, and consequently the pressure on it is very great. In America long bearings have been the rule for years, and some few English firms are at length introducing the system, with the result that, owing to the pressure being distributed, the friction and consequent heating and wear are reduced and their longevity largely increased.

In preference to white metal alloys as used in the States, gun-metal and phosphor-bronze are the materials usually employed here, and a bearing of from three to four diameters in length can be recommended. For all saws above 30 in. in diameter, three sets of bearings should be fitted, one of these being placed outside the driving pulleys to overcome the pull of the belt. The author recommended that this latter bearing be made adjustable for wear; this can readily be done by dividing the bearing vertically and unevenly, and by passing set screws through the side of the pedestal. In large benches, at any rate, it will be found convenient to let the bearings in from the top of the bench and fit in false plates in preference to fitting them in plummer blocks bolted to the under surface of the frame. To ensure the saw spindle running true, all bearings should be bored out in their places instead of in a lathe, as is occasionally done. The saw spindle should be of steel and free from seams or hard places, and fitted with an adjustable lock-nut to take up the end wear. The saw collars and steady pin should be very carefully made, and the latter be an easy fit, or it may throw the saw slightly out of centre. The hole in which the pin is fitted should be countersunk. The fence should be very accurately planed, arranged to bevel, and fitted with strips and fine adjustment screw for accurately gauging the thickness of the cut. In heavy machines, a lever pressure roller and weight for holding the wood up to the fence will be necessary; and the drag-rope, roller, chain, rack, or other feed for taking the wood through the saw is usually fitted. We take it a very important factor in the effective working of circular saw benches is found in the diameter and width of the driving pulleys employed. Many of these are undoubtedly made of too small a diameter and too narrow on the face for the work they have to perform; on this point we shall have something to say further on. These pulleys should be crowned on the face, and the pulley driving them flat, and of a width equal to both of them. With reference to the loose pulleys on saw benches, there is little doubt that they are amongst the most troublesome things in a saw-mill to keep in order, and it may not be out of place to say a few words thereon. In the first place, they are not always properly designed for the work they have to perform, the same pattern being used for all kinds of duty.

For use on saw benches, where the speeds are high and the belts often heavy, the pulleys should, in all cases, be bored and rhymered perfectly true. If an ordinary loose pulley be used, the boss should be extended so as to project, say, an inch beyond the rim of the pulley; the inside of the boss should be recessed and an oilway cut. The pulley should fit the shaft easily but not loosely, so as to admit of a thin film of oil penetrating between the pulley and the shaft, the object being for the pulley to ride on the oil and not on the shaft. For use in saw benches, the loose pulley can, with advantage, be made of less diameter than the fast, so that the driving belt is relieved from strain when not at work, and has time to recover its elasticity; it is usual in this case to make the loose pulley with an inclined flange leading up to the fast pulley to facilitate the shafting of the belt.* The oil-holes should in all cases be of ample size, and either a lubricator or pipe fitted. The lubrication should be carefully attended to, especially when the pulley is new; should it once be allowed to seize, it will require re-rhymering, or it will be constantly giving trouble. If properly fitted and lubricated, cast iron makes an excellent wearing surface; a little fine lumbago introduced into the oil will keep it longer in the bearing, and by filling up the little pores in the iron, produce a fine, smooth surface. Should the loose pulley be made of less diameter than the tight, the difference should not be great, say not more than 1 in., or, in shifting the belt from the loose on to the tight, it will become unevenly stretched on the one side, and be apt to run out of truth. In many cases, it will be found an excellent plan to arrange the loose pulley to run on a sleeve of cast iron. A patent in this direction has been taken out (Davis's Patent), of which we hear satisfactory results. In this plan, the boss of the loose pulley is somewhat enlarged, and made to revolve on a sleeve instead of on the shaft itself. The pulley boss is recessed to form an oil chamber, and the oil is supplied in the usual way through a pipe, and is prevented from leaving the bearing by means of a flange fitted to the end of the boss, and by the centrifugal force engendered when the pulley is set in motion, which causes the oil to fly immediately to the largest diameter, which is the working or rubbing face of the sleeve. Tight belts, often too narrow for the work, are a fruitful cause of loose pulleys grinding on the shaft and getting out of order. The author has recently patented a system of bushing loose pulleys with glass which has every appearance of being highly successful. In this case the bush is crenated in such a manner that a supply of lubricating material—of which very little is required—is retained in it.

Circular saws may run out of truth from a great variety of causes, amongst which the following are perhaps the chief, but practical operators will be able to add to the list:—

(1) Saws of too thin a gauge for the work.
(2) Irregular setting.
(3) Improper form of teeth for the work.
(4) Too rapid a feed of the timber.
(5) Improper sharpening of the teeth.
(6) Teeth of an improper pitch, or with insufficient gullet space to allow sawdust to escape freely.
(7) Saw plate unevenly "balanced," or improperly hung.

(1) The thinness of the gauge at which a saw may be safely run depends in a large measure on the nature of the wood being cut and the skill of the operator in selecting the right shaped tooth, sharpening and "packing" the saw properly, and keeping it in what may be termed scientific order. In America thick gauge "distorted" saws, run with guide pegs but without packing, have been the fashion, but, as this means loss of power and wood, they will, as wood becomes dearer, doubtless give way in favour of thinner ones. In selecting a saw, what is required is one of a gauge not so thick as to waste unnecessarily power or wood, or so thin as to give constant trouble to keep in order. It must also be borne in mind that the thinner the gauge of the saw, the more teeth will be required to allow of the same amount of feed; the power required will, however, be increased in ratio. A thick saw can be run at a higher speed than a thin one, as it expands less rapidly from the centrifugal force set up, and is less likely to become "rim" or "centre" bound.

* "Saw-mills: Their Arrangement and Management," by M. Powis Bale.

(2) Irregular setting is a frightful cause of saws running from the line and turning out bad work. Setting by rule of thumb is a stupid and wasteful plan; in all cases a gauge should be used, whether spring, hammer, or spread setting be employed. In working, it is found that the teeth of a saw wear at the side of the points, and if some teeth have more set than others, these are strained unduly, and rapidly worn away, and from the severe and uneven friction are often heated, and are inclined to buckle and run from the line. The operator must exercise his judgment as to the amount of set required to suit different kinds or conditions of wood, as it is both useless and wasteful to give a saw more set than is absolutely necessary. Care must be taken that both sides of the saw are set alike; should one be set more than the other the teeth will, of course, lead or run from the line.

(3) If teeth of an improper form or unsuited to the nature of the wood being cut are used, we need hardly say that a great amount of friction is set up; in some cases the teeth are broken, and the result is in every way unsatisfactory. Teeth of almost any shape and in any condition can be driven through the wood by sheer force, but this is mangling, not sawing. What is required are teeth of the correct shape for the nature of the wood sawn, and equal in pitch, space, bevel, gullet, length, and set. This list may appear a long one, but users will find that any reasonable amount of time spent in keeping saws in fine condition, and working them in a scientific manner, is a very paying investment, the result being more work, of better quality, less wear and tear and expenditure of power. The question of the shape and cutting action of saw teeth is a scientific matter of much importance to timber converters, but as it would require many drawings and much space to discuss the subject fully, it is beyond the scope of the present paper; the author would, however, refer those interested to the following books.* We may say, speaking generally, that for cutting soft wood the angles of the teeth should be more or less acute, according to its softness, and those for medium and hard wood more obtuse in ratio to the varying densities of the wood. It may be some little guide to know that when a saw is cutting sweetly it should produce extremely minute chips like those from a mortise chisel, and not very fine sawdust; if the latter is made the saw is scraping, not cutting. Whatever teeth are selected, should they spring or tremble in work, it may safely be concluded that they are unsuited to the work in some way, possibly either too long or too hooked, or of too thin a gauge.

(4) Too rapid a feed of the timber is a matter that can only be judged by the sawyer, and depends entirely on the nature and condition of the wood being cut, the kind of feed gear, and the condition of the saw. Of course no one would attempt to feed hard, frozen, or difficult wood much more than half as fast as soft, and some woods, such as cocus, rosewood, etc., at less than this. If the feed is too fast, the timber will often rise up the back of the saw, and in some cases the sawyer will get a gentle reminder by having it thrown at him, or the saw will become jammed and buckled, or the driving belt thrown off. "Swagged" or spread set teeth will stand a quicker feed than spring set.

(5) An immense variety of opinions exist as to what is the proper way to sharpen a saw, almost every operator having ideas of his own, good, bad, and indifferent, chiefly the last two; consequently we find an immense quantity of badly and improperly sharpened saws. We ourselves thoroughly believe in sharpening with a machine with which there is no difficulty in getting each tooth of the saw alike in their cutting angle, pitch, and depth of gullet. The great point to aim at, whether emery wheels or files are used, is to sharpen each tooth so that it will take its allotted share of work; to effect this, the cutting angles of the teeth must, together with the set, be exactly uniform. It is impossible, however, to properly describe the operation of sharpening in writing without an elaborate system of drawings. To keep all the teeth uniform the author can strongly recommend the use of sheet steel standard templates of several teeth; by mounting these in a light, adjustable, radial arm, fixed on the sharpening stud, and made to bear flat against the saw plate at the periphery, the exact shape and depth of the teeth can be obtained from the template by traversing the saw round by hand.

(6) A fruitful cause of saws buckling and running from the line is the insufficiency of throat space in the teeth; consequently the sawdust cannot escape fast enough, and becomes clogged. The teeth should also be all of equal length; if not, the longest teeth get the most work, and the cutting power of the saw much lessened. The length of the teeth should be regulated by the nature of the wood being sawn; for instance, for sawing sappy or fibrous woods, long, sharp teeth are necessary, but these must not be too long or they spring, and perhaps break in work. The author is of opinion that many of the saws in use in Europe carry too many teeth, and he is in favour of the American system of using fewer teeth—if not carried to excess—as more throat space is given to the clearance of the sawdust, and less power is required to drive. The throat space of saw teeth should be varied according to the depth of the wood being cut, as it will be seen at a glance that teeth with a sufficient throat space to allow sawdust to escape freely in sawing 18 in. deep would probably become jammed in sawing double that depth.

For gulleting, an emery wheel is much to be preferred to a fly press; the latter is wasteful and apt to spring the plate when punching out deep gullets. If a saw is kept in good order, and the teeth are not allowed to get short and stumpy, very little gulleting should be required at one time; in fact, the gulleting press should be conspicuous for its absence, and only be used for retoothing broken saws.

(7) In hanging a saw care should be taken that it does not fit too tightly on the saw spindle or bind the steady pin. A saw, when properly hung, should, in the horizontal line, incline very slightly towards the timber, so that the teeth at the back of the saw may rise without scoring the wood. The saw should be perfectly in balance, that is, *perfectly round;* if it has teeth of unequal length, size, or shape, it is not properly or scientifically balanced.

There are other reasons—no fewer, indeed, than fourteen—why circular saws sometimes run out of truth, but we will deal with these in another paper, giving, as we have done above, first the causes, and then dealing with the means that should be taken to prevent their occurrence, as we judge it to be best for our readers not to separate one from the other.

* "Worssam on Saws," "Grimshaw on Saws," "M. Powis Bale on Saw-mills."

VERTICAL SUN-DIALS.

BY ARTHUR YORKE.

East and West Dials.

Principle of East and West Vertical Dials—Setting out these Dials—Materials and Methods of Construction for Vertical Dials—Ornamentation—Mottoes—A Suggestive Spanish Dial.

In the *east and west vertical dials*, although the face of the dial will still represent a plane at right angles to the plane of the horizon, that plane will also be at right angles to the planes in which are the faces of the south and north dials. Hence it must follow that though the stile will still be parallel with the axis of the earth, it will also be parallel with the plane of the dial, and that the gnomon, instead of being, as in previous cases, a triangle, must be a parallelogram. It is hard to explain this by a mere diagram; to make it clear a model is required. If, however, the reader will refer to Fig. 1 (page 105, Vol. II.), where he will remember that the line, *e f*, represents the plane of the vertical south dial, *seen edgewise*, and will imagine that plane turned at right angles to its present position so as to present its full front, he will see that it will become a plane identical with or parallel to the plane in which is the line, A B, which is parallel with the axis of the earth. The stile in these dials has therefore to be parallel to the plane of the dial.

As time-keepers, east and west dials are far from having an equal value to the horizontal or south vertical dial. They are indeed more useful than the north dial, which notes time for some four or five hours in the height of summer only; but their period of service extends only from sunrise to noon, and from noon to sunset respectively. The two are required to accomplish the work done by the horizontal dial alone. Another shortcoming in these dials is their want of symmetry, owing to which it is not easy to make decorative features of them. It is indeed necessary that they should be explained in this place, yet we imagine that few will care to construct them, except it be for the arrangement known as "combination dials"—an arrangement which has been in favour in most of those ages in which dialling has been practised. In the combination dial a cube of material, commonly stone, is mounted on a pedestal, and so fixed as to be level and facing the four cardinal points; its top can thus be made into a horizontal dial, and its four sides into north, south, east, and west vertical dials respectively.

To set out an *east vertical dial* we have first (as in Fig. 4) to draw a horizontal line at A B, and from this, say at C, to set off a line which shall with A C make an angle equal to the complement of the latitude of the place for which the dial is intended. This place we will, as before, suppose to be in the same latitude as Edinburgh (56°). The angle, A C D, will therefore be one of 34°. Then, at any convenient point on D C, as at *e*, and with any convenient radius, as *e f*, we describe a circle, and draw the lines, *g h* and *i k*, touching the circle, and parallel to D C. Through the centre, *e*, we now draw a line, *f l*, cutting D C at right angles. This will be our 6 o'clock line. By the lines drawn, the circle is now divided into four quadrants, and the two of these which lie nearest to C we proceed to divide each into six equal parts. Through these divisions we draw lines from *e* till they cut the lines, *g h* and *i k*, and the points thus gained will, when united by

lines parallel to *f l*, give the hour lines, VII., VIII., IX., X., XI. Continuations of the lines giving the points for VII. and VIII. being carried through *e*, will also give points for the hour lines, V. and IIII.

The *west vertical dial* is the mere counterpart of this, and to construct it we have only to trace and reverse the plan given in Fig. 4.

In Fig. 5 is shown the proper gnomon for the plan Fig. 4. It is so pierced as to be made somewhat ornamental. When in place, it will stand with its substile stretching along the 6 o'clock line, which (in Fig. 5) is represented by the line, Y Z. The width or projection of the gnomon must be equal to the radius of the circle in the plan, and its length as much greater than the diameter of that circle as the arrangement of the numerals which denote the hours may render desirable. This gnomon will alike serve for an east or west dial. In arranging the actual dial, due allowance must of course be made for the thickness of the gnomon.

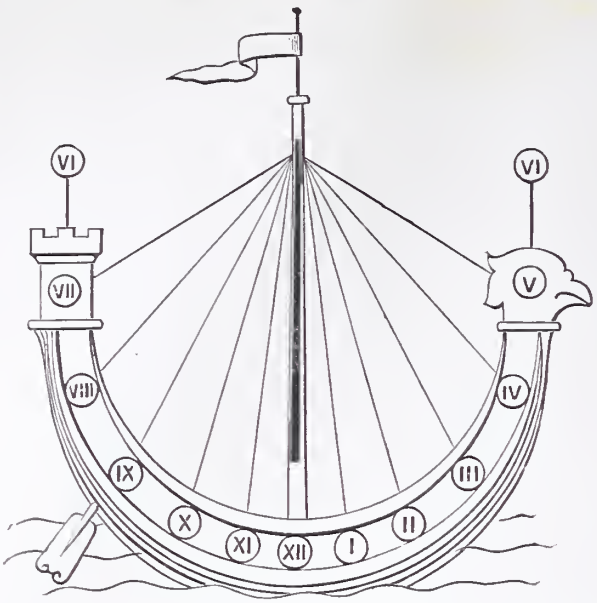


Fig. 6.—Suggestive Treatment of a Vertical South Dial at Tortosa, in Spain.

To the non-professional diallist the vertical dial offers an easier and more tempting field of labour than the horizontal, and for reasons already given it will most commonly be the south dial that he will elect to construct. Against a stone building, perhaps the most suitable dial will be one shaped from a slab of freestone, and having the lines, numerals, etc., incised and blacked. A vertical dial will not suffer in this material as would a horizontal one, for to a great extent it can be readily sheltered by the eaves or otherwise, and if wetted will readily dry again. With an occasional retouching of the black paint it will endure for ages. Slate may be provided more cheaply and worked with less skill in the art of the stone-cutter, but left in its natural colour will be less legible at a distance. A slab of slate may, however, very well be painted with some damp-resisting paint, and so be made to show up more plainly; it would last for a reasonable length of time. Zinc is not good for a dial, partly from its tendency to warp in the sun, partly because paint does not stand well upon it; and if wood be used, it should, to avoid warping, be in a thick slab. It may then stand for a lifetime. On the writer's own premises is a dial painted on a slab of oak, bearing date 1834, which is still perfectly sound and serviceable.

Or at no further cost than a little trouble, the dial may merely be painted on the wall of the building—provided the aspect exactly faces a cardinal point; and as in this case the diallist will be less cramped for space, he may indulge more liberally in ornament. Any wall which is fairly smooth may be made fit for painting or gilding upon by coating it with gutta-percha dissolved in naphtha, a little shellac dissolved in the same being added. This preparation will stop absorption and resist damp. It is as yet a thing little known, having been till a few years since a trade secret in possession of a single firm of country decorators. A certain amount of shelter might always be provided for such a dial painted as described. In vertical dials, moreover, the necessity for going to the expense of a metal gnomon is less urgent. A slate gnomon, which any one can cut for himself, and of which the material costs virtually nothing, may be considered safe at the height at which a vertical dial is likely to be fixed; and it will have the advantage of never getting bent.

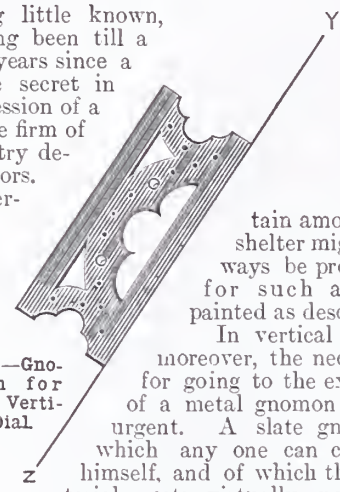


Fig. 5.—Gnomon for East Vertical Dial.

The decorator of dials has before him an admirable and a boundless field in which to exercise his invention. The sun-dial has in all ages been looked upon as a fit subject for the display of fancy. A favourite form of what may be called intellectual decoration has ever been the use of mottoes. These, like Touchstone, as described by the melancholy Jacques, commonly "moral on the time," and owing to the greater terseness and epigrammatic power of that language, they most frequently moralise in Latin. Something of a rhyme or of a pun is often attempted. "*Orimur, morimur*"—we are born, we die—says one Warwickshire sun-dial, the truth being equally applicable to the fleeting shadows on the dial and to those who watch them. In "*Transit hora sine mora*," another in the same county reminds us how time and tide wait for no man; whilst in the adjacent county of Gloucester is a dial which with "*Lex dei lux diei*," proclaims that the (moral) light of the world is the law of God. Indeed, there would be little difficulty in quoting a long list of such mottoes.

As an illustration of fancy applied to the dial itself we may instance Fig. 6. From ancient times the ship has been regarded as an emblem of the course of time. This is a south vertical dial, and the diallist has here taken the form of the antique galley, and so conventionalised it as to adapt it to his requirements. The holes for oars have served as spaces for his numerals; for his hour-lines he has utilised the cordage; the mast is his meridian; and the projecting gnomon would to some extent carry out the idea of a sail.

This dial is from the front of a house in the ancient city of Tortosa, Spain, where it gave the writer some small amount of amusement in sketching it whilst detained by the washing away of a railway bridge. Spain is the land of sun-dials. From the frequency with which they meet the eye whilst traversing their country one might infer that the Spaniards had a high idea of the value of time. The world does not credit them with this; if, however, they love industry as little and procrastination as much as is generally supposed, it is not because they have nothing to remind them of the flight of the hours.

This design might well be used and perhaps improved upon by English diallists. A friend of the writer's suggests that the idea contained in it might be more fully carried out (by a diallist who knows how to paint) by placing the figure of Time on the rostrum of the boat and one of the Recording Angel in the poop; with the appropriate motto—borrowed, let me say, from a dial at Gloucester Cathedral—"*Pereunt et imputantur.*"

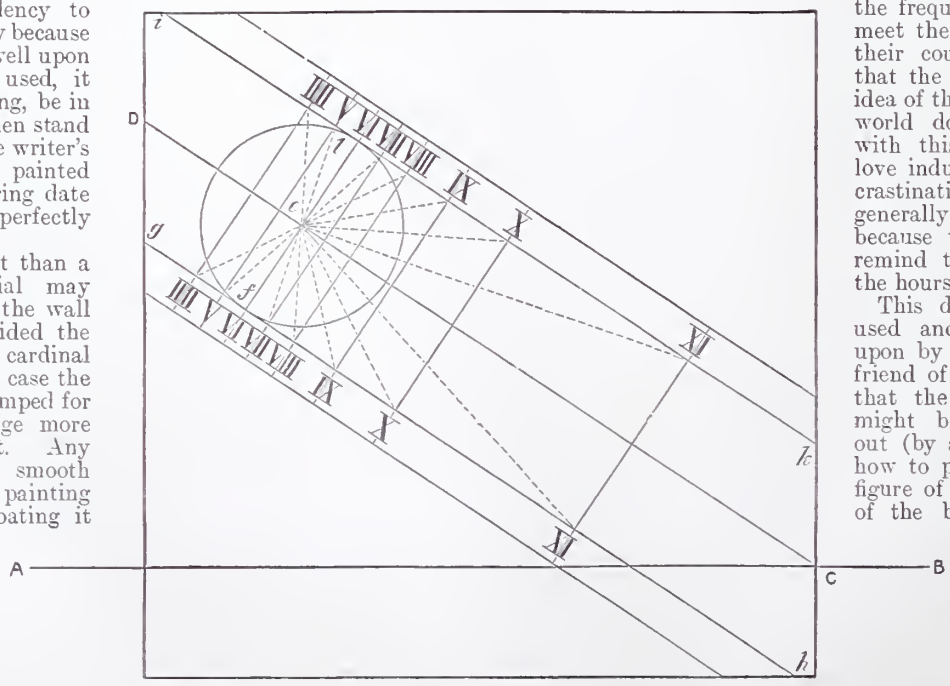


Fig. 4.—Setting Out an East Vertical Dial. (For the Latitude of Edinburgh.)

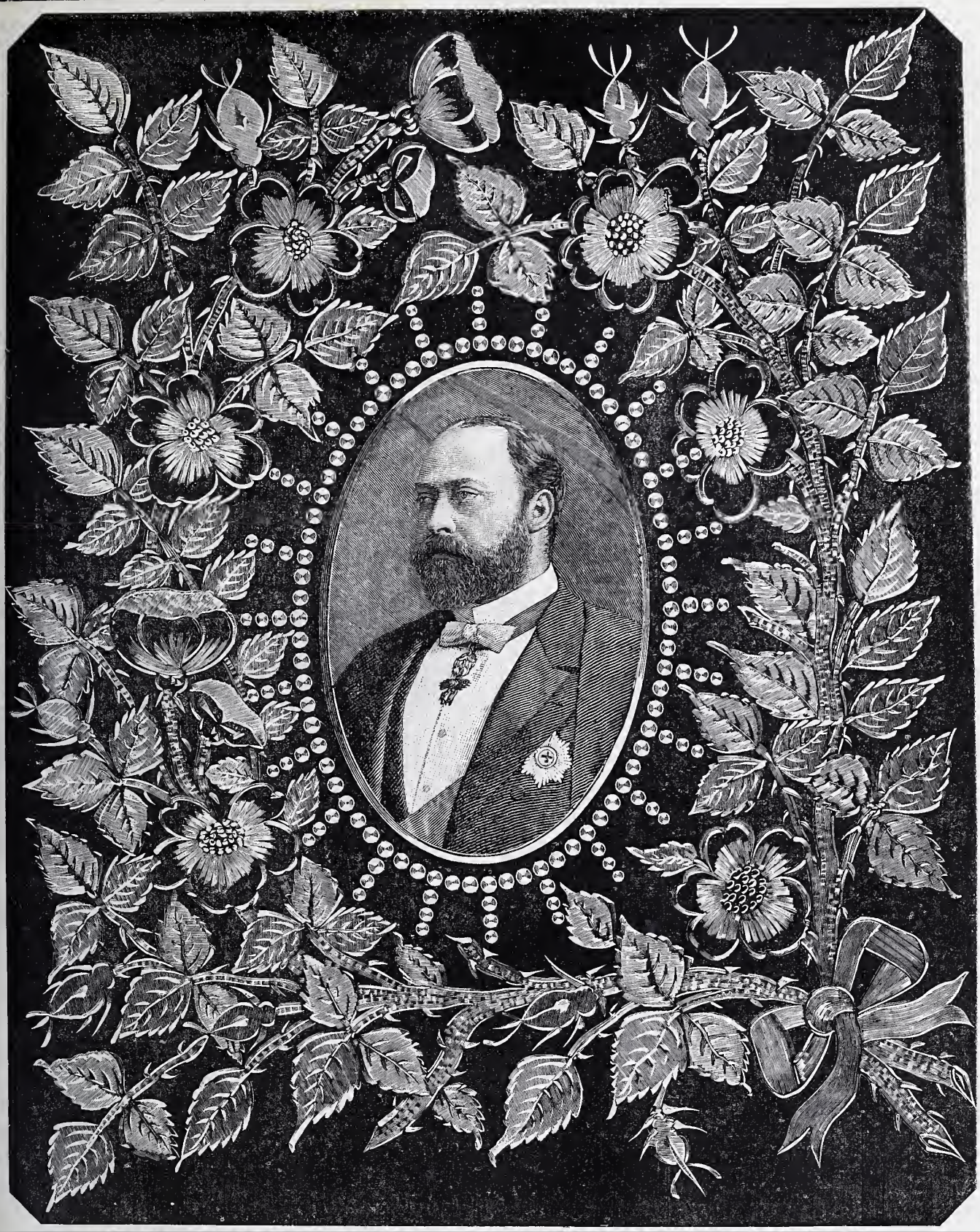


Photo Mount. (A piece of fancy work for engravers on soft metal.) *(Portrait from a Photograph by W. & D. Downey.)*

A NOVEL AND ARTISTIC PHOTO MOUNT.

BY NORMAN MACLEAN.

N accordance with my promise, I now ive the details of a novel idea, applicable o photographic and small picture-frame nounts generally. I commence by giving a list of materials, to be followed by the mode of preparing the metal for engraving. My readers may gain some idea of the effect from the accompanying sketch. An engraved plate of the size given is intended for a carte-de-visite.

List of materials for photo mount :—

Mahogany board, 12 in. by 12 in. by 1 in., planed smooth ; sheet of Britannia metal, 9 in. by 7½ in., 12 gauge ; one tin of Aspinall's blue enamel paint; camel-hair brush or badger-hair brush; one dozen full size carpet pins.*

The mahogany board may be supplied

* The carpet pins may be obtained at an upholsterer's.

by any cabinet-maker, and the enamel and brush by a dealer in artist's materials, etc. For a list of tools required by the engraver, see No. 33 of WORK. The second article (the sheet of Britannia metal), being the most important, requires a paragraph to itself.

While all other metals can be bought at the respective dealers, I do not know a single place where Britannia metal can be purchased; the principal reason for this being that users of the metal mix and cast into ingots for themselves only, and send to the mill to be rolled to such a gauge as will best suit their own particular requirements. Britannia metal* is usually composed of pure tin ninety parts, copper two parts, and regulus of antimony eight parts, the tin being first melted, the copper and regulus being added to the tin while in a melted state, carefully skimming the dross from the surface, after which it is poured into a mould 9 in. by 6 in. by 1 in., and allowed to set, when it is sent to the rolling mill to be rolled to such a gauge as may be required. Those of my readers who are unable to obtain for themselves sheet Britannia metal are respectfully referred to the advertisement column for my address in No. 52 of WORK. Now for the photo mount: take the mahogany board, and place the metal on the top, and with a moderately hot laundress's iron carefully flatten the sheet of metal by rubbing the iron forwards and backwards, taking care not to let the iron remain in one place too long, or the metal will melt, and consequently spoil the sheet. This being done, wait until the sheet of metal is cold, and handle carefully. Now take some turpentine and clean rag, and clean both sides of the sheet to remove grease, and stand before the fire to remove odour.

The sheet of metal is now ready for the enamel, of which I generally give two coats, allowing the first to dry before applying the second, and having handy a cardboard box with lid to it, into which I place the sheet immediately after the enamel is laid on, to preserve the surface from dust, and as a further precaution I put the cardboard box in a drawer. The painting of the sheet requires no special training, merely a little care in the laying on of the enamel, and smoothing off always in the same direction. When the first coat is completed, wash out the brush in turpentine, and dry, and it will then be ready to use when again required. Leave the sheet to set for a day or two, after having given the second coat of enamel.

To fix the sheet to the mahogany board, bore four small holes, one at each extreme corner, and insert the carpet pins; this will be sufficient fastening as regards the sheet itself. But we must not forget that we require a piece cut out to receive the photograph. This may be cut out of the centre of the sheet or out of the right-hand bottom corner, and may be circular, elliptic, or square, or in the form of a parallelogram. I think, however, we may at once dismiss the square outline as being too ungraceful. There remains the choice of the other three, of which the oval and oblong are far the best.

Suppose the engraver has decided upon the oval outline for the photo: he will find it necessary to fix the part to be cut out with four more carpet pins. Before doing this, the sheet should be properly divided by faint pencil lines lengthways and across. Those lines will give the exact centre of the sheet.

* The mixture composing Britannia metal varies according to the user's requirements.

Now, as the oval outline is rather difficult to cut by hand, we must have a true oval for a guide, or else we shall never succeed.

The best plan is to cut the oval out by means of the oval chuck in a lathe, and as a matter of fact, the specimen is so done, and is further enriched with ornamental drilling in the lathe. As but few amateurs possess an 8 in. centre lathe, which would be required to "take" a board 12 in. square, I must refer them to any of the well-known processes for obtaining an oval by means of the elliptic compass: the ellipsograph lately described in Messrs. Cassell's "Family Magazine," or by means of two pins fixed on the line of the longer axis of the ellipse, aided by a loop of cotton and a finely-pointed pencil. By these latter means we are enabled to strike a comparatively true oval of any size and shape, either sharp or blunt, the distance between the two pins providing for the sharpness or bluntness of the oval. Having got the outline of the oval marked on the sheet, we now take a wide-faced graver, and cut the oval in a single cut and an equal depth, using for this purpose a freshly-wetted graver, and polishing on a piece of sea-horse hide, on which some jeweller's rouge has been well rubbed in. This will cause the graver (if properly sharpened) to cut with dazzling brightness. Now go over the outline of the oval, gradually cutting with the right-hand facet of the graver (to produce the bevel) until the oval is completely cut through. A little care will make a neat job of this.

Now that we have got the oval cut out, all the rest of the work is comparatively easy. It will be necessary, however, to decide upon the style of ornament, which may be in almost any style; but my liking is for floral design in this case, and in my opinion cannot be improved upon.

Sketch in with a "BB" lead pencil the design decided upon, using caution, not bearing too heavily on the pencil. Then outline, improving on the pencil sketch as you proceed, not forgetting to brighten the graver on the rouge buff. The outline of the subject being done, fit the sheet of metal into its frame and study it from a short distance (as from its destined position on the wall), and suggest your own improvements.

The flowers themselves must not be entirely shaded away, but must have a little relief, as shown in my specimen; but the leaves, stalks, buds, and branches must be cut away bright, using for the purpose a fine shading graver, afterwards veining the leaves to produce a given effect at a little distance from the observer. To those of our readers who would wish to present their own photo with the mount and frame, I may suggest an autograph signature by way of a finish.

If this is decided upon, it should find a place in the right-hand bottom corner of the mount. To do this, write in your usual handwriting "Yours truly," followed by the name, with the "BB" pencil, and cut with a lozenge-graver, giving as nearly as possible a fac-simile of your usual signature.

As regards the thickness of the metal, it may be of 12 in., 13 in., or 14 in. *sheet metal gauge*, not B.W.G.; and the ground may be of almost any colour.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

17.—MARRIS AND COOKE'S PATENT "VICTOR" CARRIAGE.

THE "Victor" Carriage, of which an excellent illustration is given below, is a capital form of cart for children, recently invented and patented by Messrs. Marris and Cooke, Grimsby, who are the sole manufacturers. The back part consists of a seat with a well in front and back and long sides above, affording room for one child, while another can occupy the seat in front and be safe against being thrown off by any sudden jerk, because there are handles, one on each side of the seat, which he can grasp with his hands, and a step supported by irons on which he can place his feet. Absolute safety is ensured against tipping too far forwards or backwards by the S-shaped irons behind and the irons that carry the step in front. Since its first introduction the inventors and makers have added several improvements, which they have also patented, namely, a reversible back to the front seat, enabling a child in front to sit with his back to the horse and put his feet in the well, thus permitting both occupants to be covered with a rug in cold or wet weather. The shafts also, instead of being rigid and unmovable as shown in the engraving, are made separate from the cart, and so contrived that when the bolts that hold shafts and cart together are put through the bottom holes of plates, the shafts are straight and in the right position for the carriage to be drawn by a boy; but when the bolts are put through the top holes of plates the handles of the shafts are raised nine inches, thus rendering the carriage more convenient to be used as a perambulator. The price of the carriage, as shown in the illustration, is 32s. 6d.: for reversible back to front seat 5s. extra is charged, and 3s. 6d. extra for patent adjustable shafts.

Marris and Cooke's Patent "Victor" Carriage.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Fretwork Designs.—C. D. (*Camberwell*) writes:—"I send a suggestion for copying fretwork designs, hoping it will be of service to some of the subscribers to your most valuable paper. The articles required for this are an ordinary hektograph, hektograph ink, and a medium-pointed pen. Having procured a design you wish to copy, (1) dip the pen in the hektograph ink and trace over the design with it. (2) Place design on the hektograph, remove, and print off in the usual way. By this means a clear and distinct copy of the design will be obtained to about the number of 30 (if required). If any one is unacquainted with the hektograph and its uses, I would be glad at a future date to state how to make and use it."

Gassner Dry Cell.—G. H. (*Middlesbrough*) writes:—"Will you kindly grant me a little space in 'Shop' to give my experience with the 'Gassner Dry Cell'? I have seen some inquiries about same in WORK, but have not seen anything like satisfactory answers to questions put well to the point. I have bought five altogether at different times, the first two cells about eight months ago, and three more about Christmas, and I find them to vary very much in E.M.F. The first one I got gives a very good current, much stronger than a 'Leclanché,' while the others do not reach that standard; three of them are somewhere between a 'Daniell and a Leclanché.' The last one failed altogether in about a week. I then made up a four-cell chromic acid battery, and connected it to the cell, of course the positive pole of battery to positive pole of cell, and left them about an hour and a quarter. At the end of that time I tried the cell, but it would not do any work, so I took it back to where I bought it, intending to get another in place of it, but before I left the shop I made up my mind not to trust them any more, because the shopkeeper (a friend of mine) told me he had one returned only a day or two before I went with mine, and he showed me another that had broken down in the shop. While trying it the terminal came away in his hand, and, upon examination, it could be seen that the terminal was merely screwed into the top of the carbon rod (very coarse carbon, by the way). It was not coppered or capped in any way. In fact, after it was once out it would not hold at all; it would slip in and out quite easily. I think it was only held on by the marine glue, or whatever it is. Well, to sum up, I think they would be a useful cell if more pains were taken in the making of them. It would not cost much to lead-cap them in the first place. It cannot be done when they are made up, because the carbon of this one I saw was quite wet, and the hole was entirely filled with a thin milky-looking liquid. I cannot, of course, say if they are all alike, but I expect they are; at any rate, I will not buy any more until I am assured they are capped, and a little more care taken in charging them, so as to have them something like uniform."

Slide Rule.—H. E. (*Clapham*) writes:—"I read on page 28, Vol. I., F. C.'s reply respecting the above, and, after a search, J.'s answer on page 797 of last volume. Whatever the original query was I do not know, but as a daily user of this most useful instrument, I certainly cannot agree with F. C.'s remarks. My fellow subscriber evidently knows very little about the matter when he says, 'I always found I could work more rapidly on paper than by this much-praised instrument.' As to the use of the rule for accuracy, I may mention that it is in constant use by the officers of H.M. Excise Department, which fact will speak for itself, and by its use the drudgery of computation is avoided, and the time and trouble expended on mere arithmetical workings proved to be a waste of effort; in fact, the slide rule is to arithmetic what shorthand is to ordinary writing. From the tone of J.'s remarks, I presume it is an engineer's slide rule that is wanted, and these are manufactured by Messrs. Jno. Rabone and Sons, of Hockley Abbey Works, Birmingham, and they publish, for about sixpence, a very useful little book, the title of which is 'The Routledge Engineer's Slide Rule.' They also make a carpenter's slide rule, and keep a book to show its uses; and our friend J. is right, the rule costs about 4s. 6d. I copy from Messrs. Rabone and Sons' book that 'many kinds of slide rules are used under different names, but they are all constructed upon one general principle, and show results by the same unerring law, the only difference in them being that each kind is adapted to suit the particular special purpose to which it is intended to be applied.'"

Treatment of Cuts.—MEDICUS, in reply to J. C. K. (see page 12, Vol. II.), writes:—"I say that I did not 'overlook the distinct statement that the treatment of cuts by French polish, and using pins to close the wounds, was offered as the best in cases of emergency,' but said that such measures are utterly wrong, and opposed to the principles of surgery, whether the case be one of emergency or not. J. C. K. seems to forget that 'hospital procedure,' as he terms it, is based upon common sense and vast experience, and that the means I suggested for treating injuries are just as available as those he so unwisely put forward. I do not purpose discussing surgical treatment with one who shows plainly that he has not mastered even the most elementary principles in spite of his 'forty years' long experience.'"

Glue for Earthenware.—INQUIRER (*Jersey*) writes:—"I am pleased to notice the statement made by M. R. (*Burnley*) (see page 27, Vol. II.), but he did not state whether there would be any likelihood of the edges becoming detached from each other through heat or moisture, as such would be liable to be submitted to in a domestic manner. An explanation to same would oblige an inquirer at an early date."

Boot and Shoe Making.—J. R. (*Hillsboro'*) writes:—"I would thank G. H. (*Bishopsgate*) to give me the name of the various shank irons, and description for any finish on waist. (1) Should the feather for a broad welted boot be the same breadth as for a close welt? (2) How do you cut a pair of shoe tops to last less than the full measure—I mean from edge to edge across the sole? (3) How to dress up a pair of welts before sewing, should there be a little bit taken out of edge with knife? Surely this is not a difficult or vague thing to answer."

Glaze for Porcelain.—B. J. T. (*Tunstall*) writes:—"I have just received my monthly part of WORK, and was somewhat amused at M. M.'s description (to W. B., *Holloway*) (see page 781, Vol. I.) of how to glaze porcelain. I think M. M. or any one else would have their work cut out for them if they thought of glazing it from the description given. Having to make the glazes used at one of the large factories in Staffordshire, I herewith send particulars of how it is prepared for general purposes, though, of course, we have different kinds for different purposes. They are mostly made on the same principle, and from the same materials in different proportions. The method followed is by, firstly, sifting the materials through a wire sieve. These consist of borax or tincal, and sometimes boracic acid and soda, with Cornish stone, felspar, flint, Paris white, and Cornish clay. These are well mixed together, and put into a furnace, or, as we term it, the fritt kiln. Here they are allowed to remain for three hours, or until they are all properly fused. Afterwards the mixture is run into a vat and water poured on to it, and when cold it appears as a kind of glass. This is then weighed, and more stone, flint, and lead, according to the recipe in use (which, I may say, varies with most manufacturers). It is now ready for grinding, which is done in mills specially arranged for this purpose, and the grinding continued for about fifty hours, water being added occasionally. Afterwards it is transferred to another vat containing a number of magnets, which take out any particles of iron that may have got into it during the process of grinding. If wanted of any particular shade other than white, it is coloured by stains prepared for the purpose from different metallic oxides, etc. The method of applying it to the ware is similar to the description given by M. M., after which it has to be passed through the kiln to burn it on to the ware, which brings out the brilliancy of the glaze."

Combined Mitre Block and Cramp.—KILDONAN writes:—"I am pleased to see that the sketch I submitted (see page 636, Vol. I.) has found at least one who approves of it. In answer to KILBURN, I should say that it seems to me immaterial how he makes the central triangular piece so long as the conditions of accuracy in the angles are kept. As a matter of fact, I made mine in one piece, and made the saw kerf after it was fixed in position. I will not go into details. My method of procedure would harrow up the souls of all experienced workmen: therefore I refrain."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Ear Drums.—DEAFNESS (*Pallasgreen*).—You should apply to an aurist for information on the subject on which you write. I cannot permit the pages of WORK to be opened to what might turn out to be a long discussion on the merits or demerits of a patent appliance for remedying deafness. You must not think that this reply indicates any want of sympathy on my part, but it is a matter altogether beyond the province of WORK, and to ventilate it in any way would deservedly draw on me the rebuke implied by the old saying—*Ne sutor ultra crepidam.*—ED.

Band Saw Wheels.—S. A. (*Enniskillen*).—You can get the wheels from any maker of light machinery, and very likely by advertising in a paper like WORK you might get a second-hand pair cheap.—F. C.

Key.—E. M. (*Glasgow*).—I think you would be able to get the parts of locks, etc., you require from Messrs. B. Walters & Co., lock manufacturers, Willenhall, if you want them in large quantities; or in smaller from Messrs. Skinner & Co., Blackman Street, London, S.E.—T. W.

Roller Composition.—A. A. (*Manchester*).—We are unable to give you the recipe for making the patent (*patent*, mind) "durable" roller composition. It is the result of years of experiment on the inventor's part, and even if you obtain his specification, in which of course he is bound to set forth the recipe, he, if he is wise, will have further protected himself by keeping some one little point of his experience, which any would-be imitator would have a great deal of loss and trouble to find out. It would save you much loss both of time and trouble, and of material and annoyance resulting from imperfectly carrying out what requires great care, long experience, and expensive plant, quite incommensurate with the small amount you might expect to save, by purchasing from someone who is agent to the "Durable" Roller Composition Company, Limited, 57, Shoe Lane, E.C., who rigorously prosecute anyone who infringes their patents.—J. W. H.

Wood Engraving.—INVICTUS.—Wood engraving *per se* presents so many difficulties that, we fear, it could not be taught by any instruction book; at any rate we have never seen any that would give any assistance to a "tyro" such as your letter admits you are. The "hold" of the tool takes weeks of constant practice to acquire; the proper sharpening of the different tools used, and the keeping them in proper order and sized suitably for the work, would take at least twelve months' constant devotion of some hours a day, and this would be next to impossible without seeing the various operations properly performed, with minute detailed counsel as to the attempts to succeed in imitating them. Again, it may seem paradoxical, but it is perfectly true, that to engrave in outline on wood, even by a good journeyman engraver, is frequently more difficult than to *shade* the same drawing, and will absorb much more time. Nowadays the "shading" is nearly all done by the tinting machine. If INVICTUS still feels "fit" to attempt his self-imposed task he can obtain the wood blocks of any size at from 1d. to 3d. per square inch according to quality ready to draw upon from Mr. Edward Badoureau, 14, St. Bride Street, E.C., who also supplies tools ready made up for use, eye-glasses, sandbags, and every other requisite.—J. W. H.

Book on Printing.—R. C. (*Bexley Heath*).—The article you mention appeared in No. 275 of *Cassell's Saturday Journal*, January, 5, 1889. The handbook you want, we presume, on letterpress printing (although you do not make this very clear), we think you will find in Messrs. Cassell & Co's. series. Write to their publishing department for list, and you may also write for list of "Wyman's Technical Series," published at 65, Chancery Lane, if you wish for information on kindred branches of the art of printing.—J. W. H.

Perforated Zinc.—G. T. S. (*Barnsley*).—The following are the addresses of some of the principal manufacturers and dealers in zinc, both plain and perforated, in various gauges, sizes, and patterns. Frederick Braby & Co., London, 352, Euston Road; Liverpool, 688, Hatton Garden; Glasgow, Petershill Road; Croggon & Co., 16, Upper Thames Street, London; Davis Brothers & Co., Crown Works, Wolverhampton; the Redcliffe Crown Galvanised Iron Company, Bristol.—R. A.

Fire Lighters.—R. J. (*Dublin*).—Mix a very little of the tar, barely sufficient to make the mixture sticky, with the sawdust, and subject the latter to heavy pressure. The cake can be cut up into blocks or sticks as required, and will make capital fire lighters.—F. B. C.

Indiarubber Type.—EXPERT (*London*).—The manufacture of date-bands and solid and rubber-faced type is a branch of the indiarubber stamp making business, requiring expensive special appliances, and with which I have no practical acquaintance.—QUI VIVE.

Imitation Stained Glass (Patent "Glacier" Window Decorations).—PLEASURE AND PROFIT.—I am unable to give any detailed information about the manufacture of above. They are produced by lithography on specially prepared paper; the latter, however, does not appear to be common property. Messrs. McCaw, Stevenson, and Orr, of Linenhall Works, Belfast, were the original patentees of the process, but I could not say whether the patent is still in force. No doubt the official Patent Blue Book, which you can buy at the corner of Cursitor Street, Chancery Lane (cost, 6d. or 8d.), would give the information required.—F. B.

Harmonium Reeds.—T. J. E. (*Bristol*).—You cannot do better than apply to the American Organ Agency, 2, Oseney Crescent, London, N.W.

Silver Plating.—G. W. B. (*London*).—Articles on silver plating will be given in WORK in due course. We have not yet taken up the subject, but it is on my list for treatment at an early date. Meanwhile, I would advise you to get your mouthpiece plated at one of the shops in Clerkenwell. They will do it better and cheaper than you can do it yourself.—G. E. B.

Electrotyping Stereos.—ELECTRO (*Gloucester*).—You have started wrong, hence your failures. In the first place, a Bunsen is unsuitable, because it causes the copper to go on too fast. Use a Daniell, a Smee, a Walker, or even a Wollaston battery in preference. In the second place, you use a wrong solution. Your solution is poor in copper, and it has too much acid. Dissolve as much sulphate of copper as a pint of warm rain water will take up, add one ounce only of sulphuric acid, and make up

to 1½ pints with cold rain water. The anode will do, if it has the same surface area as the stereo to be copied. You cannot successfully take a copy of the stereo in copper direct. A copy of the stereo must be taken in yellow bees-wax, or gutta-percha, this coated with blacklead, and the copper deposited upon this blackleaded mould. See paragraph on page 458, Vol. I., on blackleading. See also note on page 262, Vol. I., on how to treat a finished electro. It will take from eight to twelve hours or more to get a shell thick enough to print from. I have an article on "How to Copy Busts, etc." (now in the Editor's hands) which will help you.—G. E. B.

Gilding Solution.—A. B. (*Wednesbury*).—You impose conditions which cannot be met or complied with. I do not know of a cold gilding solution made up without cyanide of potassium, which will dissolve the anode freely. Cyanide of potassium is needed as a solvent for the anode in all solutions for electro-gilding. Roseleur's cold gilding solution is made up of:—Fine gold, 10 parts; cyanide of potassium, 30 parts; liquid ammonia, 50 parts; distilled water, 1,000 parts. The gold is converted into the terchloride of gold, and this dissolved in distilled water. The liquid ammonia is added to this, and fulminating gold is thrown down as a brown precipitate. This precipitate is washed on a paper filter, and dissolved at once with the cyanide of potassium solution. The water is now added, and the solution boiled for an hour to drive off excess of ammonia. Care must be taken in making this solution not to dry any of the precipitate, as it is a dangerously explosive substance.—G. E. B.

Time Alarum and Electric Bell.—J. K. (*Manchester*).—I am sorry you should have suffered any delay in completing your bell and time alarum, on account of lack of detail in my papers on these subjects. The letters B.W.G. following after a number in a reference to wire show that the diameter of the wire was measured in the Birmingham Wire Gauge. The sizes of wires are usually expressed by numbers, and those of the Birmingham Wire Gauge are given, because this gauge is the best known. Respecting the quantity of wire required on each bobbin of the magnet cores, follow the rule here given:—Multiply the diameter of the bobbin by three, and this will give you, nearly, the length of wire for one coil; find out how many coils of your wire, laid side by side, will lie in an inch of space, then measure the length of the bobbin, and calculate how many coils can be laid on it from end to end, or between the two flanges of the bobbin (No. 21 B.W.G. will run to about thirty coils to the inch); then measure the depth of the flanges and find out how many layers will fill the bobbin (also coils to the inch). Next, multiply the length of one coil by the number of coils the bobbin will take between the flanges, and this by the number of layers of wire coils which may be laid on the bobbin; this will give you the length needed for each bobbin, with, probably, a slight excess for connections. No. 21 will run to about 162 yards in the lb. One of the line wires leading from one pole of the battery must be connected to the binding screw to which the wire from one of the magnet coils is fastened. The other end of the wire from the magnet coils is fastened to the armature spring; this spring touches the platinum pin of the contact screw, and thus connects it with the contact posts. If now we connect a wire from the other pole of the battery to the contact post, or to a binding screw connected with this post, the bell will ring. The current goes through the magnet coils, the magnetism attracts the armature and pulls it away from the contact pin; this breaks the current for an instant and the magnets let go their hold, whilst the spring jerks it back again. This causes the to and fro movement of the armature. More will appear later on about connecting alarums to bells.—G. E. B.

Silicine Glass Painting.—V. M. W. (*Leicester*). Any artists' colourman will supply you with the materials you want.—C. B.

Case Hardening.—F. W. R.—"Case hardening" means that just the outer part of metal which comes in contact with the part against which it works is hardened, and of the nature of steel. Only wrought iron is treated thus. It may be effected in two or three different methods. A mere film of surface hardening may be effected by heating the iron red-hot, rolling it in powdered yellow prussiate of potash, and quenching in water. When the hardening is required to extend to a depth of $\frac{1}{32}$ in. or $\frac{1}{16}$ in. the work is enclosed in a cast-iron pot along with leather clippings, bones, horn, and yellow prussiate of potash, and subjected to the heat of a reverberatory furnace for from twenty to forty hours. The work is then turned out into water.—J. H.

Writing Desk with Folding Flap and Secret Compartment. — CAMPBELL (*Glasgow*). — In the sketches here shown I think you will find what you require. It is somewhat different from the usual run of desks, and I have designed it to possess a secret compartment. Your reason for wishing to have this latter is no doubt because you consider it necessary or convenient to be able to hide private letters from prying hands and eyes. Any wood will be suitable, but a light wood is preferable. The secret compartment is entirely out of sight in Figs. 1 and 2, and if you construct as I instruct, no one will dream of its being where it is. You want two sides, each 10 in. long on the back and front edge, and about 12 in. to the top of the serpentine shaping, and 9 in. wide. A board 13 in. long and 9 in. wide (G in Figs. 3 and 4) will be fixed between these two at the bottom. A back-board 13 in. long and 9 in. wide (F in Figs. 3 and 4) will also be fitted between them. The top board, which forms the bottom half of the case when open, will be 13 in. long and 8½ in. wide, and will fall over the edge of the back-board, where it should be fastened with a lock. The top half of the flap, which forms the front of the desk, will be the same length and 5 in. wide. These two pieces are hinged together in the middle as in Fig. 2, and the last-mentioned half is hinged to the division above the drawer. A piece of wood about 1¾ in. wide may be fastened on the top piece to answer the purpose of a handle; and when the flap is down (the top part comes right over, bringing with it the front part) it will serve to support it. A small fastening, similar to an ordinary catch, must be fitted, as shown, to the flaps, to prevent them falling together when leaned upon by the user. The stationery box must be made separately, and not joined to any part of the desk. It should be 5 in. wide; the front board might be 5 in. high,

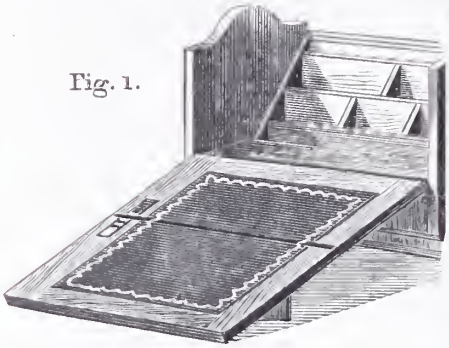


Fig. 1.

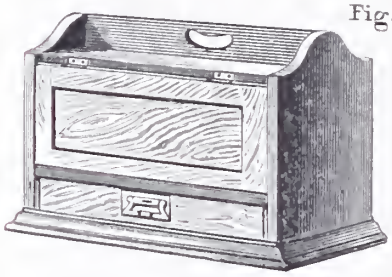


Fig. 2.

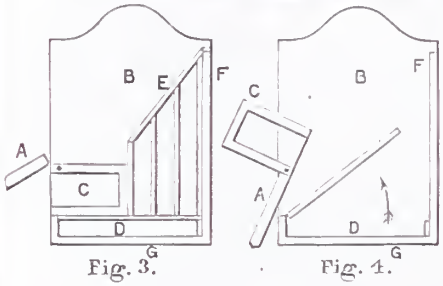


Fig. 3. Fig. 4.

Folding Writing Desk.

the second board 6 in., the third 7 in., and the back-board 8 in. Three compartments in front will serve for envelopes, two behind these for note-paper, and the back one for foolscap; and here let me say that if you do not want the desk to contain foolscap paper, you can make a smaller article by proportionately reducing my measurements. Next we want two boards, each 13 in. long and 4 in. wide; another the same length and 2½ in. wide, to fit between these last two at the back; two small pieces, each 3½ in. long and 2½ in. wide, to fit in between them at the ends; this gives us the part into which the drawer will go. It must work on a pivot as in Figs. 3 and 4. A is the writing flap, B the side of the desk, C the drawer, D the secret compartment, and E the stationery box. A hole should be bored through the sides of the desk, and a pin driven through it into the top thickness of the drawer box. The hole should then be filled up as neatly as possible, to hide all traces of the pivot. A piece 1 in. deep, on to which is hinged a lid, as shown in Fig. 4, will be fixed under the drawer box in the front of desk. Three narrow pieces must be fitted in the secret compartment to support this lid. Now, if a lock or fastening of some description is fitted at the back of the drawer box, so that it and the stationery box can be firmly fastened together, it will be impossible for any one to discover the secret space. To get at this space, it will be necessary to take out the stationery box and pull the drawer box round on its pivot, as in Fig 4. A deep moulding should be mitred up all round the desk bottom for about 1½ in. For thickness of wood, make all except stationery box, drawer, and secret compartment fittings, ½ in. thick, and allow a little extra for joining. Line up inside of flap with leather, and panel or leave plain, according to taste, the front.—J. S.

Lathes—Earthenware.—BARRA.—The weight of a fly wheel suitable for a lathe depends upon the work which will be most commonly done. For example, a wheel which will be driven quickly, for light wood turning, would not be as heavy as one which goes slowly for taking cuts off metal. BARRA need not be very particular as to weight; anything from fifty to one hundred pounds, or even more or less, would suit, and, of course, be better than a grindstone. With regard to earthenware drillings, I have succeeded in drilling half inch holes through half an inch thick with an ordinary diamond-pointed steel drill, made thin and very hard. It must be constantly sharpened, and the work is not pleasant at the best. A method which I have read of as producing excellent work is as follows:—Use as a drill a piece of soft brass or copper tube, charging the point with diamond powder, corundum, or emery; revolve in a lathe or vertical drill, and it will be found to grind or cut out a circular piece the size of the internal diameter of the tube, leaving a hole in the work the size of the external diameter. This might be driven with a brace, but would require great steadiness. Charge frequently with the powder mixed with oil. Many thanks for your kind wishes.—SELF-HELPER.

Thread of Nuts.—J. A. (*Liverpool*).—Make the depth of the thread equal to its thickness, then its bearing and shearing resistances will be equal.—F.C.

Book on Dynamo Building.—G. L. (*Pimlico*). —There are several books on the subject. "The Dynamo: How Made and Used," by S. R. Bottone, initiates the amateur into some of the principles, illustrated by directions on how to build a small Siemens dynamo. "How to Make a Dynamo," by A. Crofts, is another simply written, instructive little book on the subject, showing how to build a Gramme dynamo. Then there is "Practical Dynamo Building for Amateurs," by F. Walker, introducing a little more technical work than the others. If you want something in advance of these, get Professor Thompson's large book on the subject. Perhaps you may learn something from my articles, "Model Electric Lights," which will appear shortly, as I have a little to say in those on dynamo building.—G. E. B.

Silvering Reflectors. — CARBON. — Copper reflectors for lamps may be silvered by the electro-silvering process, and then burnished to get the requisite bright polish. This silvering will be most durable. A cheaper but less durable coat of silver may be put on by the simple silvering process. The paste for this process is made by mixing together equal weights of silver chloride, freshly prepared, and cream of tartar, in a mortar, and rubbing them well together until the paste is quite smooth. The copper reflector must be polished to a mirror-like brightness, free from any trace of grease or animal pollution. It must then be coated with the paste, and well rubbed in every part with a piece of soft cork until coated with silver; then rinsed in hot water, and dried by polishing the surface with a soft linen rag. Many of the small cheap reflectors are merely coated with tin, and then highly polished.—G. E. B.

Renovating Leather.—C. H. R. (*Leeds*).—If the leather of your suite is merely dull you may improve it by going over it lightly with a little French polish. Do not on any account saturate the leather, which you would make worse than it now is by doing so. The cutting you send looks all right, and requires nothing doing to it. If the surface has got broken you had better not attempt to restore it, for you will not be able to do so. Of course the leather is only common stuff, but you could not expect the suite to be covered in best morocco at the price you name. You paid for "shoddy" things, and you probably got them, so there is no reason why you should feel disappointed. When people are willing to pay a fair price for fair work and materials to good upholsterers, such things as your suite will cease to be an article of trade. If you had gone to a first-class shop and inquired the price of a suite similar to yours, you would probably have been told that the price would be about double. You must blame yourself, not the things.—D. A.

Coloured Book of Designs for Sign Writers. —A. S. (*London, N.*).—The only work of the kind such as you require is "The Art and Craft of Sign Writing," by William Sutherland, price one guinea, from Mr. W. G. Sutherland, 15, Saint Ann Street, Manchester.—H. L. B.

Lincrusta Methods.—H. C. (*Liverpool*).—You will find the information you want given in "Shop" in a previous number.—E. D.

Filter.—PLEASURE AND PROFIT (*London, W.*). The only filter I know of that comes anywhere near the name you mention (Lipscoomber) is Libscomb's, and the only refitting they require is to either remove and thoroughly cleanse the filtering media, or replace it with new; and as this media is generally the invention of the manufacturers, it can only be obtained through them. I think you will find that this also applies to nearly every make of filter.—E. D.

Theatrical Lime-Light Boxes. — MECHANIC (*London*). — Theatrical lime-light boxes, with coloured shades and all necessary accessories, may be had from Walter Lawley, 78, Farringdon Street, London. These will suit your *tableaux vivants*.—H. L. B.

Violin Belly.—VIOLIN (*Manchester*).—The back or belly of a violin is removed by inserting a knife (not too sharp) between the "ribs" and the part you desire to take off. This seemingly simple operation is one which requires great care, especially as regards the belly. By all means try your hand with a common instrument to begin with.—B.

Lubricant.—H. L. D.—No lubricant is used for brass or gun-metal. If the castings get hot you run the drills too fast. Brass and copper tubes are bent cold, being first filled with sand.—J.

Cast Chains.—AUREA CATENA.—The only chains that I am aware of that are cast are made in steel, for which patents have been taken out. But I have never seen any, and do not think they are used to any large extent.—J. H.

Artificial Frost for Lettering Purposes on Windows.—TRADESMAN (*Farnworth*).—It is almost impossible to put any kind of paint on windows to represent frosted glass. The glass itself is made with artificial frost upon it, and that is all that can be said. Give the glass a thin coat of white paint, and then work the surface with a dry brush and imitate as near as possible.—H. L. B.

Scene Painting.—J. C. (*Winnington, Cheshire*).—It would take a whole page of this portion of the paper to describe, even in a concise manner, the process of scene painting, especially to a novice like yourself. Send sixpence in stamps to S. French, 89, Strand, W.C., for "The Art of Scene Painting," which, although only containing about a dozen pages of matter, will tell you more than I can here. A series of articles, entitled "Scene Making and Scene Painting," appeared in the new volume of the *Journal of Decorative Art*, which commenced with the January part. It is 7d. per month, and published by Henry Vickers, 317, Strand, W.C. These papers treat fully on scene painting in all its branches.—H. L. B.

Wood Letters for Signboards.—W. R. H. (*Minories, E.*).—It would not pay you to make these. They are turned out by special machinery, and the wood has to be specially prepared, I believe, by steaming, etc. Besides, the home-made article would soon split in all directions. However, I refer you to an article in No. 35 of this journal, page 550, Vol. I., entitled "Solid Letters for Shop Front Facias." There are several shops in Holborn and Gray's Inn Road where wooden letters are made and sold, but I prefer Willings' enamelled iron letters, or those made by the Patent Letter and Enamel Co., Limited, 144, High Holborn, W.C., who will send illustrated sheets and price lists on application.—H. L. B.

Lock Repairs.—A. M.—There appears to be no book upon this subject. Am glad you like the articles upon the matter in WORK.—T. W.

Enamel Paint and Bronzes.—F. W. M. (*Norfolk*).—Enamel paint is made in a great variety of colours, and by a score of different manufacturers. Aspinall's is the best advertised, and hence the most used. If you cannot purchase near at home, they will send a small tin, post free, for 1s. 6d. The same size, marked 1s. 3d., can be bought at "store price" in most towns, 10½d. Enamel paint is quick drying, and if desired to be spread evenly on large surfaces, requires a painter's practice, and a soft or nicely worn brush. Bronze powders can be bought of any dealer in painters' and gilders' tools. Aspinall's factory is—Hollydale Works, Peckham, London, S.E. Let us have something more worth printing if you write again, as a few inquiries in your own neighbourhood would surely have obtained answers to the above, and "Shop" space is very valuable.—F. P.

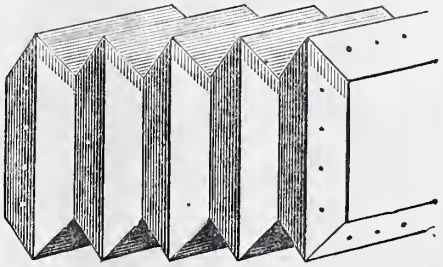
Distempering.—H. G. C. (*Great Yarmouth*).—There is nothing that can be added to distemper in order to make it dry "shiny and smooth," so far as I am aware. Excess of size or glue in water colour will often give an "egg shell" gloss, but the amount of size there must then be in the distemper will probably cause it to crack and peel off. Unless used upon walls, distemper is best with only sufficient size to bind it, and not to show any gloss whatever. The "dead" surface of distemper is one of its chief attractions. Twenty and more years ago walls were sometimes distempered, and then polished with French chalk, but it is very seldom done now. The satin surface of some wall papers is obtained, I believe, by such a process. Smoothness will depend upon the preparation of the stuff, condition of the surface to be covered, and the proficiency in spreading it.—F. P.

Graining.—A READER (*Newton Heath*).—Instructions for making and using graining colour have been given, as far as space would permit, in recent answers in "Shop." These, I hope, will suit your case also. I cannot further aid you, as you are only making a general inquiry. Friends who really want practical help *must* put their queries into definite form, and say *precisely* what they wish to do, otherwise time and space are but wasted. Graining will, I believe, soon be practically treated in WORK, and, if possible, wood cuts of figures, and characteristics of woods and marble, will accompany same. If you have a special need beyond ordinary matters, write again, and I will help you.—F. P.

Battery for Time Alarum.—F. G. (*Bow*).—A No. 2 Leclanché will not furnish power enough to properly ring a 3-in bell through 22 yards of wire and the alarum clock, unless the magnets are wound with a short length of wire and all the parts nicely adjusted. Your alarum hand, too, although very inexpensive and ingenious, adds to your trouble by being made of steel. Had it been made of brass, it would have offered less resistance, and your battery would have had a better chance. You must have a battery of at least two No. 2 Leclanché cells, connected in series, to properly ring the bell. If the wire is well covered and properly laid, as directed in my articles on burglar alarums, you need not fear leakage from having them only two inches apart.—G. E. B.

Electro-tinning Iron Goods.—IRONMONGER (*Marylebone*).—Iron goods have been and can be electro-tinned, but I do not think they can be done more cheaply than by the ordinary tinning process. You would require the ordinary plater's plant of vats, solutions, lathe, brushes, battery or dynamo machine, acids, and polishing materials. At the lowest estimate the cost of plant would not be less than £50. This subject will come up for treatment in due time.—G. E. B.

Camera Bellows.—CAMERA (*Shipley*).—To make a camera bellows, proceed as follows:—Procure a supply of either thin marone leather or bookbinders' cloth and buckram, with some strong paste; then buy all the materials required for either leather or cloth bellows. For the sake of economy, it is as well to cut out a paper pattern of the necessary size before cutting out the leather. For a square bellows, an oblong piece is required; each side of the proper size to attach to the framing of the camera, and the length to be determined by the amount of extension wanted. The buckram being cut out to the proper dimensions, smoothly paste the leather upon it and allow it to get nearly dry. Then rule a series of lines, one inch apart, as a guide to folding, which must be done in a fan-shaped manner, folded and dried under a little pressure. Lines having been previously marked to correspond with the corners of the camera, the material is sharply creased along them; the pressure of a warm iron may be used to make it retain



Camera Bellows.

the fold better. Now bend the creased material so that the first fold may be at right angles to the second, and with the finger and thumb pinch the corner thus formed, so that they will permit extension or compression without difficulty. The sketch above represents how the corner should appear when finished. A little extra width must be allowed for overlap in closing up the bellows. For conical bellows, the only difference is that instead of the material being cut in the form of an oblong, the ends are measured to fit the front and back of camera frames, the secondary lines and creases being made from the corner of the large end to the corner of the small end, thus giving a somewhat triangular shape to the material; the folds will be straight across, as in the square bellows, and the corners pinched up in the same manner: a slight allowance must be made in the length to compensate for the shortening produced by the folds. After the bellows are joined up and dry, the inside should have a coating of dead-black varnish, made by thoroughly amalgamating fine lamp-black with thin shellac spirit varnish, until it is of a suitable consistency—a sort of thin cream. This well brushed over the buckram leaves a perfectly dead unreflecting surface. The two ends of the bellows should have the last folds left turned inwards, to be attached with glue and small screws to the woodwork of the camera.

Battery for Lamp.—QUÆRITOR (*Manchester*).—All depends upon the voltage of the lamp. A 6-volt 2½ c.p. lamp might be lit up with current from three single fluid bichromate cells, but this would be driving matters rather close. A 25-volt 2½ c.p. lamp would require at least thirteen such cells connected in series. You may calculate on 2 volts each cell, 1 ampère for each 6 square in. of negative plate surface, and 6 ampère hours for each pint of solution. A suitable battery is described in my articles, "Model Electric Lights," which will shortly appear.—G. E. B.

Electric Repeater.—F. D. (*Crewe*).—I do not know of such a thing in the clock trade as an electric repeater. There may be such a thing, and I might be able to invent a method for making a striking clock repeat the hours by means of an electric arrangement, but I have no time to attend to such a thing now, and I think I should patent my invention before describing it in WORK. Perhaps some one of my colleagues in the clock business will oblige.—G. E. B.

Melting Temperature of Brass.—H. G. H. (*New Southgate*).—(1) As the composition of brass varies considerably, so does the temperature at which it will melt. Common brass may be taken as having a melting point somewhere near 1,900° Fahrenheit, or a little above a cherry-red temperature as viewed in the dark. The fusibility of brass increases with the quantity of zinc put in it, or decreases as we increase the proportion of copper. Bronzes require a temperature of from 1,922° Fahrenheit to 2,372° Fahrenheit, according to their proportions of copper and tin. (2) I cut sheet brass with a pair of stout shears, if it does not exceed $\frac{1}{16}$ in. in thickness. Over this thickness I should use a sharp cold chisel, resting the brass on a soft iron plate or a block of copper. I have not seen your first letter.—G. E. B.

Permanganate of Potash Stain.—G. T. S. (*Barnsley*).—G. T. S. asks:—"What can I dissolve permanganate of potash in for staining wood, instead of dissolving in water, as water raises the grain of the wood, which has to be sandpapered down, and this takes off most of the stain and makes the wood look streaky?" Seeing that the action of such wood stains depends upon the known avidity of wood for water, I cannot see how a useful stain can be made up without it. The pores of the wood absorb water, and this carries with it the particles of the staining substance. I do not know of any solvent for permanganate of potash, free from water. Perhaps Mr. Adamson may be able to inform you how to avoid raising the grain of the wood and making the stain streaky.—G. E. B.

Perforated Zinc Sheets.—G. T. S. (*Barnsley*).—Perforated zinc can be got in any quantity and of any gauge required at the West Kent Zinc Works, Loampit Vale, Lewisham, London, S.E.—G. E. B.

Zinco Blocks, etc.—AMATEUR (*Cornwall*).—We cannot say anything as to articles on zincography, and refer you, as we have previously done other correspondents, to Josef Bock's little manual (Wyman's Technical Series) 65, Chancery Lane, E.C., 2s. 6d. You do not say whether the engraving machine is for wood, copperplate, or stone, but in any case we never heard of any machine that would outline, and regard it as an impossibility, unless by means of the pantograph. All so-called engraving machines are for "tinting," *i.e.*, ruling lines of uniform depth to produce the effect of shading, and even then the "tints," after being cut by machine, require "returning" by hand, that is, cut up to the outline, which no machine can do; it leaves always a certain uncut portion about ⅛ in. at both ends, to be finished after by hand. If you attempt to cut close up to the outlines, the tool would inevitably run through them in some places and spoil the work. The great care and perfect accuracy required in the fitting and construction of such machines must of necessity make them costly, and place them above the means of most amateurs—who further could not be expected to be sufficiently conversant with engraving to utilise them properly. An amateur would have less difficulty in sending his machine work out to a practical engraver to execute for him, a plan adopted by many wood engravers themselves, who would not have sufficient work to make it worth their while to have a machine of their own. Mr. E. Badoureau, Poppin's Court, Fleet Street, E.C., who supplies boxwood tools and all other requisites for engravers, would no doubt undertake this for you, and also any electrotyping you may require.—J. W. H.

Electrotyping Composition.—H. G. (*London, S.E.*).—We do not remember to have heard of any ingredients for incorporating with gutta-percha for electrotype moulds; we think that sulphur moulds would answer best for zinco blocks; they are sharper than either wax or gutta-percha, and would be no doubt largely used for wood blocks but for the heat required, which would injure wood, but could not injure zinc. They are used very extensively in electro-plating, and copying works of art in metal by the use of the battery. American type-founders, we are told, use them for copying type from electro matrices again to form copper matrices to cast in.—J. W. H.

China Cement.—W. J. L.—Like you, I should only be too pleased to meet with a cement that would join glass and china so as to stand heat and wear; I do not know of any that will do that. For small clean breaks I have used Lepage's liquid glue, but it has been for ornaments that are not much handled nor subjected to heat. Some of the cements sold make good joins, providing you heat the two parts very hot, and bind tightly with tape until perfectly set; in fact, the way of using cement has more to do with a strong join than the kind of cement used, the great point being to make the articles hot enough. Many are afraid to heat delicate glass or china, and therefore their failures. Shellac makes a very strong join, if both pieces are heated sufficiently to fuse the shellac; but the disadvantage of this is that it shows a dark mark upon a piece of white china. Should you wish to try experiments in making cements, I shall be glad to assist you with recipes if you will apply through "Shop."—W. E. D.

China Repairs.—H. S. B. (*Watford*).—(1) Both the drills and bits used in drilling glass and china are of a special kind, and used only for this work. The drill consists of a steel spindle about 14 in. long, tapering at one end, weighted by a piece of hard wood, and rotated backwards and forwards by tapes coiling and uncoiling round the spindle. The bits are diamond chips cemented into a tin holder made to fit the tapering end of the spindle. (2) No; I do not think the rivets can be bought ready-made, at any rate; it is usual to make them, and the operation is a very simple one. Take a piece of brass wire the thickness you wish your rivets to be, say 12 or 16 gauge, according to the

size of the work; file or scrape with an old knife one side quite flat; turn down one end at right angles about $\frac{1}{16}$ in. (more or less), flat side underneath; place this in one hole, carefully mark where the other turn should come, cut off, turn down in the nippers, and the rivet is finished. (3) The cement used to fill up the holes and cracks is simply plaster of Paris mixed with a little water. Be careful to make the rivets fit as tightly as possible, and do not depend too much upon the cement for holding them in; in fact, if they need a gentle tap with a hammer to cause them to spring into their places, it will be all the better. Further questions I shall be glad to answer through "Shop."—W. E. D.

Red Stain.—F. W. R. (*Norfolk*).—Beech cane-seated chairs are finished in various shades of red, so that your question is rather vague as it stands. However, I suppose you want to know how to stain them in so-called imitation of mahogany. If this is the case, it may suffice to tell you that any mahogany stain will do, and that it is applied in the usual way. The manufacturers of these chairs usually, I believe, buy their stains; but if you want to make your own, you may do so with Bismarck brown, of which you can easily make a solution. If this is too red for your liking, reduce the colour with vandyke brown.—D. D.

Ebony Stain.—G. T. (*Kettering*).—To make a good black stain, boil logwood chips in water till the colour is extracted. Put iron filings in vinegar, and let them remain some time. A mixture of the two liquids forms a good black stain, depending for its intensity on the strength of the materials making it. If not deep enough in hue add a little gas black. Sometimes a little indigo is added. Black stain can be bought better and cheaper than it can generally be made on a small scale. If you want the colourless varnish for cabinet work strengthen good white French polish by allowing resin to dissolve in it.—D. D.

Easily-Made Fret Machine.—A. J. P. (*London, S.W.*).—Will endeavour to send another drawing of the work, page 651, Vol. I., "Easily-made Fret Machine," referred to by F. R. C. B. (*Camberwell*).

Patent Medicines.—W. H. (*London, N.*).—You do not make allowance for the necessary delay of publication.—C. C. C.

Electric Bell Construction.—W. B. (*Highgate*).—"Electric Bells and all about them," by S. R. Bottone, published by Whittaker & Co., price 3s., is a good elementary work on this subject; from which you may learn the principles governing their construction. I should also advise you to get Mr. Allsop's treatise on "Practical Electric Bell Fitting," published by E. and F. Spon, price 3s. 6d. This deals with the details of electric bell fitting, and their maintenance in working order. You may learn something from the recently published articles in WORK on burglar alarums, as these give an illustrated description of electric bells.—G. E. B.

Gassner Battery for Electric Light.—J. H. H. (*Rochdale*).—Three cells of a Gassner battery will be useless to provide current for lighting up a small sitting-room with the electric light. I must refer you to my articles, "Model Electric Lights," which will shortly appear, for further information respecting the best battery to use for this purpose.—G. E. B.

Indicator for Electric Bell.—WORKIST (*Lambeth*).—You will find illustrated description of a good drop indicator on page 313, No. 20, Vol. I., of WORK. Others will be forthcoming in future numbers. The cost of making will depend upon how many parts of the indicator you can make yourself.—G. E. B.

Recharging Gassner Cells.—G. H. (*Middlesbrough*).—On receipt of your letter I communicated with Mr. J. T. Mayfield, 41, Queen Victoria Street, E.C., the London agent for the Gassner Patent Battery. In his reply he asks, "has your correspondent ascertained whether the patentees are ready to recharge the Gassner cells or not, or does he *assume* the contrary? We shall be ready to charge the spent cells at a very low price, but we cannot name a figure, as up to the present time there have been none to recharge. Your correspondent is looking well ahead, for we expect the cells to stand a few years of ordinary use before they will need recharging. It would be mere guesswork to say what is the real chemical action in the cells whilst at work, and also whilst being recharged, as the composition of their contents is kept secret. The wear of the zinc is uniform, so there is no danger of wearing through." A Gassner cell has been known to ring a 3 in. bell through 1 yard of No. 20 copper wire for 286 hours without stopping. It was then stopped for 24 hours to rest, after which it was connected up to a bell through a high resistance and continued working it for 60 days without interruption. So says a circular sent me by Mr. Mayfield. The recharging current must, of course, be a direct one, having an E.M.F. high enough to overcome the resistance and cells, and oppose their fully developed counter E.M.F. It would be safe to reckon on at leasts 2 volts per cell, hence six cells in series will require a 12 volt current to recharge them.—G. E. B.

Dissolving Sal-Ammoniac.—G. J. (*Barnsley*). This will readily dissolve in warm water. A large number of bell fitters put the sal-ammoniac in the outer cell and add the water, allowing the salt to dissolve. The most approved method, however, is to dissolve sal-ammoniac in warm rain water until the water will not dissolve any more, dilute this solution with an equal bulk of rain water, and charge the outer cell with this "half saturated" solution.—G. E. B.

Combination Wardrobe and Bookcase.—WARDROBE (*Glasgow*).—If all would send a rough sketch of what they want—as you have done—queries would be more easily replied to. As you are a working man, I have only given *one* robe compartment; if you do not find that sufficient, increase the width. I have put the doors on the side, as, if they opened in front, you would very seldom have books wide enough to fill the shelves; whereas in the side cupboard no room is lost. Two drawers on each side, and one inside the long cupboard, will, I think, be sufficient. For making these, and also for details of joinery, read late articles, such as "Some Lessons from an Old Bureau," etc; and for one way of making plinth and cornice, *i.e.*, the bottom and top parts, see my article entitled "Combination Bedroom Suite," No. 26. As I intend this wardrobe to be about 3 ft. 6 in. wide, $\frac{3}{4}$ in. wood will be thick enough for most parts. The long door stiles might be 1 in. thick. Silvered glass in the front will look much better, and be more convenient than wood. At each side on the top I have left a handy space for articles of ornament or use. Presuming that you will make it of $\frac{3}{4}$ in. wood, the following will be the measurements. Total width of back-board will be 3 ft. 6 in.; height, 6 ft. $\frac{3}{4}$ in. To this is joined, at the distance

A Combination Wardrobe and Bookcase.

of $16\frac{1}{2}$ in. (inside measurement) from each other, and at an equal distance from each end, two boards, each 6 ft. long and $17\frac{1}{4}$ in. wide. Then a bottom board, 3 ft. 6 in. long and 18 in. wide, is fitted beneath these, and a top board, 18 in. long and $17\frac{1}{4}$ in. wide, will surmount the centre cupboard. Next you require two boards, each 5 ft. long and 12 in. wide, which are joined to the cupboard sides, each forming a side of the book cupboards. At the tops of these, connecting them with the centre cupboard and back of job, are boards each $17\frac{1}{4}$ in. by 12 in. When the plinth and cornice are fixed, the skeleton of the article will be prepared. The length of the centre door will be 6 ft., the width $16\frac{1}{2}$ in. Door stiles will be 2 in. or $2\frac{1}{2}$ in. wide. You will scarcely require the bottom shelves in the side cupboards lower than I show them. The two top shelves will each be $16\frac{1}{2}$ in. by $11\frac{1}{4}$ in.; and the two boards, between which the two drawers run, will each be $16\frac{1}{2}$ in. by 12 in. You can easily ascertain what distance apart you would prefer these shelves, and the size of the drawers. The length of the side cupboard doors will be determined accordingly. In the long cupboard are trays (movable or fixed) for collars, cuffs, etc. One is supported by strips of wood fixed underneath it along the cupboard sides; the other by the drawer framing. The fronts of the trays and drawer must be at a distance of 1 in. from the front, to allow for the thickness of the door. Pediment, shaped pieces, and ornamentation, I will leave to individual choice. These are only bare measurements; you must allow for the various joints.—J. S.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. W. (*Dinting*); E. A. R. (*London, W.C.*); H. A. T. (*Bermondsey*); J. B. (*London, S.E.*); A. H. F. (*Cheltenham*); OXIDE; DIPLOMAS; A. B. (*Manchester*); LIVINGSTONE; HOPEFUL; A. B. (*Bow, E.*); C. H. (*London*); A CONSTANT READER OF "WORK"; TERRA COTTA; J. S. (*Spilsby*); A. P. (*Herne Hill*); C. B. (*Manchester*); F. M.; W. L. C. (*New Cross*); F. T. (*London, N.*); Q. J. E. (*Worthing*); MOTO; A NOVICE; J. G. (*Blackburn*); G. A. D. (*London, E.*); D. W. R. (*Walsall*); J. F. (*Donegal*); F. E. (*Wakefield*); G. S. (*Holmwood*); W. B. (*Leeds*); J. H.; TELEPHONE; THE BRITANNIA CO.; NEMO (*Sandbach*); W. A. Y. (*Cambridge*); MONA; G. W. (*Airdrie*); J. C. (*Rugby*); F. W. W. (*Brixton*); F. MCC. (*Birmingham*); A. C. (*Birmingham*); ENGRAVER; F. B. (*London, S.W.*); FRANK AND HUBERT; AQUILUS; AN AMATEUR IN PROCESS OF CONVERSION; W. R. (*Sheffield*); E. A. F.

Trade Note.

FROM the Third Statistical Tables and Report of Trade Unions, compiled by the Labour Correspondent of the Board of Trade, it is satisfactory to be able to give from this report a refutation of the statement often made that the union funds are misappropriated to strike purposes. Thus, the returns of 39 societies, with a total membership of 274,727, had in the year 1888, when strikes were numerous, only expended an aggregate of 2s. $4\frac{1}{2}$d. per member on strike pay. As illustrative of the depauperising benefits resulting from the unions, we note that of those included in this report 32 per cent. have superannuation benefit, 66 per cent. a sick benefit, 70 per cent. an unemployed benefit, and 81 per cent. a funeral benefit. As a result of his investigations, Mr. Burnett remarks:—"Almost invariably a period of improved trade leaves strongly marked tokens of its arrival and duration upon the statistics of trade unions. These indications are shown in various, and sometimes in unexpected, ways. There is in the first place an increase of members; very often, though not always, an increase in the amount of income, but invariably a decrease in ordinary expenditure. Not only is the demand for unemployed benefit less, but very generally the sick and funeral expenditure is less than in years of industrial depression.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	.. .. ..	1s. 8d.
6 months, "	.. .. ..	3s. 3d.
12 months, "	.. .. ..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [15 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 sheets, 2s. 6d. All post free. Lists free.—F. COULTHARD, East Cliff Terrace, Bournemouth. [1 S

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [17 R

Glass Silverer and Beveller.—EDWIN HAMMOND, Junction Road, Romford, Essex. Please state requirements. [19 R

Mothers—The "Victor Carriage" combination perambulator and cart), 32s. 6d., carriage paid England or Wales. Dublin for Ireland, Glasgow for Scotland.—MARRIS & COOKE, Grimsby. [18 R

Photo Goods, burnishers, castings for ditto; illustrated list, 3d.—BUTLER BROS., Bentham Road, South Hackney, London. [2 S

Model Ships' Fittings, engine castings, etc. Illustrated Catalogue, 4d.—STIFFIN & CO., 324, Essex Road, London, N. [3 S

Machinery and Tools.—Largest Stock in London. BRITANNIA CO., 100, Houndsditch. Cash or Hire Purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks and Dies, Forges, etc. Catalogue of new, 6d.; second-hand, 2d.—BRITANNIA CO., Colchester.

Best Book on Lathe, Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [21 R

Six Cabinets for 3s. 6d.—To prove the excellence of my productions, I will send on approval to all readers (who, within six days, send Carte or Cabinet Photo) one highly-finished Cabinet copy and return original. *No payment unless absolutely satisfied.*—ETHELBERT HENRY (late HENRY BROS.), Alvaston, Derby. [22 R

"**Bird Stuffing,**" illustrated, 7d.; "Egg Collecting," $3\frac{1}{2}$d.; Egg Drills and Blowpipe, 1s.—Messrs. DAVIS, Entomologists, Dartford. [4 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

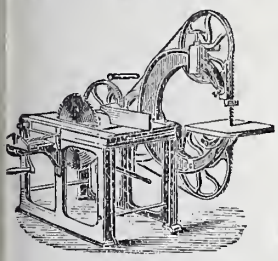
Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

LEWIS & LEWIS,

ENGINEERS,

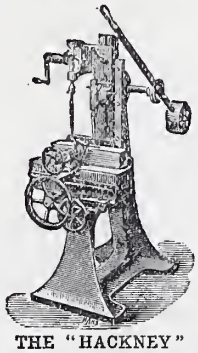
CAMBRIDGE HEATH,

LONDON, N.E.



THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,

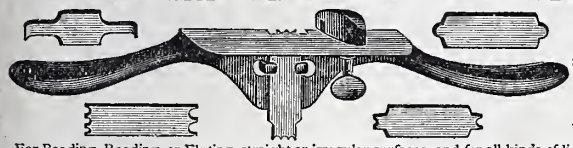
For Hand or Power, will take in 2 in. Circular Saw, and will cut by hand-power up to 5 in. deep.



THE "HACKNEY" MORTISING & BORING MACHINE, With 8 Chisels, 1 Coredriver, Key, 3 Augers, and 3 Drills.

NOTE.—Our New Illustrated 200-Page Catalogue is now ready, containing 700 Illustrations, of all the Latest Improved Tools for Carpenters, Joiners, Engineers, and all Metal Workers, Carvers, Fretworkers, &c. By post, **6d.** The Polytechnic List of Tools for Students on application.

UNIVERSAL HAND BEADER.



Iron Stock, with Seven Steel Cutters, **5s.** each.

Free by Post.

For Beading, Reeding, or Fluting, straight or irregular surfaces, and for all kinds of light Routering, this Tool is invaluable to Wood workers. Seven superior Steel Cutters go with each Tool. Both ends are sharpened, thus embracing Six ordinary Sizes of Beads, Four Sets of Reeds, Two Fluters, and a double Router Iron (⅛ and ¼ inch). The Cutter is firmly clamped to the Stock. A Gauge with long straight bearing surfaces is used in ordinary work; and a Gauge with oval bearing surfaces is used for curved or irregular forms of work. Either Gauge can be shifted from one side of the Cutter to the other, without separating it from the Stock, and can be rigidly set at any required distance from either side of the Cutter.

Note the Address—**MOSELEY & SON, 323, High Holborn, W.C.**

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

STERN'S

PUMILINE LINIMENT

NEVER FAILS to give immediate Relief and finally to cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

T. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

WATERPROOF FLUID GLUE.

(Patent.)

By post, **1s. 3d.** *and* **8d.**

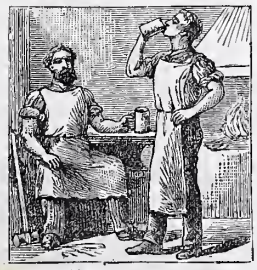
WATERPROOF GLUE CO., 62, Dale Street, LIVERPOOL.

Monthly. 4d.

CASSELL'S TIME TABLES.

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

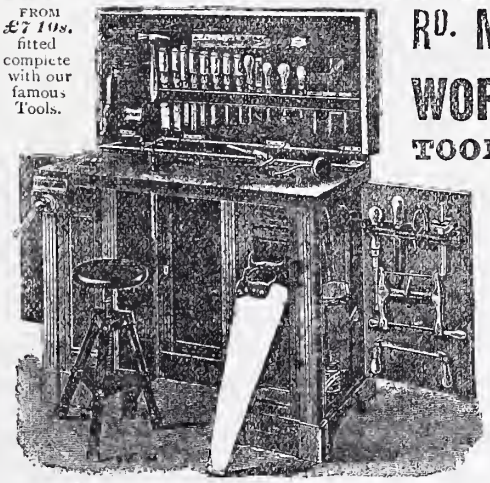
One Tablespoonful of Mason's Extract of Herbs makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

FROM £7 10s. fitted complete with our famous Tools.



RD. MELHUISH'S PATENT WORK BENCH AND TOOL CABINET.

Illustrated Lists Free by Post.

Excellence of TOOLS for Wood Carvers and all Metal Workers.

Bronze Medal - 1884.
Gold Medal - - 1890.

We hold the most complete Stock of Tools and Hardware in this country.

RD. MELHUISH & SONS, 84, 85, 87, Fetter Lane, LONDON.

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.

SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

PRICE, TALBOT & CO., LIMITED, LATE DALE & Co.,

26, LUDGATE HILL, LONDON, E.C.

WATKINSON & LONSDALE.

WRITE FOR PRICE LISTS

MANUFACTURERS OF *Photographic Apparatus,*

NEW BRIGGATE, LEEDS.

Post Free on Application.

CASSELL'S CLASSIFIED CATALOGUE.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents, 37, CHANCERY LANE, LONDON, E.C.

MELLIN'S FOOD

FOR INFANTS AND INVALIDS.

MISS STOECKER.
Age 3 Years.

"27A, Sloane Street, London,
"18th February, 1889.

"Mrs. A. STOECKER encloses a photo of her little girl, who was fed entirely on MELLIN'S FOOD for more than a year, and she has never had an illness."

Samples, Pamphlet, and Prospectus Post Free on Application to

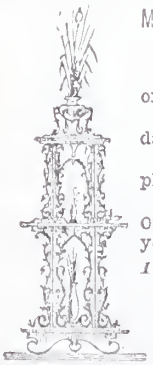
G. MELLIN,

Marlboro' Works, PECKHAM, S.E.

FRETWORK AND CARVING.

Highest Award—Gold Medal for Tools and Patterns.

NO. 731



OCCASIONAL TABLE. SIZE 26" × 18 INS.

Machines, Designs, Tools, Wood, Mirrors, Hinges and Fittings, Varnish, etc.

T. N. writes:—"I got a First Prize from one of your Designs."

R. W. A.:—"Received your Catalogue today, and consider it the best I have seen."

R. B. M.:—"Machine to hand, am highly pleased with it."

J. A. S.:—"I have taken Eight First and One Second Prize with various patterns of yours."

Illustrated Catalogue of all Tools, Wood, etc., and 500 Miniature Designs, free for Six Stamps.

Harger Brothers,
SETTLE, YORKS.

NO. 730.

FLOWER OR LAMP STAND. SIZE 44 × 12 INS.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic **WEAKNESS** speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,
President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—**THE MEDICAL BATTERY CO., Ltd.,**
52, OXFORD ST., LONDON, W.
(Corner of Rathbone Place).

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 62.] SATURDAY, MAY 24, 1890. [PRICE ONE PENNY.

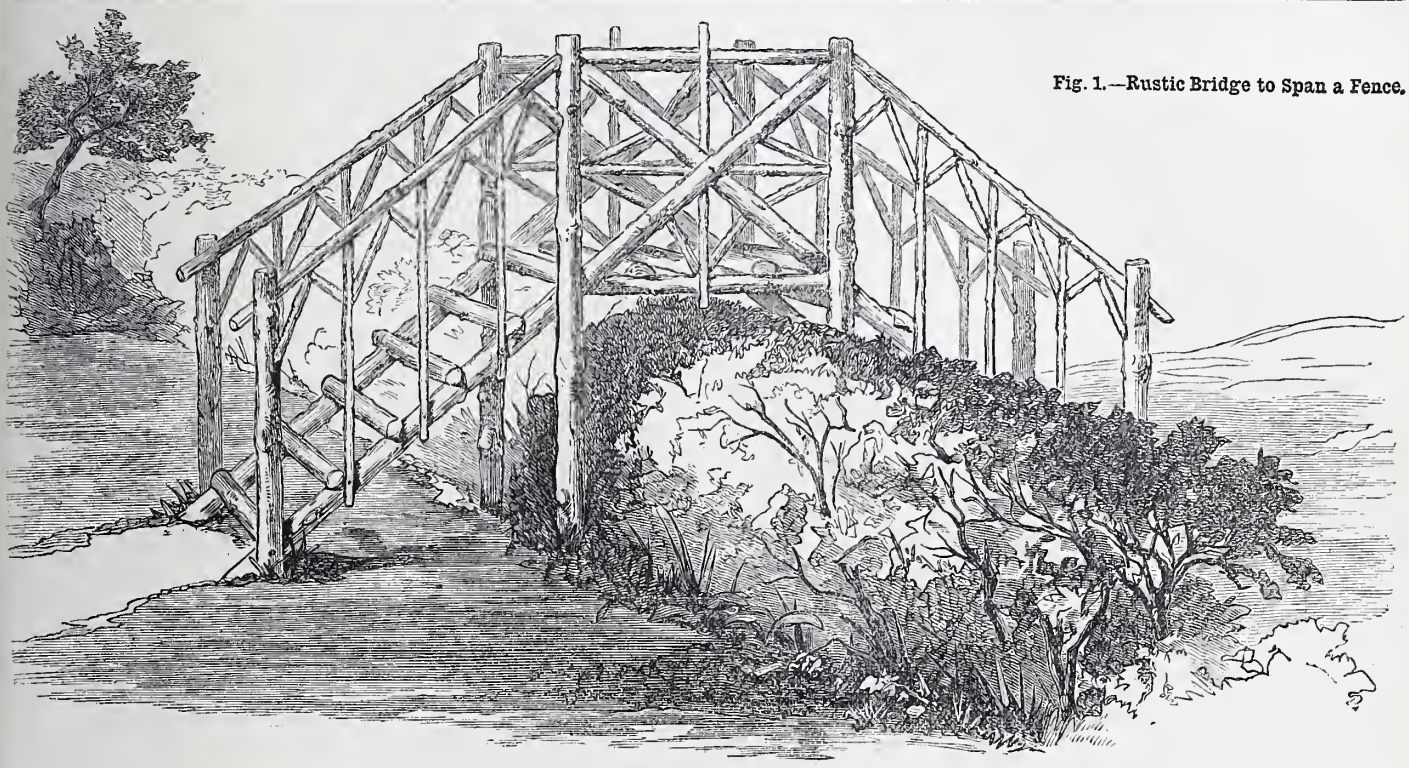


Fig. 1.—Rustic Bridge to Span a Fence.

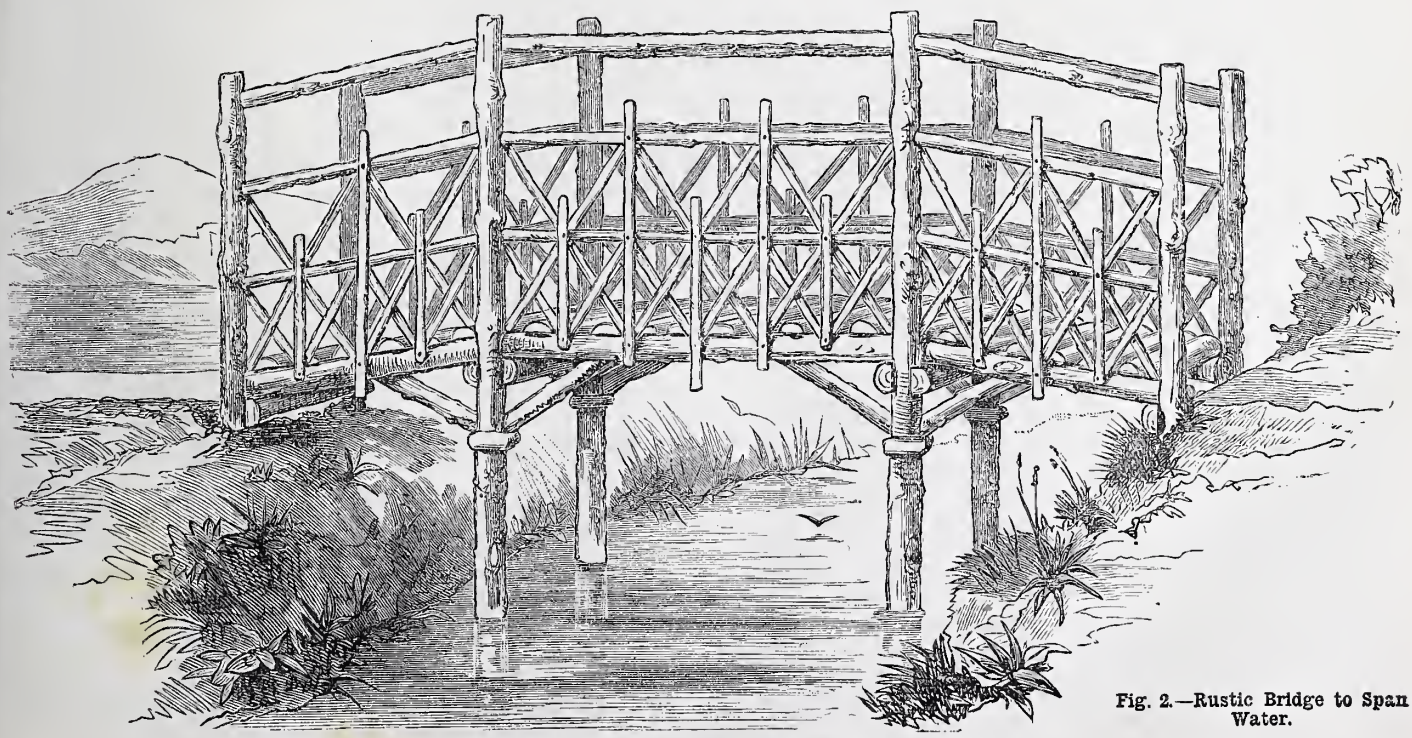


Fig. 2.—Rustic Bridge to Span Water.

TWO RUSTIC BRIDGES FOR THE GARDEN.

TWO RUSTIC BRIDGES FOR THE GARDEN.

BY ARTHUR YORKE.

THE RUSTIC BRIDGE AS A MEANS OF CROSSING A FENCE—REASONS FOR ADOPTING IT—CONSTRUCTION OF SUCH A BRIDGE—RUSTIC BRIDGES TO CROSS WATER—A WORD ON THE INTRODUCTION OF WATER AS A FEATURE IN GARDENS—AN INSTANCE—CONSTRUCTION OF THE BRIDGE GIVEN IN THE DESIGN.

RUSTIC bridges can scarcely be introduced as things necessary to the completeness of every garden. It is not through every suburban plot that a river or even a trout brook can be made to flow. The reader will, however, observe that one of the designs given is intended for bridging dry land only, and those to whom this may be useful or suggestive will be many in number. This bridge, though not exactly like the step-stiles with which one meets in a country ramble, might perhaps, instead, not improperly be called a step-stile. It is, as shown in Fig. 1, for crossing a quick-set hedge or other fence. As a means of entrance to, and of exit from, a garden, it would scarcely be suited for general traffic; it is rather for use where merely an occasional way, and at the same time an ornamental object, are desired. Apart from picturesqueness, it has certain advantages over a gate. No gap needs to be cut for it; it does not injure the fence, nor will stray animals avail themselves of it, as of an unfastened gate, for giving the gardener their unwelcome company, for no four-footed creature less active than a cat would be able to cross it.

The illustration given of it in Fig. 1 is in perspective, since being by no means a familiar structure in rustic work, it might otherwise have been difficult to realise its appearance; whilst its construction is so simple and so easily seen as to need no further diagrams. Two pairs of side timbers set, as a herald would say, "chevron-wise," and strengthened by two pairs of upright posts, are placed a convenient distance apart—in the illustration about 2 ft. 6 in. These are connected by the steps which are nailed or pegged into notches cut in them. A handrail connected with a very little ornamental rustic work is added. The bridge in the illustration is shown as spanning quite a low clipped hedge, but were the fence a more formidable one and the four posts consequently higher, it might perhaps be well to strengthen them with an additional tie in the shape of diagonal braces connecting each pair just below the steps.

A more simple bridge of this kind may be made without posts—those for the handrails only excepted—by placing the side-timbers more like an inverted V, the topmost step resting upon its apex, and with another inverted V as a handrail. Such an arrangement would require less material and less labour, but it would be more steep and more difficult to climb than that before us. The steps in Fig. 1 are, it will be observed, as easy of ascent as an ordinary staircase, whilst the little landing or platform on the summit, which is wanting in the V-shaped bridge, constitutes a pleasing feature. The steps here being pretty closely laid, it is no bad place in which to loiter for awhile.

The design, Fig. 2, is for an ordinary bridge to span water. Fewer persons, perhaps, will need to make use of it than of the last; yet there are gardens in which something of the kind might be used advantageously. Where water can be introduced in a garden, it may always under tasteful management be made a pleasing feature. Some time since, an acquaintance of the writer undertook the highly unpromising task of turning into a garden a portion of a disused brick field which lay near his house. Anything more hopelessly ugly than the clay pit which he took in hand, with its bare bluish banks and its pool of stagnant water at bottom, it would be hard to imagine. His friends laughed at him; but he went quietly to work. Some portion of the pool he filled up so as to make it into a long, irregular piece of water. At one end, and a little above its level, he built a summer-house. He planted his bare banks with our native, hardy English shrubs, of which he got together an interesting collection, and than some of which, as instance the furze and broom, nothing could be more lovely in their season. Over banks where nothing else could be made to grow he trained ivy. The edges of his pond he filled with aquatic plants, in the beauty of which you forgot that it was stagnant water only in which they grew. His paths, which sometimes wound along the high banks and sometimes skirted the pond, were in two places carried over narrow parts of the water on rustic bridges, so placed as to show most effectively from the summer-house; and these being like our present design rendered as ornamental as might be, formed no mean part of the attractiveness of his little paradise. Thus with some outlay, it must be admitted, of taste and labour, he made a most pleasant retreat of a spot otherwise valueless and a mere eyesore. This is mentioned to show how objects like the present design may be utilised to good purpose.

As to the particular bridge in the illustration, although it has been drawn in perspective, the side nearest the spectator may be considered as an elevation to scale ($\frac{1}{2}$ in. to the foot), and it is shown as spanning a water some 5 ft. broad. Such a breadth might, of course, readily be crossed by a bridge of which the side-timbers were merely two straight pieces. But in matters of this nature, appearance is of almost more importance than use, and it would not be possible to render a straight bridge so picturesque as one in which, as in the illustration, the centre is higher than the ends—the gain is worth the extra material and trouble.

The weight is chiefly borne on four main pillars, of which two appear. Each pair of these is supposed to be set about 3 ft. apart, which gives a good width of way for ordinary purposes; the two pairs of shorter posts at the ends have but little strain upon them. Each pair of posts is connected by a cross-piece or pieces, of which the ends only show in the figure. On these cross-pieces rest the side-timbers, to which are nailed the treads of the bridges. These latter are shown to be of half-round stuff, nailed some little space apart; these will wear longer than planks, as water will not lie on them, and in appearance are vastly superior. The handrail is about a yard above the treads, that being a convenient height to lean upon.

For building either of these bridges, no other wood will in any way be found equal to larch.

It is not every one, assuredly, who will be able to find either room or requirement for a bridge in his garden or on the ground that surrounds his house; but it must be remembered that parts of the designs, and especially of Fig. 1, may be utilised and adapted to form means of access to entrances and places above the ground level, or, in other words, to supply a picturesque set of steps or stairs.

MECHANICAL PROBLEMS.

BY FRANCIS CAMPIN, C.E.

EVEN as there is a period for big gooseberries, and for the newspaper discussion of unusual and sentimental topics, problems of a supposed equivocal character are put forward for the mental exercise of a certain portion of the curious public. From the fact that different solutions of the same problem are submitted for acceptance, the conclusion must be drawn that some of the solvers have only confused ideas of some very elementary principles.

All kinds of work, every form of motion, the strength and stability of matter, all terrestrial phenomena, exist in accordance with certain mechanical laws, unalterable in their nature and continuous in their action; and if we give a little thought to the primary principles upon which these laws rest, our labour will be repaid by the acquirement of a distinct perception of what can and what cannot be brought about by any given mechanical means; this clear first notion the student must not allow to be clouded by any subsequent complications built upon it, and if at any time in doubt, by reason of the complexity of a machine, let him consider what takes place at each end, according to his own calculations, and see how that accords with primary laws, which can never be varied by any mechanical arrangement whatever.

The first law to receive is that the total quantity of force or energy is constant; it cannot be increased or diminished in quantity, although its form may be altered. It is this law which precludes the possibility of perpetual motion machines. In the sense of machines that shall create power, perpetual motion at a constant velocity may be conceived to exist as motion simply, no work being done; but as in the motion of every machine there are frictional resistances to be overcome, mechanical perpetual motion is impossible, and it may further be remarked that if it were possible it would be useless, as mere movement unaccompanied by a delivery of power can effect nothing. "From nothing, nothing comes," is, in one form or other, one of the oldest dogmas of philosophy, and to the disregard of it has been due the immeasurable waste of time and money, brought about by the perpetual motion infatuation. As an instance of how obstinately dull even an educated man once absorbed in this study may become, I will mention one of many that came within my own knowledge some years ago, and it is only one of a very common type. This inventor required the assistance of an expert in perfecting the "mechanical details" of his machine. "The machine was a success; it worked all right, but there was a *little hitch to be overcome* at one part of the revolution." The italics are mine. The overcoming of that "little hitch" simply meant imparting sufficient power to the machine to enable it to overcome the frictional resistances of the next revolution; yet the inventor could not be brought to see it, and so sacrificed a hard-earned fortune and the latter years of his life to this fancy.

If a single force acts upon a body, motion must ensue; and also if two forces act upon it, unless they are exactly equal in intensity and opposite in direction, when the body will be held at rest, and the general law is that for a body to be at rest any forces acting upon it in one direction taken together must be balanced by other

forces together equal to them, acting in an opposite direction. Now let us get rid of an elementary misapprehension, which arises more from a mode of speech than anything else, which is that any body exists at any time unacted upon by any force. If a ball lies at rest upon a table, two forces are acting upon it to keep it in position: first the force of gravity to draw it vertically downwards; second the cohesive elastic resistance of the material of the table acting vertically upwards. When the ball is placed upon the table the latter bends (although not sufficiently to be visible to the unassisted sight) until its upward resistance is equal to the weight of the ball.

This action can be more clearly shown by placing the ball upon a flexible spring, the deflection of which will be plainly visible. Two laws have now been set forth: first, that the total quantity of energy in existence in all forms is constant; and second, that if forces are acting upon a point at rest, the action and reaction must be equal, and in opposite directions. Now let us turn to the effects produced by unbalanced and partly balanced forces.

The value of a force is measured by the velocity it will impart, when unresisted, to a body in a given time; thus the attraction of gravitation will in one second impart to a falling body a velocity of $32\frac{1}{5}$ feet, if the body is falling freely, and by comparison with this other forces, such as centrifugal, can be measured. At the end of two seconds the velocity will be doubled, and so on; from this we can easily calculate the velocity any freely falling body will acquire in a given time. One use of this will be seen further on.

When "work" is spoken of, a resistance, overcome through some distance, is inferred, and it is usual to speak of it as pounds pressure, exerted through a given number of feet; thus, if a truck is pushed 100 feet by a steady pressure of 80 lbs. against it, the quantity of work done is 100 feet multiplied by 80 lbs., equal to 8,000 ft.-lbs. If a weight is lifted vertically, the work done in lifting it is equal to the amount of the weight multiplied by the height to which it is lifted; if the weight so lifted is allowed to fall against a resistance, it is capable of doing the same amount of work in its descent as was done upon it in lifting it, and if it falls unopposed, this amount of work will at the end of its fall be accumulated or stored in it, and instead of coming to rest it will have a certain velocity, calculable as shown above. All moving bodies have energy or work accumulated in them, in proportion to the velocity of motion, no matter what direction the motion takes, and the amount of such work is equal to the weight of the body multiplied the height it would require to fall to attain such velocity. The falling body starts from a state of rest, so its mean velocity would be half the final velocity, and this multiplied by the necessary time of fall will give the required height. The time of fall is found by dividing the final velocity by $32\frac{1}{5}$. This may be illustrated by the case of a train assumed to weigh 120 tons and travelling at a rate of 40 miles an hour. There are 5,280 feet in a mile, and 3,600 seconds in an hour, so the velocity in feet per second will be 40 multiplied by 5,280 and divided by 3,600, which equals $58\frac{2}{3}$; dividing by $32\frac{1}{5}$, we find time of fall $1\frac{41}{50}$ seconds; multiplying this by the mean —that is half the final—velocity, $29\frac{1}{3}$, we have the height of fall, $53\frac{1}{2}$ feet, as that corresponding to the velocity of the train.

The train weighs 120 tons, or 268,800 lbs., which multiplied by the calculated fall gives 14,380,800 ft.-lbs as the amount of work accumulated in the train. It must be clearly understood that it does not matter from what source the work is transmitted—gravity, steam, electricity, or any other—the accumulated work depends solely upon the velocity and weight of the body under consideration, and, simplifying the above method—which I have used to make the reasoning clear—will be found by multiplying the weight in pounds by the square of the velocity in feet per second, and dividing the result by $64\frac{2}{5}$. As no energy can be destroyed, this accumulated work must be transformed into some other form of force in order to stop the train. If the steam is shut off and the train allowed to run until it comes to rest, the stored work will be expended on friction of axles and air resistance, and be converted into heat; and if brakes are applied it also will be converted into heat if the train is running on a level; if the train is running up hill, part of the accumulated work is spent in raising it; if running down, the gravitation of the train is adding to the stored energy, and this addition must also be converted before the train is brought to rest. We can thus trace the heat given off by the coal in the boiler furnace through its first change into motion of a solid body, back to its re-conversion into heat, which passes away to cause the growth of plants and trees, that may in distant ages again appear as coal, and thus complete the cycle of changes.

There is in this matter another point to be considered, which I have never seen explained in text-books or elementary articles on mechanical matters, and which, therefore, to complete the illustration, I shall here deal with; for although it does not affect the practical working, yet its study will help to clear away such cobwebs as obscure the fancy problems mentioned at the commencement of this article. We know from daily experience that if we wish to put a body in motion we must have some abutment from which to work. We press our feet against the ground at an angle to get thrust against a truck; the explosive which drives a ball from a gun presses equally against the breech, causing the recoil; and generally the propelling force acts between two bodies, and the greater velocity is imparted to the lighter mass, in the ratio of the weights and other resistances of the masses. If one surface were absolutely fixed, the whole motion would be applied to the other; but there is nothing absolutely fixed, not even the earth itself, which is both moving through space and revolving upon its axis. Now, in respect of two forces acting upon one body, it does not matter what disproportion there is between them, the less must modify or increase the larger, according to its direction and intensity. If one drop of rain falls into the Pacific Ocean, there is that quantity of water added, although we cannot discern it, and the slightest change of force cannot occur without producing an effect—small, inappreciable by our senses perhaps, but still, produced.

Now, when the brakes are applied to a rapidly moving train, there is a very considerable pull upon the rails, and this pull must be transmitted to the earth, and tend to increase or retard its rotative motion, and for this there must be a compensation, as its rotative motion does not, on the average, vary, and this compensation is in the starting of the train. When the engine is started it is a question whether it moves forward or the rails beneath it backward, and while the speed continues accelerating this backward force acts on the rails and on the earth; as soon as a uniform speed is maintained, the forward pressure on the air is equal to the backward force on the rails, and equilibrium occurs so long as the speed remains unaltered. This applies directly to the following catch problem. A bullock or other animal is fastened by a long chain to the mast of a vessel; he is supposed to be standing aft, when he suddenly rushes forward to the end of his tether, where he is suddenly pulled up. Will the shock of stopping him augment the speed of the vessel? Certainly it will; but during his rush the backward pressure of his feet, corresponding to the forward momentum he was acquiring, was retarding the vessel—the effects of his efforts upon himself and the vessel being proportional to their weights and resistances to motion. This question may be put in many different shapes, but will always work out the same if all the circumstances of the case are fairly considered.

Another problem is:—Suppose two trains travelling in the same direction at the rate of one mile a minute and being a mile apart, and at the rear of the first train there is a cannon, loaded, and capable of discharging its shot at a muzzle velocity of one mile a minute, what will be the result of firing the cannon? The ball within the cannon is moving in the direction of the train, at the rate of a mile a minute, so when the powder is fired which would give it that velocity in the opposite direction, it simply arrests the motion of the ball the cannon leaves to fall on the road; the reaction of the powder on the breech of the cannon imparts to the train the momentum previously invested in the ball, therefore the train has the same accumulated work, while its weight is reduced by that of the cannon ball, and its velocity therefore proportionately increased.

From the foregoing remarks it will be seen that the points raised admit of very clear and simple treatment, and call for no particular mathematical ability for their solution, and yet it is astonishing how many people are puzzled by them, though this may in some degree be explained on the ground of expecting something involved where all is clear; but at all events they afford an opportunity of showing how perfectly the forces of nature balance, and thereby present an absolute check against all calculations connected with mechanical work.

It is further seen that the principle of action and reaction being equal in intensity and opposite in direction is not in its application confined to forces acting upon a body at rest, but also finds its place in regulating the phenomena of motion. Co-important with all, at the completion of any cycle of events matters are in exactly the same condition as they were at its commencement, thus evidencing the constancy of the quantity of energy in existence.

It might be interesting to some to pursue this matter further, but my idea in making the above remarks has been to emphasise the expression of the primary laws of static and dynamic force without becoming abstruse, and to this end I think enough has been said. At all events, sufficient has been advanced to render the subject intelligible and, I hope, interesting to those who might fail altogether to grasp it if it were brought before them in strict mathematical parlance, and it is to such as these that I venture to recommend the attentive perusal of the present paper.

MY CRICKET BALL: HOW I MADE IT.

BY FRANK HINDS.

I DARESAY many readers of WORK will like to know how I made a cricket ball that stood the knocking about of a season with some old corks and other materials. The corks were cut square and glued together with ordinary glue, and when quite dry I trimmed the cork mass neatly round, and then bound it with twine until large enough, and then glued it well all over and hung it up to dry. Having procured some suitable leather, not thick but strong, I cut four pieces the shape of Fig. 1, in length half and in width a quarter the circumference of the ball, allowing a quarter of an inch all round for the seam. I then soaked the leather in water a short time to make it soft, and then fixed two of the pieces between two pieces of wood cut to the same shape as the leather, for they act as a guide in sewing. I put them into a vice, as shown in the illustration, Fig. 2, the inside of the leather outside, and with two harness-makers' needles—one on each end of a waxed thread—I sewed them together, making the holes with a small stabbing awl. When the two halves were done the seams were laid open and hammered down flat. I then sewed the two halves together on the ball. There are two ways of doing this—one is to sew them together with a straight awl and cut the ends off close, open and hammer down, or to sew it with a bent awl, have the seam bent over, and take in one stitch four pieces of leather instead of two, which makes a much better job and stronger, but more difficult to sew perhaps. Fig. 3 will help to show how to do it. The stitches must be pulled up close; the leather will shrink in drying and make all tight. The seam can be trimmed neatly with a sharp knife and flattened down with a hammer. Harness-makers' needles are needles without sharp points. The slightly bent ones are the best for sewing the leather on the ball. A small bent awl can be had at any leather cutter's, as well as hemp and wax (shoemakers' wax) to make the thread.

The hole in the leather is bored with the awl, and as it is drawn out one needle is passed through from the opposite side; and while one needle is in the hole the other must be passed through one needle, acting as a guide to the other.

It may appear difficult to hold the ball while you are sewing it. Fig. 4 may help you to understand how it is done. A piece of wood, say a foot long, is screwed on the bench with a long screw. Having cut a hole in the centre not quite so large as the diameter of the ball, and with your foot in the strap or string, the ball can be held fast while it is being sewed, and easily turned round.

To some no doubt this may seem a long explanation of a simple job. But I hope it may be of use to some fellow cricketer whose boys have split their cricket ball, and that it will put him in the way to mend it before the next fine day. Many a time they have run to me with a broken ball, and in a few minutes I have made it sound, whereas if they had had to take it to the nearest shop it would have spoilt their afternoon game: or if it had been knocked about more entirely broken to pieces, for the old saying comes in here, "A stitch in time saves nine."

Fig. 1.

Fig 3A.

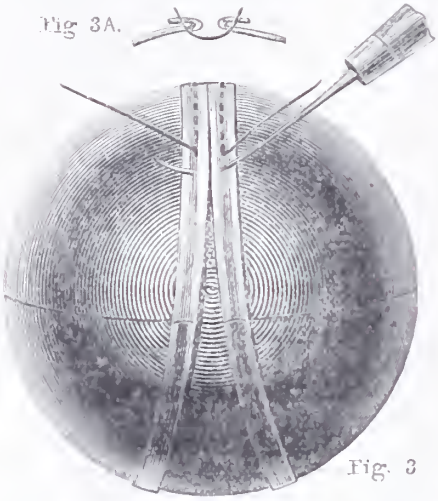


Fig. 3

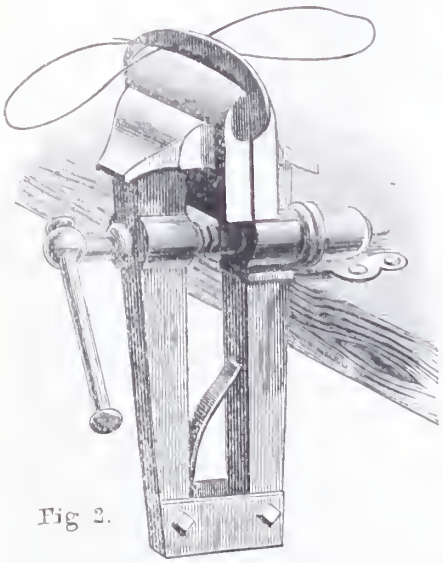


Fig 2.

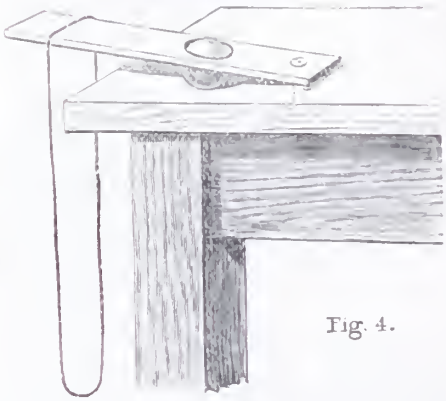


Fig. 4.

Fig. 1. Shape of Gore of Leather. Fig. 2.—Mode of holding Gores when Sewing together. Fig. 3.—Mode of Sewing Halves of Leather on Ball. Fig. 3 A.—Section of Edges of Leather. Fig. 4.—Appliance for holding Ball during Sewing.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

GRAINING, OVERGRAINING, AND SHADING OAK.

THE student of graining must be prepared to expend a considerable amount of his time and patience ere he acquires proficiency in wiping out the "lights" or figure of oak—at which stage of the imitation the subject was left in the last paper. Presuming, however, that each evening for a month at least has been perseveringly devoted to this end, and that the worker has so far availed himself of copy, graining panel, and my previous instructions as to be able to imitate the natural characteristics of the wood in some half a dozen different treatments, he may now with advantage turn his progress to practical advantage by graining an ordinary four-panel door. The door, having been carefully prepared and "grounded" in accordance with my preceding papers, it is finally lightly glass-papered and well dusted down.

In *graining a door oak*, it is advisable to use both a full-size paint-brush and a tool (see "House-painters' Brushes," page 820, Vol. I.) for spreading the oil graining colour. If both are nicely "worn in" to a level edge, and providing the graining colour has been properly mixed according to my directions, no difficulty will be experienced in spreading the same evenly but barely upon the door.

The "rubbing in" of graining colour is worked on similar lines as are followed in plain-painting a door. At the risk of repeating oneself, it is, perhaps, advisable to briefly indicate the method. Suppose, my reader, you stand aside, figuratively, and watch an experienced hand for a few minutes. My first action is to get a small wooden wedge, and so fix the door that I can comfortably work on it. Now, the brushes being well worked into the colour, and being previously clean and free from any white lead or coloured paint, I place the pot conveniently to my right, and with the large brush in my left hand in reserve, I start with the tool. We all know that every door must have two edges as well as two sides; one of these edges is always treated with the inside of the door. You see this door opens towards us, into the room, therefore the front edge belongs to the inside treatment. The edge is now first rubbed in, after which I coat the panel mouldings. It is apparent that a little graining colour goes a long way, as there is sufficient left in the tool, from "working it in" at the start, to cover all the mouldings. Besides the two brushes, you will notice that it is a further advantage to have a smaller one, called a *fitch* (see also "Painters' Brushes"), for this enables me to go into the "quirk" of the moulding and to pick out any superfluous colour at the mitres, without severely rubbing and forcing the hair of the tool into such recesses. Now I change hands with the brushes, and, using the large one, the four panels are coated from the top downwards. Although I find sufficient colour in this brush for one large panel, I must take a "dip" to finish the door. Here, you see, there is a difference from plain-painting a door. When using a body colour, we can take a good generous brushful, leaving the superfluous portion against the side of the paint-pot; but with graining colour, such a quantity would be sufficient for two doors, and would make it impossible for me to give this one the bare but even coating that

is desired. This is a more important matter than it may at first sight appear.

The panels being covered and laid off the way of the wood, from top to bottom, I start with the stile between the top panels, next the top rail, bringing the outer stiles down some distance also. Here, again, I coat the stile between the lower panels, then the wide middle rail, or lock rail; then the bottom rail of the door, and, finally, finish with the long outer stiles, which run the whole length of it. You have seen how, having first spread the colour evenly on each portion so that it is all the same depth, I lay it off lengthways, or perpendicularly, just as the wood is used which forms each part of the door; and now, having given the mouldings a final "lay off" with the tool, you can bring out your combs and graining tools and start with the four panels.

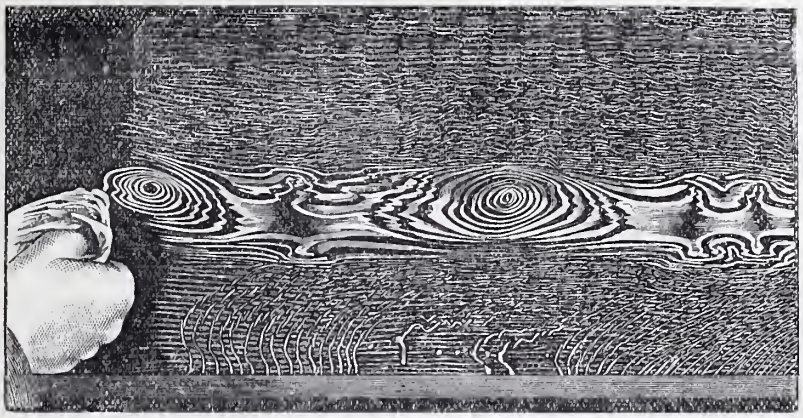


Fig. 24.—How the Sap is wiped out.

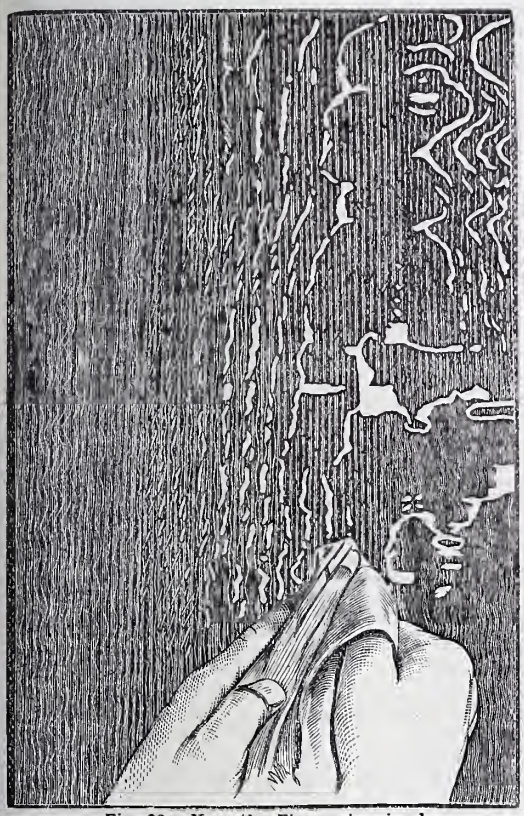


Fig. 22.—How the Figure is wiped.

The varieties of plain combing in oak graining is a matter it will now profit the student to consider here.

Assuming that the door panels have been creditably combed and veined after the manner indicated in the preceding paper, the learner will naturally inquire, "How should the remainder of the door be treated?" In offering some assistance upon this point—which is one that scarcely any two grainers are entirely agreed upon—I must mention that there appears to be two working principles which stand before any questions of individual choice or experience. The first of these—that the constructive lines and framing of the woodwork must be *rigidly* adhered to—is a matter I have explained in "rubbing in" and "laying off" the colour. Second to this, we have to consider it the duty of the grainer to treat the door in such a manner that its *design* and proportions shall be clearly displayed and "set off" to the most advantage.

That the recessed and moulding-framed *panels* are the most suitable portions for the best figured work displayed upon a door no one will question. Such being the case, the woodwork surrounding them should certainly not only frame, but act as a foil thereto. I therefore, personally, must recommend a good variety of cleanly-executed "plain combing" for the bulk of the remaining woodwork. The usual exceptions to this simple treatment are the middle rail, the bottom rail, and, occasionally, the narrow rail across the top. A large proportion of grainers invariably make a practice of imitating a piece of the "heart of oak," or sap portion of the wood, across the entire width of the lock rail. The success of this treatment will very much depend upon the manner of its execution. Fully three-fourths of the "sap" (so-called) that is worked in this position consists of coarse ungraceful markings, unnaturally wiped, and very crudely breaking into the coarse surrounding grain. When, however, a piece of "sap" is neatly and properly executed, I see no reason to condemn its introduction, although it should always be executed with subservient effect to the panels. The alternative treatment of the lock rail is to comb it into grain of a graduated nature, and then to work a little quiet figure thereon—this, of course, being put in across the grain, just as in graining the panels. The latter method is one often applied also to the bottom rail, and is equally acceptable there; whilst the very coarse grain and sap which is occasionally used on the top narrow rail is less happy in effect than on the lock rail.

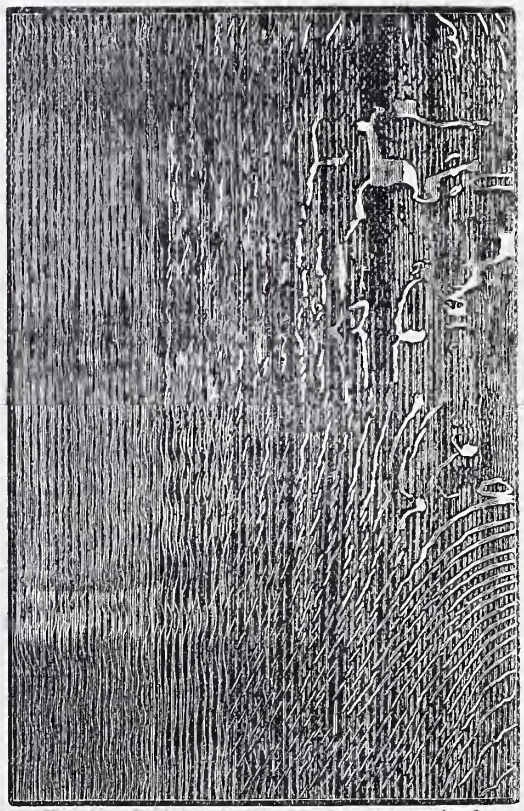


Fig. 23.—Graining in Fig. 22 when overgrained.

The characteristic markings and growth of the sap, or heart, of oak will well repay the student's careful study, and also his practice in "wiping." I am well aware that many good grainers will never use it. Some will say that as the sap is the least acceptable portion of the tree, the carpenter would seldom put it into a real oak door. This may be right in theory, but I venture to think the coarse-grained and sap is to be seen in a real door more often than not. Observation on the student's part will well repay him in

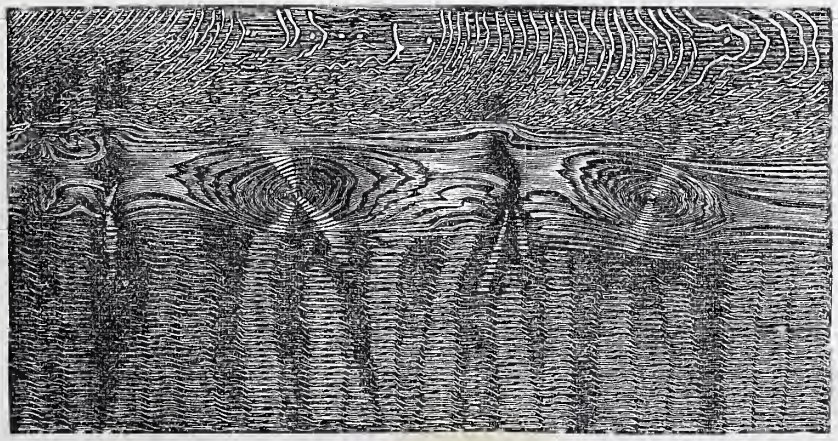


Fig. 25.—Appearance of Sap when shaded or overgrained.

such matters. Again, there are some professional grainers, to one's personal knowledge, who, notwithstanding they are able to wipe the lights most naturally, can only make "a poor fist" with the "heart;" and therefore, knowing this, they naturally decry its use. Other experienced workers also contend that only on the thickness, or "returns," of a piece of work should sap be worked; but this also may not be so acceptable in general practice as it appears on paper, for the grainer who sets himself the task of showing the growth of the wood upon face and thickness both requires exceptional skill and knowledge. Independent of this, I do not think the mouldings of a panel are improved by coarse markings worked *across* their bulk, which would neither assist the contours of the moulding nor give a better effect to the panels.

With this brief consideration of what is most in vogue, and the reason and effect thereof upon the remaining portions of an ordinary door, we will now turn to the completion of our imaginary sample. The graining colour I laid off carefully, as you must both remember and practise, cutting up each joint with the brush in a sharp line. Before using the combs, I here take a handy little straightedge, and laying the thin, bevelled edge against the joints of horizontal rails with the perpendicular stile, I wipe off, with a clean piece of rag, a little of the graining colour from one side. This will further define the joints as they exist in the real wood.

As one specimen of combing effects, I now take a coarse gutta-percha comb and draw down the stile between the upper panels, giving it first a straight and then a slightly angular direction. I now go over this with a medium steel comb, and, using it a little out of the upright, obtain a fair effect of coarse combing. The stile between the bottom panels is now similarly worked, but hardly so coarse in grain. The top cross rail is next combed with a coarse steel comb, and then a fine one, which gives a somewhat light effect. Here you see my combs have gone over the limit and on to the outer stile. This must be put right, or, in combing the latter, we shall get a "muslin" marking instead of a grain. To this end I place the straightedge up the joint, and with the paint tool, used comparatively dry, I remove the objectionable comb marks by carefully brushing them out. The lock rail next invites my attention. Using a coarse gutta-percha comb, I commence on the upper half to wipe out the colour, giving the comb a curving movement, and thus varying the width of grain, and suggesting the formation of the "sap," which is worked into it. I now, with rag and thumb-piece, wipe out the heart, working from one knot, or centre, into another centre, according to the growth in nature, which the learner must explore. To finish this, I take a fine comb, and diagonally cut up the coarse grain surrounding the sap, and also use it carefully upon the latter, taking care that there is no harshness of figure or of general effect, and graduating the coarse combing in a natural manner. The bottom rail I now comb in a plain and graduated effect, and content myself with putting in a few simple lights across the top portion. Making sure that my combs have not again intruded upon the outer stiles, I finish these latter by a level combing with the 4 in. steel coarse comb, and then draw the fine comb in a wavy motion down the entire length. The mouldings finally are combed with a little variety, care being taken, you see, that the mitres are cleanly treated. The door now can stand and dry, when it will be ready for overgraining or shading.

Before leaving this practical stage of the work, I may with advantage indicate some other plain-combing arrangements. If, as is advisable with a learner, he does not try his hand at "heart" upon the lock rail, using instead the graduated combing and simple veining, the whole of the perpendicular stiles might with advantage be treated with the same plain clean combing with two steel combs. The rails should then be worked with a good variety of combing and veining, and the complete effect will be very much as would appear in real oak, the action of light upon the different ways of the "grain" giving the variety of depth at which we are aiming. In combing a light piece of grain, a "woody" effect can readily be obtained by placing over a coarse steel comb a piece of "paperhangers'"—that is, a loose, very open—canvas. A yard of this stuff is a good and useful help to a grainer, but it requires a thorough washing to free it from "fluff" ere it can be used for the purpose mentioned. A piece of rag must always be at hand, and each comb should be wiped after every stroke. Plain-combing in itself makes a serviceable and pleasing finish to the woodwork of basements, etc., and can be recommended before much of the "rubbishy" figuring one sees repeatedly in small houses. Practice alone will make the student a good, clean, and quick worker with the combs, in which matter my written instructions cannot, I believe, further aid him.

Overgraining and shading oak is the final process applied to all imitations of oak worth calling such, the object of which is to give more variety of natural depth to the work, and to enrich the whole effect. It is worth noting here that, beyond the national associations of the wood, and its beauty and serviceability, the oak has another prominent claim for obtaining the first place in any practical considerations of the imitative art, and this from the fact that the two processes of "oil" and "distemper" are both used in graining it. The preceding part of my paper has been occupied with the manipulation of oil colour. In now following the overgraining process, the student, whilst completing his study of oak, will further acquire knowledge and facility of execution such as will materially aid him later on in graining other hard woods, which are usually worked in distemper, or water, pigments.

"Overgraining," as practically interpreted by most grainers, means the application of very weak stains of a pigment, ground in water, upon certain parts of the grain and veining, and in such a manner as the real effects aimed at are displayed in the natural wood. We have previously seen how the grain and figure are obtained by the use of one transparent oil colour manipulated upon a solid, opaque ground. It is at once apparent therefrom that no *variety* of depth of colour is possible with these two factors only, hence the "overgraining," or "over-*shading*, of portions of the oil graining. If we further examine the grain of the real wood, we are easily made aware of what our oil-grained combing now appears lacking in—a variation of shade and a "softening" of some portions of the grain. Beyond colour *depth*, it is the province of overgraining to either warm or cool the oil graining, to enrich or to make more sombre, according to our requirements of finished colour, different constructive divisions of the door or other woodwork. In order to more simply and practically illustrate these remarks, I will take the required tools for overgraining oak in water—viz., a medium oak overgrainer (Fig. 15, "Grainers' Tools," page 40, Vol. II.), the badger-hair softener (Fig. 16), a small piece of sponge, a piece of wash-leather, and a partly-worn paint tool, and with these finish graining our door. The paint-tool, which will answer the purpose of a mottler (Fig. 5) for our present purpose, must be perfectly free from oil paint or grease of any kind.

The water pigments used for overgraining oak are principally Vandyke brown, ivory black, blue black, and occasionally the siennas and Prussian or indigo blue. As I purpose devoting the succeeding paper to a brief *résumé* of the varieties of oak, and the grounds, graining colours, and pigments used for such, I confine myself here to a description of the *modus operandi*, and of those pigments only which I prefer to use in finishing a door already combed and figured in imitation of very light or new oak. To this end, I take a little of each Vandyke brown and blue black (both purchased ready ground in water), and place them upon the side of a palette (an old plate will answer), and have also at hand the tools just mentioned and a little diluted beer in a vessel. Had I a large amount of work before me to overgrain in water, it would be preferable to stain a quantity of the liquid to the desired depth and colour in a vessel; but with only one door side this is not necessary.

Vandyke brown is the pigment most extensively used for overgraining oak, its richness and transparency making it suitable for all varieties. For the new-oak colour applied to our door this pigment alone would give our finished work too warm a general tone. I therefore stain a little of the beer with a little blue black and Vandyke upon the plate, then dip the long oak overgrainer (Fig. 15) into the beer, which makes the hair cling together; and here I work the stained liquid into it, which is ready prepared on the plate. If the overgrainer had not naturally formed itself into the two or three divisions of hair, I could easily have given it that effect with the fingers. With the brush well charged, you see, I now place the hair thus divided upon a panel, and draw it down in line with the grain. This shading I prefer to apply rather sparingly down the figured half of the panel, and, as I replenish the brush after each continuous stroke from top to bottom of panel, notice that the hairs must not separate into divisions of too fine a nature, which would give a "liney" effect to the panels. Before the markings have had time to dry, I now take the badger, and, with a gentle "flicking" motion across the panel, ease off the hard edge of each line. Having similarly treated the two upper panels, the shading being only just noticeable, I take the tool, and, with an equally thin wash, I put in a few broader horizontal shades upon the lower panels, placing them where the grain has been given any decided curl or inclination. This being softened off at once, the lock rail, with its sap, is next treated. The sponge is now dipped into the stained wash, and then, well charged, is "dabbed" against the knots, or centre of the heart. Before the colour can run down, I bring the badger into play, and by it, with a facility acquired with practice, the colour is manipulated into a patch, with its darkest parts over the knot, and its extreme limits so softened as to be nearly imperceptible. Now I take the damp

leather, and, by folding it and using my thumb, wipe a couple of sections cleanly out of the knot shade. The badger gives a final softening, and having put in, with the tool, an occasional dark shade where the sap takes any decidedly "knotty" turns, the lock rail is finished. The two short stiles between the pairs of panels I now shade with a darker wash of a warmer tone, wiping out a light where the grain turns. Across the top rail the tool is now crossed at broadly regular intervals in a very light wash, and then well softened across. The outer long stiles are finished with solid shading, whilst the wide bottom rail I leave with a dark shading to the lower half, and lighter effect on the top edge, so that the joint of the same with the small stile between the lower panels is emphasised and clearly preserved to the eye.

The plan above described for overgraining, in the ordinary sense, a four-panel door is one that preserves the unity of the structure to the eye. If there is too much cross-shading to the panels or rails, the effect is not conducive to repose, whilst the general darkening of the stiles, especially the outer ones, frames up a door very pleasingly. The strength of the washes used must always be so faint that, when varnished, the two oil and water processes become mellowed into one effect. If the overgraining is sufficiently obtrusive—either by difference of colour or depth of shade—to allow it to be clearly picked out by the eye from the combing beneath, it is overdone. There are many other simple and woody treatments for overgraining oak, and these the learner will be best able to acquire by the study of masses of real wood, and especially the finished graining of experienced workers.

Shading, or glazing, oak is a process by which either old or new graining can be altered in tone or colour by using *oil colour*. As this requires no megilphing, a drying mixture simply needs to be stained according to desired colour. Grainers occasionally glaze over portions of their new work, such as the stiles as above treated, with the same graining colour, and may also coat the panel mouldings with the same. In matching old graining, the oil glazing process may be useful in helping to get the mellowness which, independent of the graining, the ageing of varnish gives to work. Whether used partially, as just indicated, or as a means of converting light-grained oak into medium, or medium into dark oak, this is a practice that any intelligent worker who has mastered the foregoing will easily be able to accomplish. Occasionally the glazing principle is reversed, if I may so term it, in this manner: The panel is rubbed in, figured with lights and half-lights, but not combed; when this is dry, the oil colour is again spread thereon, and the imitation of *grain* obtained with combs of gutta-percha, cork, or a similar soft material. The grain which crosses the lights is then wiped cleanly away, and the work is finally overgrained and varnished. It is very obvious that this method would be too tedious for all ordinary purposes, but the zealous student will not fail to practically study a process which is capable of being developed into imitations far more realistic and natural in effect than the usual method will allow.

Whether the worker uses gutta-percha, steel, or leather combs; whether he wipes his figure with nail or thumb-piece, or shades in oil or watercolour, are really but secondary considerations. Providing the grainer understands and feels what effects he is working to obtain—a knowledge to be derived only from painstaking study of natural samples, which cannot be reiterated too persistently herein—and providing, beyond this, that his study of the nature and qualities of the materials and tools he uses is of an equally thorough description, then unceasing application can and will find its own methods, and success alone will justify them.

CANOE BUILDING IN WOOD.

BY AN OLD OARSMAN.

PAINTING—LAYING ON DECK—FINISHING OFF—INDIARUBBER COVER—WOODEN COVER—BACK REST—PAINTER—SEATS—PADDLES—INTERNAL FITTINGS—RUDDER—MAST AND SAIL—BOTTOM BOARDS—STRETCHER—CLEATS—WHEELS.

WHEN all is ready for the deck to go on, the whole of the inside fore and aft of the well should be painted with at least two coats of paint, also that part under the bottom boards. This prevents the damp causing rot. When this is done, the deck should be laid on. A very convenient way of doing this is to have it in two parts—which allows for expansion during hot weather—nailed or screwed down the centre fore and aft beam (see Fig. 19). When all is ready to put on the deck, all parts which it covers should be painted, so that no damp can settle and cause decay. The deck, of cedar, is usually from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. thick, and carefully selected, so as to be free from knot or shake. Having fastened it along the centre beam, it is fastened with screws or nails into the stringer next the gunwale, care being taken to press it gradually into the proper curve over the deck beams as each screw is driven home. When all is in place, the edge of the deck is cut away close to gunwale and shaved down with the smoothing plane, the final finish being given with glass-paper. If this is well done, it should look like a piece of cabinet work, and, if properly fitted, will be water-tight. The coaming which surrounds the well is made of ash, oak, cedar, mahogany, or other wood most convenient, but as good a material as any is an ash hoop, which can be procured at the cooper's, and is then planed down to a quarter or three-eighths of an inch thick, and from one and a half to two or more inches deep; or any other wood can be treated in the same way, this having been steamed or soaked in hot water, so as to be soft and tough enough to turn at the corners, beginning in the centre of the fore end of well by screwing it to the deck beam. A strut of wood is used to force the hoop into the corner of the well (the corners are curved at a small radius), and so on in each corner. The join, or two ends, should meet in the centre of the side of well, and there be joined with a scarf. The hoop being driven into shape as nearly as may be, screws are inserted one after another from the first in centre of fore part of well, at about an inch and a half or two inches apart, until all is fixed in place and the scarf of the ends is made. The coaming is then finished off with plane, spokeshave, rasp, and glass-cloth. If properly done, this makes a very strong piece of work, quite capable of bearing the weight of the canoe when lifted by the sides of the well. These sides are usually covered with a thicker deck than the other parts. This is to take the strain off the cleats and other fittings screwed to them. These side decks are eased or bevelled down at the ends to meet the other parts of the thinner decks.

It is a good plan to attach a bead of American elm or ash along the edge of the deck outside, so as to take the rub which must inevitably take place from daily work in going alongside boats, locks, quays, or anything else. It is made like the section of a bow, flat on one side and half-round on the other.

The shell of the canoe being finished, it should be well rubbed down all over with glass-cloth on a piece of cork, the final touch being given with some fine glass-cloth. All roughness, uneven marks, etc., should be quite removed. This being done, you proceed to finish off the keel, stem, and stern posts to the proper size to take the metal band (whether copper or iron), which runs from the top of the stem along the keel and up to the top of the stern post. This is used to save the wear and tear of those parts which it covers, and is usually a band of metal of from one quarter to five-sixteenths of an inch wide, by two to three-sixteenths thick. It is attached by screws or nails at various distances along its length—say, at from five to six or eight inches. It is a good plan to fix rubbing pieces or bilge keels of hard wood on each side on the edge of the second or third plank from the bottom. This greatly preserves the planks. Three feet will be long enough. They should be half-round on the outside, and half an inch wide, fixed by screws or copper nails parallel to the keel.

When the shell of the canoe is completed and finished off with glass-cloth until as smooth as a dining-table, it must be done all over with the best copal varnish. This must be allowed to dry and harden until it can be handled without sticking to the fingers, and then at least two more coats must be put on, each drying completely before being handled. She will then be fit for use.

The well should be covered when in use, and this can be done with an indiarubber cover, or a wooden one of light cedar.

In making the indiarubber cover, use two pieces of cedar about $\frac{1}{2}$ in. thick, the same length as the well, and about 4 to 6 in. high, just where the knees come when one is seated in the canoe. This strip of wood is sloped away from where the knees are, both forward and aft (see Fig. 20), to about 2 in. in width; these pieces of wood are placed on either side the coaming of the well parallel to one another, and are kept in place by two bits of wood screwed to the deck with two screws; these pieces of wood are 2 in. long, 1 in. high, and $\frac{1}{2}$ in. wide (see Fig. 21). When in place, a sheet of indiarubber is laid over all and nailed through strips of leather with copper tacks to the edges of the two parallel pieces of wood. When all is completed, cut off the indiarubber close to the wood, leaving a flap to go over the fore end of the coaming, where it can be fixed when in use by a piece of cord led from a cleat on the port side, round the coaming to a cleat on the starboard side, this being fixed after the paddler has taken his place in the canoe. A cord should be run in at the edge of the flap of indiarubber and firmly stitched there; the after end, or that next the paddler, can be cut any size that may suit the fancy, a good plan being to have enough to reach up to the chest, and if very wet or rough it can be fixed to a button on the coat; such an apron as this will keep out any water or rain, and is very safe, as if an upset occurs it is loose and free from the canoe in an instant.

The wooden cover is made by having the side pieces a little heavier, and at least 6 in. wide all along the length, and a light piece of ash hoop should be curved over from side

to side in two places so as to raise the deck in the centre (Fig. 22); the cedar or other light wood is pressed over these beams until it comes to the edges of the side pieces, where it is nailed and planed off to the line of the sides; the fore end can be finished with an ash hoop to fit round the coaming; the after end must be cut out, so that when in place it may fit round the paddler's stomach, and if found necessary a strip of indiarubber can be put on so as to be drawn round the waist and up to the chest, but if rough or wet, a cape can be worn which will come down and cover the hatch so as to keep out any wet; a small strip of wood should be nailed round the edge next the body to keep out any drip.

In the original Rob Roy canoe, a simple invention for a back rest has answered every purpose when on a journey; two pieces of oak, 18 in. long and $2\frac{1}{2}$ in. wide by $\frac{1}{2}$ in. thick, rounded from the centre to the edges like a rib bone of beef, are joined together by two crosspieces of the same size as in Figs. 23 and 24; the lower piece is grooved so as to rest on the coaming and freely work there when moved by the action of the paddler; it is kept in place by a piece of rope or indiarubber tubing passing through a small hole in the deck, and then tied together. Until this contrivance of Mr. Macgregor has been used, no one can imagine how comfortable it is: the two muscles on each side of the spine rest on the wood, the spine being between them, the result being that there is no fatigue from its use, and one can go paddling for days without feeling worn out. If any one doubts its efficacy, let him remove the back rest, and paddle a few miles without it, when he will find he will have a sore back from the rubbing against the coaming. When out of the canoe, this backboard lies close to the deck out of the way.

Another necessary part of the outfit is the painter: this had better be made from tanned rocket line such as is used on the coast for saving life from shipwreck, and can be bought from the ship-chandler's near the docks. To use it, there must be two holes bored through the tops of the stem and stern posts with a $\frac{3}{8}$th bit; through them the ends of ten fathoms of this light strong line must be passed, and a knot made in each end; this is quite secure enough, and can be used for tracking the canoe along the river-side, over the grass, or to drag her over any obstacle that may be met with in a day's journey, such as gates, walls, locks, fallen trees, or, in fact, anything you might encounter. When not in use, it is kept coiled up on the top of the hatch on deck; the best of this rocket line is that it never kinks like most other kinds of rope. By arranging the painter as described in the foregoing account, it is ready for instant use in case you have suddenly to jump ashore or fling it to any passing boat or steam launch for a tow.

Seats of various kinds are used to protect one from the hard bottom boards; some use a frame with cane plaited in like the seat of a chair, others an air cushion blown up, and a very good seat is a life belt rolled up with a spare pilot jacket folded upon it, but any one can improvise some kind of seat that may be suitable and useful.

The paddle (Figs. 25, 26, 27) is almost the most important article needed, as on it the progress of the Rob Roy almost wholly depends; it is usually made from a spruce plank, which has been selected so as to be entirely free from knots or shakes, and is from 7 to 9 ft. in length; the plank has the form of the paddle drawn on it, and it is then cut out with a saw, and finished with hatchet, draw-knife, plane, and glass-cloth.

Paddles of different kinds are used: if the canoe has a rudder, the paddle is short and one-bladed so as to be used one side, the rudder being held against it and a straight course thus ensured; paddles are

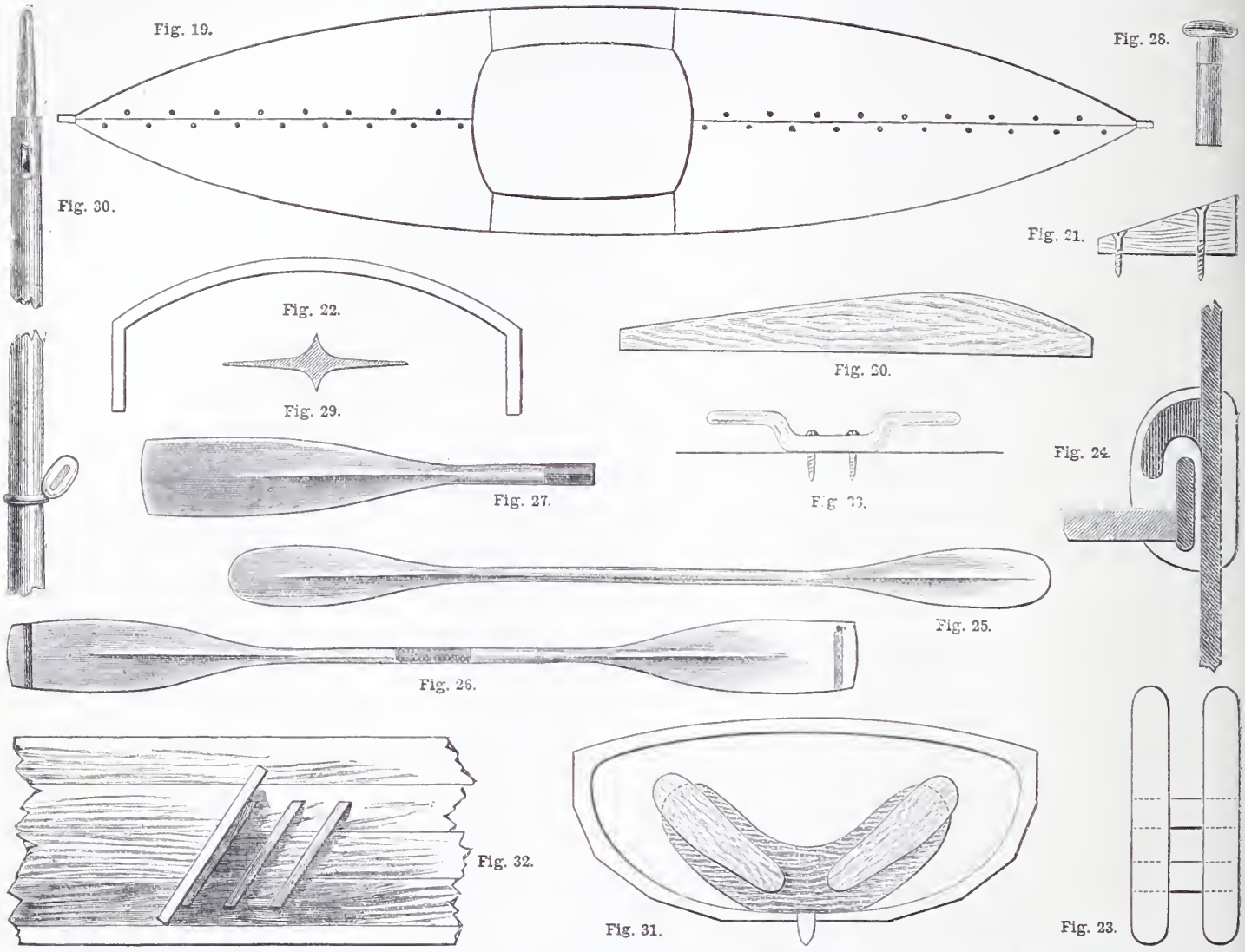


Fig. 19.—Mode of Nailing or Screwing on the Deck. Fig. 20.—Side of Apron to cover the Well. Fig. 21.—Stop to keep Side of Apron in place. Fig. 22.—Wooden Cover or Apron. Fig. 23.—Back Rest. Fig. 24.—Fastening of Back Rest. Fig. 25.—Paddle. Fig. 26.—Jointed Paddle. Fig. 27.—Half Paddle. Fig. 28.—Button and Plug to go in each End of Half Paddle. Fig. 29.—Section of Paddle Blade. Fig. 30.—Mast with Sheave and Block for Halyard. Fig. 31.—Diagram showing Feet in position on Stretcher. Fig. 32.—Frames to take Stretcher at various distances. Fig. 33.—Cleat.

also made in two parts, being joined by a tube of brass in the centre of the handle, and if desired, they are divided and a plug (Fig. 28) is inserted, which from having a smooth, flat, button-shaped top, rests in the palm of the hand and prevents a blister; some paddles have the ends rounded, others square, but all have the ends of the thin blade protected by strips of thin copper which are folded firmly round them at right angles to the handle or loom, and are then tacked with copper tacks, preventing the blade from splitting, as it would undoubtedly do without such protection; if well made and the blades are kept thin, the paddles are very light, and their weight is not felt in a long day's paddle. In most cases, an indiarubber ring is put round the loom about a foot above the springing of the blade; this answers the useful purpose of keeping the water from running up the paddle and then up one's sleeves, and giving the paddler a good wetting. In making the paddle, the loom or handle should gradually fine away into the wash of the paddle in the shape of a web or rib, which should go half way down into the centre of the blade or wash, the wood being cut away on each side until the section appears as in Fig 29, and when finished the edges of the blades should be from $\frac{1}{8}$th to $\frac{3}{16}$ths of an inch thick; the final polish is given with fine sand-paper on a piece of cork.

The internal fittings of canoes are generally put in at the option of the owner. Very good receptacles for sponges, drinking horns, and any such articles, can be made with pieces of net fastened to the fore and aft piece which keeps the bottom boards in place, and just under the gunwale; the length is entirely guided by the fancy or requirement of the paddler; sometimes shelves are placed about 4 in. under the side decks and of the same width as the deck; these are very useful to put knives or any tools on to keep them out of the wet, or books and maps. In some cases, lockers are fitted in canoes, but are not necessary in the ordinary Rob Roy; about the best locker is to have a hatch so made as to fit closely over the coamings and have a brass bar over the top fitted with a padlock, so that the whole well can be covered over and locked up.

Rudders are a good deal used in sailing canoes, but are not at all necessary in the Rob Roy, as in the mere act of propulsion one can perfectly steer with the paddle, and rudders require a straight stern post to work efficiently, and so are not suitable for the curved stern of the Rob Roy.

A mast and sail is a great help on a journey, but it need not be large; the usual rig is a standing lug, the only spars required being a mast, yard, and boom; these should be made of good white or yellow pine. A good guide for the height of mast and length of spars is just what will stow forward under the deck; sometimes they are made with joints like a fishing-rod, but for the average Rob Roy this is not necessary. The usual way of fitting the mast with a sheave at the head, and a block near the deck, is shown at Fig. 30, and is by far the simplest. The boom can be attached to the mast in several ways: one is to use a strip of strong leather, another with a brass gooseneck, or an eye in the mast into which a curved hook at the end of the boom goes, will answer. Good strong cord is required for the halyard and main sheet; none is better than a six-strand cord which has stood the test of many years' use. All spars and masts, paddles, etc., must be kept well varnished, as then they do not discolour whilst the varnish is intact; should any signs of stain appear, the spar should be rubbed with glass-cloth until it appears as clean as when new, and then it should have three or four coats of varnish.

The planks at the bottom are protected by bottom boards, which are in separate pieces for each side of the keel. They are usually a little longer than the opening of the well, and are of $\frac{1}{2}$ in. plank about 7 or 8 in. wide, and on the underside of each end a slip of wood about $\frac{3}{4}$ in. wide is fixed to act as a stop when the boards are in place, by abutting on the timbers fore and aft, just inside them; if fitted properly, they cannot move; a piece of wood on either side parallel to the keel and screwed to the timbers keeps the bottom boards from moving away from the keel.

The stretcher is a piece of wood cut in the shape shown at Fig. 31, so that the feet may rest on it and take the thrust from the action of paddling, for without some sort of stretcher the body would be dragged forward from the strain of the paddle in the act of propulsion; it should be made of a piece of $\frac{3}{4}$ in. plank and rests on the keel, where it is supported with stops just as the stretchers in a rowing skiff (Fig. 32).

Cleats of various kinds are used for fixing the ropes or painter, and are usually of brass screwed to the deck; in a Rob Roy a cleat on each side of the well is generally used and found very convenient (Fig. 33).

Wheels to convey the canoe are easily made, as two wheels about 14 in. in diameter are fitted to an axle long enough to permit the canoe to come between them, and on the centre of the axle a strong trough about a foot long, made of ash screwed together, is fitted to take the keel, which when in a line is passed from the cleat on one side amidships, round the axle up over the deck, and round the other side of the axle and secured; when all is fixed, the canoe can be driven like a barrow.

MEANS, MODES, AND METHODS.

Pickle for Cleaning Brass.

Oil of vitriol (sulphuric acid), 2 parts; aquafortis (nitric acid), 2 parts, both by measure. Cleanse the brass article from all traces of grease and oil by boiling in a strong solution of common soda or potash. Then immerse in the pickle for a few moments, and avoid breathing the noxious fumes given forth by the mixed acids. Rinse quickly, when clean, in clear water, and dry at once in hot sand, sawdust, or bran. This process gives to brass a beautiful golden-yellow tint, which may be preserved if the articles are lacquered whilst still hot and fresh from drying.—G. E. B.

Electric Fitting for Clock.

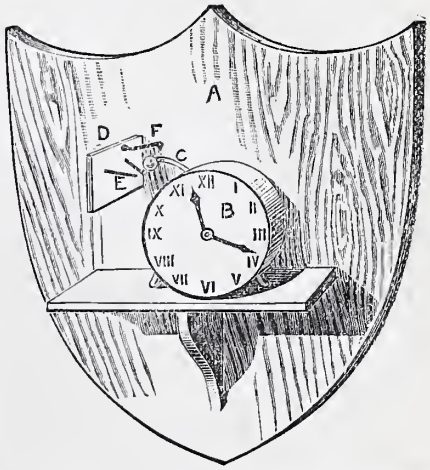
Another application of electricity to domestic use that may be of service to readers of Work is the following.

The fact that so many alarum fittings are required to be affixed to the face of the clock, and consequently cause a certain amount of disfigurement, prevents many people from having the fittings adapted to their clocks, especially those that happen to be valued for old association's sake, or for their own intrinsic worth.

The following plan is not at all a disfigurement, and has the merit of being effective, inexpensive, and practically noiseless. I was led to devise it owing to the annoyance caused by the bed-loving propensities of a maid-servant, and the necessity of some means of arousing her effectually without the discomfort of being myself roused at too early an hour. The means to this desirable end consisted of an American alarum clock, a battery and wire, and a continuous ringing or burglar bell.

The first and most important thing to be done was to fix the alarum clock (by means of wires attached to its feet) to a bracket, which was itself secured to a shield-shaped panel firmly screwed to the bedroom wall, care being taken to leave room for the hand, or at any rate for the fingers, to get to the back of the clock for the daily winding-up, or for setting or altering the alarum. My clock, one of the Ansonia make, has, as is usual with this type of timepiece, the alarum bell on the top of the clock, with a switch to shut off the alarum when not required to ring.

I removed the bell from the top, and with a small piece of black indiarubber tubing, like that used for feeding-bottles, covered the vibrating hammer that worked



Electric Fitting for Clock—A, Shield-shaped Panel with Bracket fixed securely to Wall; B, Clock; C, Vibrating Hammer of Alarum; D, Small Support at right angles to A, with Bell-Push or Wires, E, placed to admit of Contact being easily made; F, Spring Catch to hold C.

the alarum, with the twofold object of making it, firstly, as noiseless as possible in its action, and secondly, of insulating the clock from all chance contact with the electric wires.

On a small support fixed at right angles to the shield-shaped panel I arranged a bell-push, with a very flexible spring, connected with the two wires leading to the battery and bell, in such a way that as soon as the alarum hammer was started by the alarum going off at the required hour in the morning, it made the wire terminals touch each other, the circuit was complete, and the continuous ringing bell upstairs was set in motion, and went on ringing till the lazy handmaid felt in duty bound to get up—at any rate for the sake of stopping the bell.

Before the vibrating hammer makes the circuit complete, it passes under a light spring catch, which prevents it from finishing its usually prolonged and irritating series of vibrations. The hammer must of course be released from under the spring catch before the alarum can again be set to go off.

The panel may be of any shape that is desired, and may be dispensed with if there is any convenient woodwork to which

the bracket and supports can be securely fixed.

If there is any difficulty in fixing the push, the ends of the wires may be so arranged that the rubber-covered hammer makes them touch one another, and so completes the circuit.—H. J. L. J. M.

A Disaster, its Moral, and its Cause.

At the beginning of my experience as a metal-worker, I met with an accident which, to say the least, was very painful and unpleasant. Being about to work on a repoussé plaque about 12 in. by 8 in., I found that I should require to use a larger pitch-block than I had by me. As I had always found empty meat tins very useful as paint pots, varnish pots, nail boxes, etc., I thought I would try one for melting my pitch and the other ingredients, using one of Fletcher's Argand Bunsen burners to give the requisite amount of heat. After breaking up the pitch, and mixing with the other ingredients, I began the melting process. The tin I used was a medium-sized one, and as I required a considerable amount of pitch melted, I made several meltings with complete success. When the fifth boiling was finished, I found there was rather more than I had put in each time, but not enough to make two meltings, so to save time I put all that was left into the tin. It melted quite as successfully as before (and began to boil), but as soon as I lifted the tin off the gas stove, out came the bottom of the tin, and the boiling pitch ran all over my right hand (with which I was holding a piece of wood against the bottom of the tin to steady it while pouring out the pitch), the whole of which, with the exception of the thumb and a part of the palm, was covered almost up to the wrist.

The pain for a moment was excruciating, but almost ceased as soon as the fluid pitch had cooled and set, only to begin again when the scalded parboiled skin was exposed to the air after the pitch was removed. I was able to help, left-handed of course, in doing this, and owing to my hand being more or less oily, as oil was one of the ingredients in the mixture, the pitch came off without much pain with the help of sweet oil applied on cotton-wool—and patience. When the hand was quite clean, it was dressed with zinc ointment and oiled lint, with cotton-wool *ad libitum* to keep out the air, and I went to bed, and, thanks to a stiff glass of something warm, to sleep. In the morning, each finger was enveloped in a blister rather larger than a pigeon's egg; the hand felt very stiff, and there was a painful sensation under the nails where the pitch had touched them. For some days there was much throbbing and pain, but in a little over a month the hand, which was dressed every day with zinc ointment, was quite well, there being not a sign of the scald to be seen.

The lesson I learned was to buy a plumber's melting kettle for my pitch, and I may add that I have never used a meat tin for the purpose since.

The explanation of the disaster that I can give is this: that the double weight of pitch in the last boiling forced out the bottom, the solder on which was melted out by the extra heat at which the mixture was allowed, inadvertently, to boil.

H. J. L. J. M.

A Cheap File Handle.

A very good temporary, or even permanent, handle for a large file or rasp may be made by cutting a short length of composition pipe as used by gas-fitters, tapping it gently all along till it loses its cylindrical shape and becomes elliptical (in other words, flattening it out slightly for the whole of its length), and then knocking it, without too much force, on to the tang of the file. If the file be first slightly warmed and dipped into powdered resin it will hold better.

Over this composition handle a piece of indiarubber tubing may be drawn, which will give one a better grip on the handle, and prevent the hands being blackened by the lead contained in the composition tubing.

A piece of indiarubber tubing slipped on to the point of a file or rasp will often enable one to get a good firm grasp of what is sometimes an awkward tool to hold.

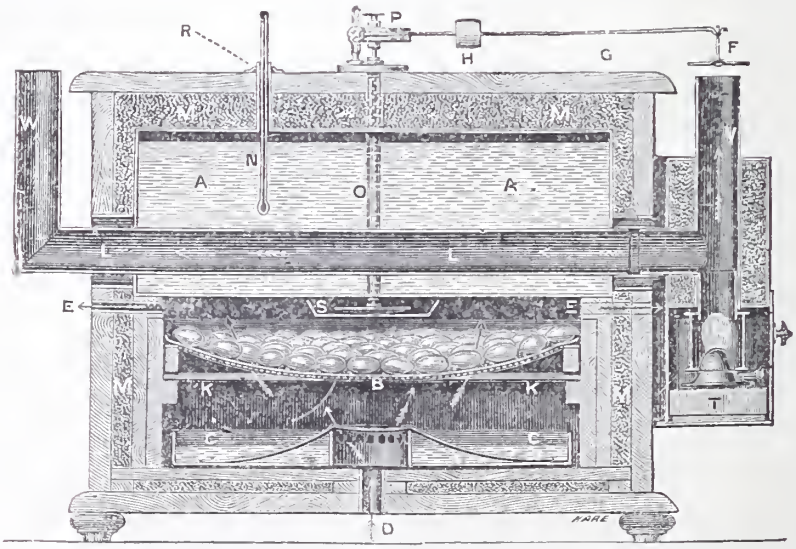
H. J. L. J. M.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

18.—Hearson's Champion Incubator.

Many of the readers of Work have expressed a wish from time to time to know something of incubators, and I have much pleasure in saying that I have in my hands a practical paper on the subject which will appear when the days once more begin to shorten and work of this kind will be taken up more readily than in summer. But as some, even at this period of the year, may desire to have some little information about them, and have made inquiries about this particular incubator known as Hearson's "Champion Incubator," knowing only that it is an excellent one, and wishing to learn still further why it has proved so successful, I am permitted to reproduce the annexed illustration from Mr. Hearson's manual, "The Problem Solved," and to call attention to the book itself, which is sold at 1s., and may be obtained at that price of Messrs. Charles Hearson & Co., 235, Regent Street, London, W. To purchasers of incubators the book is supplied gratis. It contains a carefully compiled code of instructions regarding the use of the incubator, and also meets at once all the various questions that may be put by those who are curious about artificial hatching of chickens, and affords explanatory details on all points. Many, if not all, of those who have used it declare Hearson's "Champion Incubator" is the best yet in the market, and this, without doubt, is the secret of its success and popularity. The manufacturers are always willing to lend assistance to all who use their machines.



Longitudinal Section of Hearson's Champion Incubator, showing the Internal Arrangements—A, Tank of Water; B, Movable Egg Tray; C, Water Tray; D, Holes for Fresh Air; E, Ventilating Holes; F, Damper; G, Lever; H, Lead Weight; K, Slips of Wood; L, Lamp Chimney and Flue Pipe; M, Non-conducting Material; N, Tank Thermometer; O, Needle or Push Pin from Capsule S to Lever G; P, Screw with Milled Head; R, Filling Tube; S, Thermostatic Capsule; T, Petroleum Lamp; V, Chimney for Discharge of Surplus Heat; W, Chimney for Products of Combustion.

19.—Tait's Sulphur Puff.

This is an ingenious contrivance, invented, manufactured, and supplied by Mrs. Thomas Tait, 116, Rose Street, Edinburgh, Jewellery Case and Plate Chest Maker and Fancy Leather Worker, for puffing finely powdered sulphur on plants infested with insects or otherwise requiring dressing with sulphur. The nozzle is of turned wood, and is fitted within with a piece of very fine wire gauze, through which the sulphur is blown by the action of the bellows to which it is attached. This consists of a coil of wire covered with leather and bound with fine cord between the coils of the wire from the larger end to the nozzle, which unscrews to allow the sulphur to be put in. The knob in the middle of the larger end, which is of turned wood, also unscrews. They are made in all the different colours of French morocco, and are certainly most handy and cleanly for ladies' use. The form when at full length is shown in the accompanying illustration. It is sold by most seedsmen throughout the United Kingdom. I am not quite sure about the retail price, but this may be ascertained on application to Mrs. Tait.

Tait's Sulphur Puff for Plants.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Machine for Current of Air.—Opifex writes:—"Judging from the numerous replies elicited by the original query (page 190, Vol. I.) on this subject, it must be one of wide interest. Many of the suggestions have been very good, but it seems to me that it is rather waste of time and money to attempt to manufacture such an article when it can be obtained at a very low price. I remember many years ago, when a child, being greatly fascinated by such a machine as that described by G. E. S., page 398, Vol. I., but, unless I am greatly mistaken, these blowers are altogether "out of print" in the present day, and in that case if one desires to possess one his only, or best, plan is to make it for himself. There is, however, a machine which I have found most useful, and which might serve the purpose of the original querist. It is a small fan running in a cast-iron cover, and driven by a 16 in. driving wheel with web band. This machine is made in Waterford, and may be obtained from Messrs. Booth Bros., 63, Lower Stephen Street, Dublin, for 12s. 6d., which to my mind, considering the efficiency of the article, is a marvellously low price."

Printers' Ink.—M. D. C. (*Wavertree, Liverpool*) writes:—"In reply to Paraffin (*Cardiff*) (see Vol. II., page 12), he is answering a thing he knows nothing about. He owns he is not a practical poster writer, then why does he criticise one? In answer to H. L. B., I said paraffin would not do to mix the ink with to write posters with, and I must tell you the same. Practice makes perfect, therefore practise before you preach to one who knows. As I said before, paraffin would not do to write posters with, as it leaves a greasy mark all round where the colour has been applied to the paper. Paraffin says the principal poster of his town goes for his empty tins to wash out what colours he leaves in. I don't think he can have many posters to write, or he would require more ink than the washing out of empty tins; and still he says his work is the talk of the town. Well, he does not say whether the work is good or bad, but there are some people who do not know the difference between good work and bad, and perhaps Paraffin is one. I asked H. L. B. what he would put in ink to keep it from working sticky. You say paraffin will keep it from working sticky, or leaving brush marks. How do you know if you have not tried it with a brush? If I were you, I should write about an article I understand, not what I don't understand. If paraffin will do for printing purposes, it is all right. I don't pretend to deny it, but you deny what you know nothing about. If H. L. B. knows more than I do, as you say he does, why does he not answer? I am open for his attack on this subject, or any one else. I don't wish to hurt any man's feelings, but I don't like to see people writing about what they know nothing of, and giving the readers of Work bad instructions. As it is a good paper, let us have good information that we can trust to, not what I have heard. If you don't know it for a fact, don't mention it until you do know it for a fact, then we will get what we can trust to. I would not write an article on anything unless I could rely upon what I said to be a fact, as I would not like to be taken in, as a good many would if they tried to write posters with paraffin; therefore, I hope Paraffin (*Cardiff*) will try experiments before criticising a practical man in future and things he knows nothing about."—[The tone of your letter, and, indeed, of your previous letter, in Vol. I., page 715, is such that I am compelled to reply to you myself. Whatever may be said of me, or of anything that I do or say, or write or sanction, individually is a matter of trifling importance, and, indeed, when adverse, gives me infinitely more amusement than pain. I expect to be shot at, and am frequently exposed to very heavy fire, but having got used to it, as eels are said to get used to skinning, I enjoy it rather than otherwise, and, as all my readers must be well aware by this time, very seldom fire a shot in return. I cannot, however, allow my contributors and correspondents, Paraffin (*Cardiff*) and H. L. B., to be peppered without doing in their behalf what they will scarcely care to do for themselves, namely, reply to you in the same spirit in which you write. Paraffin (*Cardiff*) has written good-temperedly enough, and if you, as a practical poster writer, as I suppose you are, can give better teaching and throw more light upon the matter than what has been already given and thrown, why do you not do so? The pages of Work and the columns of "Shop" are at your disposal, but all you seem to care to do is to find fault with what others say, and withhold the special knowledge that you claim to be competent to give, or to offer to give information privately, as witness what you say in Vol. I., page 715, under heading "Ink for Posters." Now the giving of, or offering to give, information privately is what I especially wish to discourage in Work, which is essentially a Magazine for the propagation and dissemination of useful knowledge, and in which, as members of a great and grand co-operative society, all who are engaged in it, whether as contributors or correspondents, are earnestly striving to help and benefit those who read it by placing information at their command which they find it difficult to obtain, or might have to purchase, elsewhere. Therefore, if you have anything useful to say or recommend, why not say it at once instead of carping at those who, to the best of their ability, willingly give such information as may be in their power to bestow. As for H. L. B., he has been an esteemed and valuable contributor, for the last eight years at least, to magazines that have appeared under my editorship, and I have every confidence in his power and ability as a writer on all subjects that he cares to handle. By my express wish and desire, he will take no notice of the strictures you have been pleased to make on him, but his and my best reply will be found in the following extract from a letter from him to me in reference to "Poster Painting." He writes:—"I will now take the earliest opportunity of writing my promised articles on 'Poster Painting,' and after their appearance leave the readers of Work to judge as to truth and utility. I need hardly say that having been for some years a scenic artist, and, as such, engaged in all the principal theatres in the kingdom, that I have painted some hundreds of posters of all descriptions, and that I have seen all the best poster writers of the day at work." Referring to the remarks made by Paraffin, and an idea that you seem to entertain that H. L. B. suggested an admixture of colouring matter and paraffin for ink for posters, he continues:—"I have no doubt the information given by Paraffin in Vol. II., page 12, is tolerably correct. Although I gave paraffin as a medium for printers' ink in my short answer to a query some months ago, I may say that benzine is the best 'thinnings' to use. I did not mention this, however, for reasons I will afterwards point out. I wish my readers to note that I have never even hinted at ordinary dry colours being mixed with paraffin, as M. D. C. would have one believe; no sane person would say such a thing, let alone recommend it." I can assure you that for your own sake, as well as for the sake of every reader who is interested in poster writing, I shall have H. L. B.'s article put into type as soon as it reaches me, and as he is assuredly not an amateur in this kind of work, I have no doubt that he will supply information that will prove useful and beneficial even to yourself, and give, if it be possible to do so, wrinkles for making chocolate, marone, salmon colour, and flesh colour that will not fade on exposure to the sun, or at all events preserve the original colour as long as the poster is required or expected to last.—Ed.]

Mandrel for Lathes.—J. T. (*Walworth*) writes:—"I notice that a writer in your issue of this week recommends amateurs to go to the Britannia Co. if they want mandrels made for such lathes as he describes. It happens that some months ago I wanted a mandrel, a much simpler one than that in Work, and applied to the Britannia Co.; but my mechanical ardour was somewhat cooled by their estimate of 30s. for making it. Now if your readers could point out where such small commissions in engineering work could be executed at a reasonable rate, they would be conferring a boon on your wood-working section."

Fretwork Designs in Work.—A. O. W. (*Ripon*) writes:—"I am requested to complain to you that you have never, since the first number of Work, put any fretwork designs or anything about the same in your paper, and I have some customers giving up taking the paper on this account."—[When complaints are made they should, at all events, be based on some semblance to fact, if not on fact actual and positive. Kindly refer your customers to the Index to Vol. I. of Work, which you, as a newsagent, know, or ought to know, can be supplied to them for one penny. Let me help you further by giving, for the instruction and edification of yourself and your customers, the following extract from the Index:—"Fret cutting, 46, 62, 93, 94, 126, 134, 157, 215, 236, 237, 238, 267, 316, 332, 349, 524, 535, 588, 638, 651, 667, 700, 747, 748, 765, 828; Patterns for, 77, 268, 302, 349, 429, 540, 652, 731; Wood for, 253; A cabinet for, 1, 110, 157, 172, 188, 747, 798."—Ed.]

Fret Saw.—F. T. (*London, N.*) writes:—"In 'Shop,' No. 53 of Work, I see a letter from W. E. C., describing the wire thread fret saw as worthless. I thoroughly endorse what W. E. C. says about them. I, like W. E. C., am very much interested in fretwork, and sent seven stamps for a sample dozen of the saws. I could not understand when I fixed them in my machine why they kept breaking so quickly, and I soon found out that it would not do to buy them: it would make the work come too expensive, besides a lot of filing when done. I have used for some time past Griffin's saw blades, which may be had from Messrs. Charles Churchill & Co., 21, Cross Street, Finsbury, E.C., at threepence per dozen; these saws cut much quicker than the ordinary saws."

II.—Questions Answered by Editor and Staff.

Authors' Manuscript Paper.—J. H. T. S.—Authors use paper of various sorts to suit their convenience. The ordinary note paper opened to a single sheet often serves, and is a useful size for editors, printers, and readers to handle; price about 6d. per lb. Some use ruled foolscap; 6d. to 9d. per quire. Some manuscript books, about 7 in. by 7 in., either plain or with ruled lines; about 1s. each. One side of the paper only to be written on. For a continuous story, this is as good a form of paper as any, and the reader is not annoyed by sheets getting wrongly placed, or having to adjust them in putting away. If the story is in a book it has a better chance of being returned, and may then be submitted to another editor if rejected by previous ones. Some authors take great liberties with editors in writing on the blank side of circulars, or any plain paper that comes to hand. This is hardly respectful, as it gives trouble to gentlemen who have plenty to do and think about without having to hunt up numbers in creased sheets and make out awkwardly-written matter. Those who do these things are generally careless writers; printers and readers also are taxed in their time by such shiftless methods, only excusable by being away from paper shops or to meet an occasional emergency. There are many little matters which a writer should know before he begins to write his story. If in a book or loose sheets, leave an inch space from the edge of the paper at the beginning of each line and half an inch space at the end, so as not to have the writing crowded; let each word stand well apart from every other word. Avoid the use of capital letters where not wanted; put in stops to the best of your ability. Story writing is not difficult; that is why the press is flooded with it, and, when done, how few are worth reading. Technical writing is difficult, as the writer must be a worker to tell plainly how things are done in a way to be comprehended by all readers, tyros as well as experts. Faraday was a poet, but, wisely or unwisely, never published his rhyme. His scientific writing will live for ages. —J. C. K.

D Dulcimer.—H. M. L. (*Coatbridge*).—The method of tuning the D dulcimer is identical with that of an F, as shown in Work, page 645, Vol. I., or one in any other key, the difference being solely in the pitch of the instrument itself, that is to say, no matter what key the instrument stands in, the lowest note is always called G. The actual notes on a "D" would be, if tuned to a violin or piano, 1 D, 2 E, 3 F sharp, 4 G, 5 A, 6 B, 7 C sharp, 8 C flat, 9 D sharp, 10 F flat; these are the brass strings. The steel strings on the right are 1 D, 2 E, 3 F sharp, 4 G, 5 G sharp, 6 A sharp, 7 C flat, 8 D sharp, 9 F flat, 10 G sharp; the steel on the left of the bridges, 1 A, 2 B, 3 C sharp, 4 D, 5 E, 6 F sharp, 7 G, 8 A, 9 A sharp, 10 B. The thickness of belly for D dulcimer should be ¼ in. when finished, not ½ in.—R. F.

Turning Draughtsman.—Draughtsman (*Liverpool*).—To turn draughtsman, you first prepare a cylinder or roller of wood of the size of the outside diameter of the draughts; this you drive into a turned recess in chuck made of hard wood, so that about ½ in. enters the chuck and about 4 in. of the prepared cylinder projects; by running the lathe round and tapping the wood with a hammer, you can get it to run quite true, and practised turners do this very quickly. Having the wood thus held, you can smooth and ornament the top and cut off the draughts one by one with a parting-tool, which will leave the bottom quite smooth and slightly dished.—F. A. M.

Index to Work.—D. O. W. (*Ipswich*) and numerous other readers are again informed that an Index is prepared and has been on sale for some time as advertised in No. 52 of Work, and can be had from any bookseller or from the publishers, price 1d.

Electric Tables and Scientific Degrees.—Halfway (*Newcastle*).—I have already more than once explained the meaning of the terms "ampères," "volts," and "ohms." Tables showing how to work out calculations involving the use of those terms may be found in Molesworth's "Engineers' Pocketbook," and in Maycock's "Practical Electrical Notes and Definitions;" the latter is published by E. & F. Spon, price 2s. The letters M.I.M.E. mean Member of the Institute of Mechanical Engineers; M.I.C.E. mean Member of the Institute of Civil Engineers. The office of the former is at 10, Victoria Chambers, S.W., and of the latter at 25, St. George's Street, S.W. A letter of inquiry, enclosing stamped addressed envelope, to each or either of the secretaries of those societies will bring you information respecting terms of membership.—G. E. B.

Solder.—J. R.—It is scarcely necessary to give addresses where to procure tinman's solder. If J. R. will tell me of any good ironmongers who do not keep it, I will put their names down in my notebook of curiosities. The tin used in making it is called block or ingot tin. Full particulars of solder, and the mode of making it, are to be found in No. 17 of Work, in the article entitled "Soldering."—R. A.

Clock Materials.—Young Watchmaker.—I am sorry to say I can give no information as to material, shops, prices, etc., although I should think everything could be got as easily as here. At the same time, I have heard that goods and materials are dearer there than what we can get them here—I mean clocks, watches, and their parts—but for the

truth of it I cannot answer. The only advice I can give would be to apply to the makers for the addresses of their wholesale agents, or the nearest one to where you settle. By that you would be able, no doubt, to get any or everything you required. For my own part, I don't think I should take anything but tools and cash, and see when I got there what I should be likely to want. I would gladly advise farther were I able.—A. B. C.

Organ Pipe Decoration. — BOURDON. — Zinc pipes must first be well cleaned with turpentine and then given one or two coats of oil paint till the pipes look thoroughly glossy. A coat of paint thinned entirely with turps is then laid on, and this will produce a flat or dead surface for the ground tint whatever colour is used. The desired ornaments are then drawn or stencilled on in dead colour. The ornaments may be drawn on thin paper, the back of which is then chalked and folded round the pipe. If the outline is then gone over with a pointed stick like a lead pencil, the pattern will be produced on the pipe, and can then be filled in with the requisite colours. Gilding is done by first painting in the ornament with oil gold size, and then when the size has become nearly dry (which will take some hours), and feels first a little tacky or sticky, the gold leaf is applied and the surplus cleaned off with cotton-wool. You will find the transfer gold leaf the easiest to use, as this is sold in books attached to thin paper which can be cut up to the requisite size with scissors and applied with the greatest ease; no waste or rumpling up is incurred. It is usual to pounce the surface of the pipe with powdered chalk so as to prevent the gold leaf adhering, except where the size has been applied. Gilt ornaments are also usually outlined in white, vermilion, or black lines after the leaf has been applied. For ground colours of pipes, chocolate, vellum, sage green, or pale blue look very nice, and can be adopted according to taste or suitability to the surroundings of the instrument. Care must be taken to graduate the size of the ornaments according to the size of the pipes on which they are placed, also to secure that they shall be drawn centrally on the pipes.—M. W.

Book on Organ Pipes.—F. C. (*St. Austell*).—The best, simplest, and most complete guide for amateurs is "Organ Building for Amateurs," price 3s. 6d., of Messrs. Ward, Lock & Co., London. A smaller work containing a good deal of useful rudimentary information is that called "Practical Organ Building," price 2s. 6d. (Crosby Lockwood & Co., London).—M. W.

Wind to Pipes. — ORGAN (*Manchester*).—The trumpet-shaped metal pipes in the steam organs seen at fairs and circuses are, I believe, simply reed organ pipes voiced to suit the requirements of the case. And they are sounded by the wind passing through them in the same way as in any ordinary concert organ. The only difference is that they sound more coarse and blatant than the reed pipes of an organ in a concert hall.—M. W.

Enamelling Bath. — F. D. (*Manchester*). — To remove the grease, dirt, etc., from your bath, make a strong lye of soda, say, 2 lbs. to a pail of water, and well scrub it out with this, or dissolve three packets of Hudson's extract of soap in a pail of hot water, and use in a similar manner. This will effectually remove all grease and dirt. It would certainly make the best job to remove all the old japan or enamel; but if you do not wish to go to that trouble, rub it well down with pumice stone or glass-paper. Wipe all the dust, etc., that the rubbing makes carefully out before commencing to enamel it, and do the job somewhere where it will not get any dust on whilst drying. To make a good job it will want three coats. After giving the first coat, let it stand for one day. After it is dry, before applying the second, let it be two days between the second and third coats. This will ensure each coat getting thoroughly dry and hard before the other is put on, a most essential point. Wipe round with a sponge and cold water when the third coat is dry, and let it stand for a day or two before using. As you will get no paint or enamel yet made to equal the stoved japan that is put on new baths, a hint as to the method of using a re-enamelled bath may be of service. It is this: never put boiling water into the bath; put in first a quantity of cold water, say, about half what you think you will require; then add hot water to your requirements, and cold afterwards as needed. By this treatment you will preserve the enamel three times as long as if you did put the hot water in the bath first.—R. A.

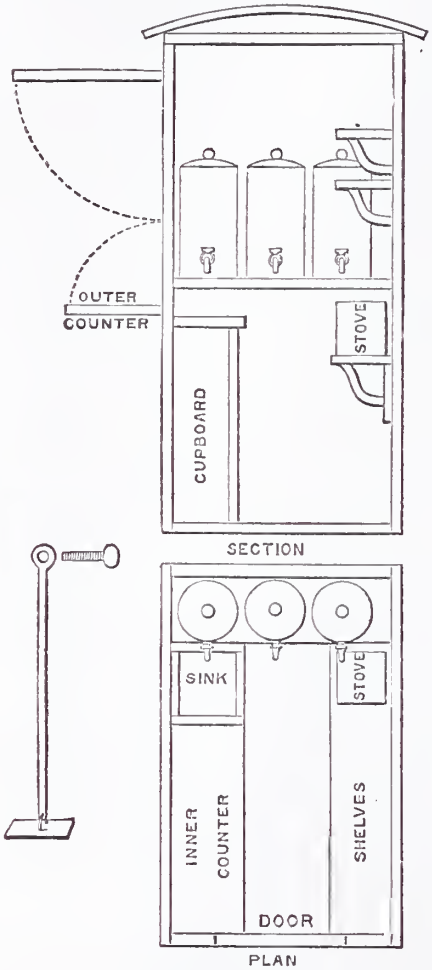
Brass Solder.—J. J. P. (*Malton*).—You should be able to procure this at any respectable ironmonger's under the name of spelter. The following firms supply it wholesale, and would probably supply you with some if a courteous request were made to them:—Warner & Sons, Crescent Foundry, Cripplegate, London; Benham & Froud, Chandos Street, London; Pontifex & Wood, Shoe Lane, London; Lewellyn & James, Bristol.—R. A.

Box Die Tool. — LAMPMAN (*South Wales*). — What you want is an oval combination die or top and bottom tool, but I fear you would find it an impossibility to make it yourself; it would necessitate the command of a forge, anvil, vice, files, and also a considerable amount of technical skill and nice fitting. The best advice I can give you is to send a sample of the work you want to produce to Rhodes & Son, Wakefield, Yorks., who make a speciality of such tools, and who would supply you with one at a far less cost than would be the case if you attempted it yourself.—R. A.

Hydraulic Punch.—RELIOB (*Hebburn*).—I do not think you could get better served by any other firm than that you name, and to make a hydraulic punch you would find a very troublesome job—all hydraulic is unless you have special tools at hand. You might pick up a cheap machine by advertising for a second-hand one. A screw press with a quick threaded screw and fly-weights (like a coining-press) might answer your purpose, and would be much easier to make than a hydraulic. A toggle-press would give the pressure required, but not the travel with it.—F. C.

Back Numbers of WORK. — T. G. N. (*Keighley*).—All back numbers and parts of WORK can be obtained of the publishers, Cassell & Co., Limited, London, E.C., should your bookseller be without them. The literary matter of the numbers and parts is precisely the same, each part being made up of four and sometimes five numbers.—ED.

Coffee Stall.—PLEASURE AND PROFIT (*London, W.*).—This stall can be made in pieces, and put together like the "Stall for covered market" (see No. 36, p. 574). The specially useful feature of this sketch is the opening of the front to form counter for customers, and a roof for them as well (see dotted lines). A couple of jointed rods with thumb-screws would support the extended roof as well as fix it when stall is closed. Chains of suitable lengths would support counter like a tail-board of a van. A



Coffee Stall.

lined ease, like a small cistern, forming a sink and washing tray, would be a great convenience; and shelves on back of stall, with clean cups, plates, saucers, and glass cake and confectionery jars, would help make it attractive. A stove might be added, and should be like a miniature kitchener, such as the Duet American Kitchener, burning coke or charcoal, and having an iron chimney, which could pass under coffee urns which rest on iron rods. A door would be in one end, which is suggested but not drawn.—B. A. B.

Clock Bushes.—J. J. (*Orkney*).—Clock bushes or bouchons may be bought at the tool shops—Morris Coben, Kirkgate, Leeds; Grimshaw & Co., 35, Goswell Road, Clerkenwell, London, etc., in all sizes, in packets of 100, suitable for French clocks, or timepieces, and carriage clocks, at 1s. 6d. per packet, and larger sizes, suitable for English clocks, at 2s. or 3s. per dozen, in lengths of about two inches. Having an assortment of these, select one that will take the pivot for size, not actually take the pivot in the hole, but that shall be large enough to take it and allow a fair margin for wear; as a rule I select one double the size of pivot. Now with a broach open out the old hole till the new bouchon just enters, chamfer slightly the inside part of the hole and more deeply the outer end, cut off the bouchon a trifle longer than the straight part of the hole, chamfer one end—the outer one—and file the inside end of the new bush and drive in from the inside part of the plate (I ought to have mentioned that the plate should have been brached from the inside part of it). When driven in nearly level with the inside of plate, rest that end on a flat stake or the face of a hammer; take a round-face punch and rest in the chamfered end of bush and give one or two sharp blows, which will spread the end of bush out over the chamfered part of plate and hold it in tightly. Now take a broach and open out the bush till the pivots fit in nicely, and finish off with a round or burnishing broach to make it nice and round and smooth. If you cannot get the hollow bushes, you can open out the hole in plate about double the size; chamfer both sides, and fit in a solid piece of brass wire, rivet it tight both sides, and drill hole through. But in that case you had better mark with compasses a part of a circle, just cutting the centre of old hole, from two opposite or right angle places before braching out, and again after stopping the hole; then make a centre dot just where the lines cross, otherwise you will get your depths wrong. I trust you will succeed from the above hints.—A. B. C.

Telephone.—F. J. H. (*Bristol*).—You need not at any time be afraid to ask questions in "Shop," nor, after having asked them, apologise for doing so, for we are always ready and willing to answer any question which may be asked. Still, although we are always willing to answer in such a manner as will be helpful to the querist, there are times when it is almost impossible to do so. There is an old proverb which runs somewhat in this way:—"Heaven helps those who help themselves." So, speaking for myself, I feel readier to help those querists who seem to be ready to "put their shoulder to the wheel" and shove past the difficulty rather than those who, when they meet a seeming difficulty, sit down and look at it and make no further effort. Now without indicating even by a hint to which of the two classes you belong, I will proceed to answer your questions. In the first place, "the top or cap, as it is called," is not constructed as you have indicated by your sketch, but is simply a piece of wood turned to shape as shown in Fig. 5, page 441, Vol. I. Now for your "little difficulty." You can't "make out why the two wires branched off in different directions, and why one is marked 'to earth' and the other 'to line.'" Well, this simply means that one wire is joined to a gas or water pipe, or something that will give you a good earth connection, and the other to the line that goes between the two instruments. That is simple enough and easily to be understood, not much difficulty about it. Look carefully at Fig. 2 on page 441, and read paragraph 4 on page 439, a portion of which you quote. I cannot make it plainer. Your difficulty lies in this (whisper, I don't want everybody to hear) —*you thought* that the wire marked "to earth" went to a battery underneath the telephone. Will you kindly allow the writer to *think* for you and do exactly as he tells you and you will find no difficulty at all. The reason why wires are joined to earth in electrical circuits is because the earth acts as a return wire, and thus saves the expense of using two wires. The most common way to make these connections is to carry a wire to the nearest gas or water pipe or to a metal plate sunk in damp earth. When two instruments made according to the directions given, and represented by Fig. 1 on page 440, are joined up together, as shown at Fig. 2, *no* battery is required for the reason given in paragraph 4. But when a microphone is introduced into the same circuit a battery is required, and the method of connecting is shown at Fig. 11. I cannot take up further space in this column. I thought that the article on the telephone was so plainly written that the merest tyro could understand it. You will notice that the answers to your questions are really the words already given there. The instrument described is quite different, in a sense, to the one which is in use by the firm in whose service you are. The last paragraph in the article under discussion indicates as much. I may yet give instructions which will enable the amateur to make such a set of apparatus. Just take up No. 28 of WORK and read the article over again, and if you decide to make the instruments, make them and use them exactly as the description, and your attempt will not prove a failure.—W. D.

Ebonite.—H. F. M. (*Dewsbury*).—Ebonite is made by kneading indiarubber between rollers and incorporating with it *half* its weight of sulphur. The mixture is then exposed for a couple of hours to a temperature equal to that of boiling water. It has, we believe, to be moulded at a great heat, and under heavy pressure, the apparatus required placing the work beyond the reach of the amateur. The soft vulcanised rubber used for stoppers, which, perhaps, H. F. M. confounds with the above, is kneaded, etc., in the same way, but the proportion of sulphur is smaller.—S. W.

Painting Brougham.—YOUNG COACH PAINTER. —Nothing has been found yet by coach painters to beat best Japan gold size as a preparation to commence painting upon on new leather work. When the trimmer has finished putting the hide upon the brougham, it should stand at least a week in the warm paint room to dry before it is touched, as the paste under the hide keeps it damp when apparently the outside looks quite dry. During the time of drying and when dry, do not let any one rub their open hands unless quite clean on the leather, as a hide is, or supposed to be, greasy on account of oil colour never drying upon new leather, unless coated with gold size preparatory to painting. When you commence to give its coat of size take my advice

and do not have the room too warm. Commence by giving the top a coat first, then the two top side quarters, and afterwards the top back quarter, with a large brush so as to enable you to get over the ground quicker. If the size soaks into the leather and looks patchy it will not matter, as it is no detriment to it. You will find that you will have to be sharp and handy in using your brush, for gold size soon sets, especially in a warm room. When the size has been on the leather twenty-four hours you can give it its first coat of lead colour.—W. P.

Casting a Figure in Plaster.—W. E. C. (*Londonderry*).—If the "modelled figure 30 in. high" is in *the round*, the mould will have to be made in two or more pieces. Where the line of separation between these pieces may best come must depend on the pose of the figure, but generally the mould will be formed in *front* and *back* halves. Make a parting along the line of separation with slips of zinc an inch wide by sticking their edges into the clay of the model. Say that the *back* half of the mould is first made. Mix the plaster as thick as cream, and throw it over the model, as far as the zinc parting wall, with the hand or a spoon till a thickness of ¼ in. is reached. It is well to tinge the water with which the plaster for this inner mould is mixed with some colouring matter—say ink. Wait five minutes for the plaster to set, then brush it over with a mixture of clay and water as thick as pea soup. This is to cause this inner mould to separate from the outer one when required. Then mix plaster for the outer mould with *plain* water and throw it over the inner mould to a depth of ¾ in., imbedding in it pieces of thin bent iron rod to strengthen it. The back portions of mould being thus finished, when it has set, remove the slips of zinc, and in the edges of the mould thus left exposed, bore at intervals conical holes. These, with the corresponding projections which will be formed in the front part of the mould, will serve as keys to ensure the accurate fitting together of the two parts. Brush clay water over the exposed edges, and make the second half of the mould in the same manner as the first. When the whole has set, the two halves can be divided by inserting a chisel at the line of separation. The clay water will prevent their adhering too firmly together. As the chink between the two begins to open, a little water poured in and gentle working of the parts to and fro will help the separation. Remove the clay off the model and well wash out the mould with soap and water. Lash the pieces of mould tightly together, and pour in the plaster to form the cast. Move the mould about so as to let it flow equally over every part. Strengthen with copper wire where required. When the cast is set chip off the mould with *blunt* chisel and mallet. The outer mould can be removed by a few strokes; the inner (tinted) mould must be broken off with more care; its colour will cause it to be easily distinguished from the white cast. Parts of the figure which project much, such as the hands in some positions, it is often desirable to cut off, cast separately, and stick on again. If the model is in *relief*, a mould made in a single piece will generally suffice. I trust that the Editor of WORK may before long be able to afford the space for an illustrated article on "Casting in Plaster," in which I shall be able to explain processes far more thoroughly and clearly than is possible in a mere paragraph of "Shop."—M. M.

Winding Dynamo.—F. H. W. (*Wolverhampton*).—If you wind your F. M. cores 4 in. × 3⅛ × ½, with 3⅝ lb. No. 16 c.c. wire, and the armature 3⅝ in. × 1½ in. × ¾, with ½ lb. No. 20 s.c. wire, and drive the machine at a speed of 1,600 revolutions per minute, you will probably get a current of 3 ampères at a pressure of 12 volts, or enough to light up a 5 c.p. 12-volt lamp. If you wind the F. M. cores with 4 lb. No. 22 d.c.c. wire, and the armature with 5 or 6 oz. of No. 22 d.c.c. wire, and drive at a speed of 3,000 revolutions per minute, you will get enough current to light up a 25-volt 10 c.p. lamp. For charging electro-magnets, you must use a current suitable to the winding on the magnet cores. If the cores are wound with many turns of fine wire, you must use a current with a high E.M.F. to fully magnetise the cores. This is ensured by winding the armature of the machine with fine wire and driving it fast. On the other hand, if the cores are wound with thick wire, the E.M.F. of the current may be low, and a machine wound with large wire will then serve the purpose.—G. E. B.

Pattern Making.—A YOUNG PATTERN MAKER.—You will make the core box precisely as you would for a spur wheel, except that the helical teeth would be substituted for spur wheel teeth. As you do not ask for the methods of striking and working the teeth themselves, I presume you are familiar with those methods. If not, I will describe them on the repetition of the question. As this would involve a column of letterpress and several woodcuts, I will not burden our columns with it, unless explicitly asked for.—J.

Malleable Castings.—CASTINGS (*Poplar*).—Write to Harrison, Malleable Iron Works, Lincoln. The price of the castings should range between 4d. and 5d. per lb. I think you could mark the article "Patent," but write to the Patent Office in Chancery Lane, E.C.—J.

Index to WORK.—A. McN. (*Belfast*).—An exhaustive Index to the first volume of WORK is on sale of Messrs. Cassell & Company, Limited, and every bookseller.—F. J. C.

Deafness.—AURAL (*Aberdeen*).—Much obliged, but we do not answer any queries relative to medical or surgical matters.

Back Numbers of WORK.—A. S. (*Stamford Hill*) and many other inquirers are informed that back numbers and parts of WORK from the commencement are obtainable through any bookseller, or through Messrs. Cassell & Company, Ludgate Hill, London, E.C.—F. J. C.

Music Stand.—J. H. S. (*Stockport*).—I am sorry you have had to read and re-read my music-stand article a score of times—literally speaking, that means you have perused it forty times!—and have at last had to give it up. But I am sure that if you had examined the engravings rather more closely, it would have been quite clear to you. As it is, the last paragraph on page 552 is quite correct, and if you read the first paragraph on page 553, and look at the inscription under the fretwork panel on the same page, you will find that no mistake is made. To answer your query, however, I must give a few diagrams. Figs. 1 and 2 represent that portion of the stand on to which the shaped piece (Fig. 6, page 553) is hinged, and the end of side rail on movable frame. The frames are

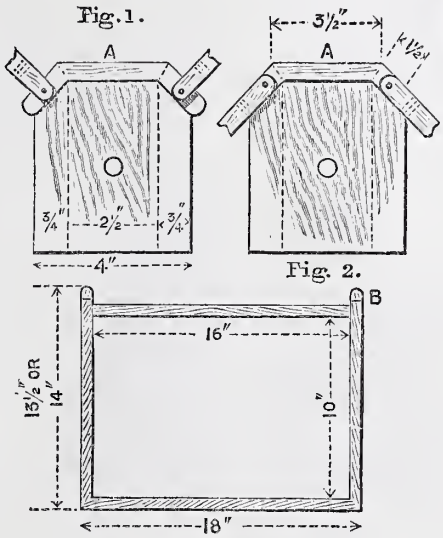


Fig. 3.

Music Stand.

fastened (at B in Fig. 3) by pivots to the sloping pieces on each side of A in Figs. 1 and 2. The plain portion above music book in Fig. 4 is to be rather Irish, not plain, but slightly shaded to show that it is entirely distinct from the whole-shaded piece above it.—J. S.

Basket Making.—J. T. (*London, E.C.*) asks if there is any book published on basket making. I may say in reply that I believe there to be no such publication in existence. Some years ago I came across a book, the title of which I do not now remember, in which there were some two or three pages devoted to the subject; that is the only scrap I have ever seen or heard tell of. With respect to the further inquiry, I may say the Editor has asked me to write on the subject, and I have consented, as soon as my business makes a rather less demand upon my time. In the meantime, if there is anything J. T. wishes to know, I shall be most willing to assist him through the columns of "Shop."—W. S. B.

Harp Regulating.—HARPIST (*London*).—I should strongly advise HARPIST not to attempt any regulating of the action of his harp, but to send it to a competent repairer, who will do it thoroughly and save him no inconsiderable amount of trouble, and probably expense. The mechanism of a harp, and especially of a double-action one, is of such a complicated character, and so many different causes will produce the same effect, viz., the "buzzing" of which HARPIST complains, that it is safer, especially if the instrument is valuable, to have it done by a properly qualified tradesman. If, however, HARPIST thinks himself capable of undertaking the job, and does not mind risking the chance of making bad worse, I will endeavour to explain how he may find out the cause of "the forks not pinching the strings tightly," and how to remedy it. Running down the inside of the column of the harp, from head to pedestal, are wire rods which connect the pedals to the metal squares in the head, and these are in turn connected to the jointed flat rods which fill the interior of the neck between the brass plates; and these, in their turn, are connected by arms or levers to the pivots on which the forks are fixed. All harps, however, do not work in this direct way, different makers adopting different methods to attain the same end, but the principle is the same. The forks in HARPIST'S case do not turn sufficiently, and this may be due first to the pedals being bent; second, to the pull-down rods having become worn in the holes at top or bottom, thereby rendering them a little too long; or, third, to the arms or levers which work the fork-pivots having become bent. In the first instance, press down the pedal and ascertain if only one or all the sets of notes acted upon by that pedal are affected; if all, the fault lies in the pull-down or the pedals. Lay the harp down, and take off the bottom by unscrewing the nuts or screws which hold it in its place; then examine the pedal to see if it is bent down; if found to be so, take it off by removing the spring and taking out the screws of the pull-down and hinge at the front, then get the pedal straightened and connect up again. 2nd. If it is not bent, after removing the springs and the screw of the pull-down, grasp the latter *tightly* with a pair of pliers just above the union, and turn this union to the right one whole turn, then replace screw, spring, and pedestal and try it. Do not give more than one turn to the union before trying it, as you otherwise may couple it up too tightly, and in pressing down the pedal again may break or strain the action. 3rd. If only one note of the set is faulty, then the evil is in the action itself, and it is hopeless for an amateur to attempt to remedy it.—R. F.

Silver Test.—J. P. (*Liverpool*).—Silver can be obtained in commerce almost pure, but, on account of its softness, a little copper is added to it when used for bullion, coin, or domestic purposes. The standard silver of England contains 111 parts of silver and 9 parts of copper. Dissolve a small piece of the silver in nitric acid; if it contains copper the solution will have a blue tint; gold will remain undissolved as a black powder. To the clear solution add hydrochloric (muriatic) acid, when all the silver will be precipitated as chloride, along with mercury or lead if present. Boil, allow the silver chloride to settle, decant off the liquid, A, and wash well with boiling water. Warm the precipitate with ammonia, which dissolves all the silver chloride but leaves the lead unchanged and turns the mercury black without dissolving it. This and the blue coloration mentioned above are probably all you require; but, if you suspect your silver to be very impure, you may test further by diluting the solution, A, with water and passing a stream of sulphuretted hydrogen through it. No coloration or precipitate, even on warming, shows the absence of lead, mercury, copper, bismuth, tin, antimony, and arsenic. But if on warming there be a precipitate, filter from the solution, B (to which I shall refer again), and wash well. Boil the precipitate with either potash solution or ammonium sulphide, and filter if necessary. The residue, C, may be lead, mercury, copper, or bismuth; and if, on adding hydrochloric acid to the filtrate, a precipitate, D, be formed, this may be tin, antimony, or arsenic. Add strong nitric acid to the residue, C; evaporate nearly to dryness, and add dilute sulphuric acid: a white residue will denote the presence of lead, and a black one that of mercury. Filter and add an excess of ammonia to the filtrate; a precipitate denotes bismuth and a blue coloration copper. The precipitate, D, of tin, antimony, or arsenic is redissolved in strong hydrochloric acid, cooled, and poured into a small flask containing pieces of pure zinc lying on bright platinum foil. The flask should be fitted with a cork, through which passes a piece of glass tubing, drawn out to a fine jet. Light the gas issuing from the jet, and allow the flame to play on the cool surface of a piece of clean porcelain; if a black stain be formed, arsenic is present. Examine the platinum and pieces of zinc in the flask; a black stain on the former is due to antimony, and on the zinc to tin. Now return to solution, B; boil off the sulphuretted hydrogen, evaporate to dryness with a few drops of nitric acid, and redissolve in dilute hydrochloric acid; any residue will be silica. Add ammonium chloride and ammonia and boil; a precipitate will be iron (chromium or aluminium); filter if necessary, add ammonium sulphide to the filtrate and boil. A black precipitate will indicate cobalt or nickel, a light pink precipitate manganese, and a white one zinc. Fuse the black precipitate with a little borax; the bead will be blue if cobalt be present, but brown or yellow if nickel. By this method you can test all silver ores very easily and rapidly, as it does not take so long as might be thought from the description thereof.—F. B. C.

Duchesse Table.—A. B. C. (*New Brompton*).—This subject will receive due attention, but a design cannot be given in the "Shop" columns, where it would be very little use to most of our readers without a detailed description of construction. I congratulate you on your success with the sofa you have made.—D. D.

Sideboard Decoration.—G. R. M. (*Greenock*).—I must ask you to explain more fully what you mean by "textile work." There are so many textile fabrics that it is quite impossible to give the information you require without knowing to which one you refer, if, indeed, you refer to any special make. If you do not, I think you would find tapestry or Utrecht velvet suitable, though I do not understand what parts you call "the corners." Both the materials named can be got from any good cabinet maker or upholsterer. The values vary so much according to quality that it would be useless to quote prices, which can be got from the person supplying you.—D. D.

Glass Polishing.—A. H. (*Edinburgh*).—Without the practical experience which you lack you would find it a most difficult matter to block out scratches on glass plate. If you are inclined to try you may do so by what may be called grinding or rubbing

down with such powders as pumice and finally polishing. The spots you refer to are probably in the silvering and not in the glass. If they are in the glass it will hardly be worth while going to the expense of resilvering. As I presume you are not going to do the silvering yourself, you can instruct the silverers to block out the scratches. If the plate is worth silvering do not grudge the small extra cost of removing the scratches.—D. A.

Polishing.—T. W. (*Rotherhithe*).—Glazing is a method of finishing polished work, and is used as a substitute for "spiriting" after "bodying in." You may as well buy the glaze. It is sold at the same places as polish. If you prefer to make your own, you can easily do so by dissolving gum benzoin in methylated spirits, in the proportion of one to two or thereabouts in bulk. The gum must be crushed small, and the mixture be filtered before using. Apply the glaze with a soft brush or rubber.—D. D.

French Polish.—BEGINNER.—French polish is made by dissolving shellac in methylated spirit, but you can buy it about as cheaply as you can make it. If you want to do this put, say, 6 oz. of shellac in a pint of spirit and wait till the shellac is dissolved. Further particulars will be given in articles on polishing.—D. A.

Rebating or Rabbeting.—BEGINNER.—From your remarks about the difficulty of rabbeting, I suppose you have never seen a rabbet plane used by any one accustomed to it. If you can get a friend to show you how to use it you will find there is really very little difficulty in cutting a rabbet, but in case you cannot I endeavour to describe the operation briefly. Mark the width of the rabbet with a cutting gauge, with which I presume you are acquainted. Guided by the cut so made take off a little with a chisel. You then have a slight rabbet, and you will then have no difficulty in doing the remainder with the plane. It may help you to know that you should keep the tips of the fingers of the left hand slightly under the plane in order that they may act as a guide. The plane of course is held when in use with the left hand in front of the iron, so the ends of the fingers are quite naturally in the required position. It is not the invariable practice to use the chisel before the plane, but you may as well do so, till you are able to dispense with it. I am almost afraid that you have made the frame before cutting the rabbet. If you have, reverse the operation with the next one you make and do the rabbeting first.—D. A.

Lead Chucks.—BEGINNER.—I am pleased to hear you have managed so well with your lead chucks, but unless there is something special about them I am afraid it would be hardly worth while to describe them. However, if you care to do so any description sent to the Editor will have his careful attention. You will be able to get the castings made by any brass founder.—D. A.

Photography and House Painting.—The article on "Pinhole Photography" appeared in No. 17 of WORK. A good book on house painting is "House Painting, Graining, etc.," by Davidson, 5s. (Lockwood & Co.).—F. J. C.

Oak Wood Purchasing.—AN AMATEUR.—Oak ready planed for use can be bought at most of the timber yards in and around Curtain Road, E.C., at the following prices:—

Thickness	$\frac{1}{4}$ in.	$\frac{3}{16}$ in.	$\frac{1}{8}$ in.	$\frac{3}{32}$ in.	$\frac{1}{16}$ in.
Price	3d.	$3\frac{1}{2}$d.	4d.	$5\frac{1}{2}$d.	$6\frac{1}{2}$d.

per foot super. Try Latham, 124, Curtain Road.—A. J. H.

Lawn Mowers.—Loco (*Colchester*).—Kindly send name and full address, that I may communicate with you respecting the proposal contained in your letter.

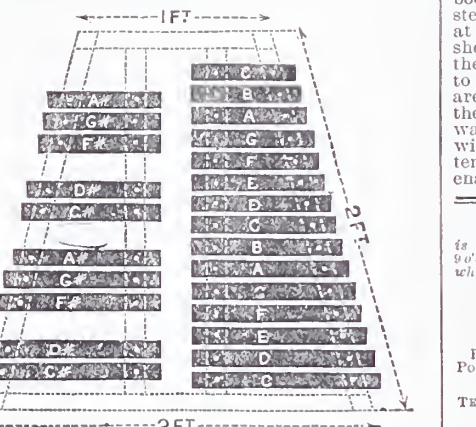
Cleaning Map.—CHIPMUNK (*Hull*).—Your mounted map will require taking up and relaying, an operation requiring great experience and tact; it is impossible to aid you by describing process, but any good print restorer, or even bookbinder, will undertake it at a very low cost.—F. B.

Sensitised Paper.—G. N. P. (*Aberdeen*).—Make a solution of seventy grains of ferricyanide of potassium in one ounce of water; in another ounce of water dissolve one hundred grains of ammonio-citrate of iron; just before use mix the two solutions. Pin a sheet of good white paper of even texture on a board and apply the mixed solutions to the surface evenly with a sponge or brush, until equally moistened all over, then dry in the dark. A yellowish-grey paper will be the result. Print under a negative until the detail is fairly out. Remove from the printing frame and immerse in water very slightly acidulated with hydrochloric acid. Wash for half an hour or so in several changes of water and dry. The chemicals can be found at any chemists, as they are in general use for other purposes. The ammonio-citrate of iron should be in clear bright scales, not clotted together; as this preparation is somewhat deliquescent it is necessary to keep it in a well-corked bottle.—E. D.

Warming Organ Room.—X. Y. Z.—A simple apparatus for keeping the organ room at an even temperature during winter can be made by placing a long cone or tube of metal over a lamp or gas jet. The metal soon becomes hot all over and radiates the heat over the room, and by adjusting the height of the gas jet the amount of heat can be regulated. A very small jet is all that would be required for a moderate sized room, as a large amount of heat is not necessary. A thermometer should be kept in the room, and about 50 degrees would be ample heat. The cone can be made of sheet iron, or preferably of bright tin-plate.—M. W.

Telephone.—J. K. (*Manchester*).—Your letter is quite a treat; I am sure the Editor will be pleased to learn that WORK is so helpful to you and men of your class. Personally I am very much pleased to be able to help you, and glad that you have taken an interest in my article on the telephone. You will find all the information you desire already given in WORK. I have described three different processes for magnetising steel bars for telephone magnets, any one of which you may use. It is quite possible for an amateur to undertake this piece of work, but I certainly would advise you to buy them. You will get them at any electrician's shop, of which there are many in Manchester. You should get a pair to suit your purpose for about 2s. If you cannot get them round, conveniently flat ones will do just as well. You need not trouble trying to get mahogany for the body; any kind of wood will do, either hard or soft—in fact a brush handle will answer the purpose. The first telephone I made had a body made with a number of plies of paper glued and rolled together; I only mentioned the mahogany because it is easy to work and looks well when finished. I hope you will be successful with your telephones. If I was nearer you I would like to help you personally. Write again if you want anything.—W. D.

Xylophone.—ANXIOUS (*Chester*).—The accompanying diagram will, I think, sufficiently explain the construction of the "Xylophone" or "Gigelira." The dotted lines show the frame $\frac{3}{4}$ in. thick. On this are fastened by wire nails the bands of straw 1 in. diameter. On these bands again are laid the notes made of wood and kept in their places by



Xylophone.

nails which pass through holes somewhat larger in diameter than the nails themselves. The notes as they approach the top of the scale are made thinner as well as shorter. The best wood to use for the purpose is rosewood, but very good results may be obtained from yellow pine or black walnut, but it is almost essential that all the notes be made from the same plank to ensure uniformity of tone. The beaters are made of boxwood, and are knobs of 1 in. diameter on cane handles 10 in. long.

Bookbinding.—AMATEUR (*Holloway*).—Bookbinders' cloth varies a great deal in price, according to the style of finish upon it, and also the colour, and, as I have never bought it in small quantities, I could hardly tell you what price the makers would retail it at. But I have sold many a yard to amateurs and small bookbinders, and charged them from 6d. to 9d. per yard. You will, however, get a fair piece, containing 36 yards, for 18s. Morocco also varies in price; a very good skin may be got for 8s. 6d. Amateurs can be easily cheated with morocco. There are so many imitations it is difficult to tell the real stuff when one does see it. I can always tell better by looking at the back; in fact, I always judge morocco by looking at the back.—G. C.

Engraving and Lithographing.—W. W. (*Kelso, N.B.*).—Both these arts require a course of instruction and education before they can be practised. Books on the subject, also on water-colour painting, are published by Messrs. George Rowney and Son, Rathbone Place, London, W. I think they cost 1s. each.—F. B.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. H.; N. M. (*Sheffield*); EELAW; A. C. (*Manchester*); C. J. (*Leeds*); J. S. (*Ashton-under-Lyne*); D. O. W. (*Ipswich*); X. E. A. (*Sheffield*); JUSTICE; CODGETO; AN AMATEUR; W. E. B.; L. B. (*Wells*); R. W. G. H.; CABINET MAKER; J. S. S. B. (*Dublin*); J. C. (*Scarborough*); KILDONAN; L. T.; J. A. W. (*Sheffield*); W. J. (*Wolverhampton*); H. S. M; (*Birmingham*); POLYGON; A. P. (*Manchester*); WATER (*Leeds*). DON; AN ADMIRER OF "WORK"; J. W. F. (*London, W.*); A. S. (*Paisley*); J. L. (*Wimborne*); E. M. H. (*Glasgow*); GOSFORTH; J. H. M. (*Meath*); G. R. D. (*Shipley*); J. S. (*Huddersfield*); DRY PLATE; TELESCOPE; CONSTANT SUBSCRIBER; TIN TICKET; DEW; DEMENTED (*Manchester*); PAPYRUS (*Petersfield*); AMATEUR STEREO; P. M. G. (*Glasgow*); W. S. (*Shipley*); E. B. (*Cheltenham*); J. E. (*Blackhill*); J. S. (*Longsight*); A. Y. (*Cullompton*); ALBERT; E. A. P. (*Whitstable*); WOULD-BE WOOD CARVER; H. A. H. (*Clatham*); AIRUS (*London, S.E.*); FARDO; SEPTIMUS; W. W. A. (*Lanark*); E. M. (*London, N.W.*); J. K. (*Mile End*); MONUMENTAL MASON; THE VICTOR CYCLE CO.; CAROL; W. C. (*West Bromwich*); HELPLESS; W. H. Y. (*London, S.W.*); W. E. (*Heckmondwike*); H. E. A. (*Hackney*); STANNUM; STOKER.

Trade Notes and Memoranda.

THE first consignment of wood from Madagascar arrived in the London Docks recently, and excited not a little interest in the timber trade. The wood has been imported by the Madagascar Forests Company (Limited). The company has the concession for a forest extending over 1,600 square miles. The first cargo imported comprises 190 tons of hard woods, which the experts declare are suited not only for furniture and purposes to which mahogany is applied, but also for flooring and ship-building. One kind, of which the Madagascar name is arzovola, resembles walnut in colour and grain, and having a fine figure, should be valuable for cabinet work. The intention is to make regular consignments from Madagascar.

RECENTLY at the Ermont Works of the French Northern Railway, a curious electrical and mechanical instrument called a "Schiséophone" was tested with most satisfactory results. It indicated with marvellous accuracy the exact spot where interior flaws in the iron and steel were concealed, the proof being obtained by fracturing the rails to see whether the invention had really discovered the presence of defects not outwardly visible.

GLASS enamelled steel casks are being made in the States for use as filters in glucose and sugar refineries, evaporating tanks for salt works, and other purposes, and to take the place of the casks in breweries. They are said to be the finest specimens of enamelled steel work yet produced. The body of the cask is composed of a number of welded steel rings, four inches thick, with right-angle flanges at each edge. The heads are stamped from single sheets of steel in a powerful hydraulic press, and the inside is coated with a glass enamel, melted on to the steel at a high heat. The sections and heads are bolted together with $\frac{1}{2}$ in. bolts, 2 in. apart, and the flanges are reinforced by continuous steel washers. The casks can be drilled at any point without chipping the enamel, which shows the tenacious union effected between the steel and the enamel.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [15 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 sheets, 2s. 6d. All post free. Lists free.—F. COULTHARD, East Cliff Terrace, Bournemouth. [1 S

Vietor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [17 R

Glass Silverer and Beveller.—EDWIN HAMMOND, Junction Road, Romford, Essex. Please state requirements. [19 R

Machinery and Tools.—Largest Stock in London. BRITANNIA Co., 100, Houndsditch. Cash or Hire Purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks and Dies, Forges, etc. Catalogue of new, 6d.; second-hand, 2d.—BRITANNIA Co., Colchester.

Best Book on Lathe, Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [21 R

Model Ships' Fittings, engines, castings, parts, etc. Illustrated Catalogue, 4d.—STIFFIN & Co., 324, Essex Road, Islington, London. [3 S

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured.—ETHELBERT HENRY, Alvaston, Derby. [22 R

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET

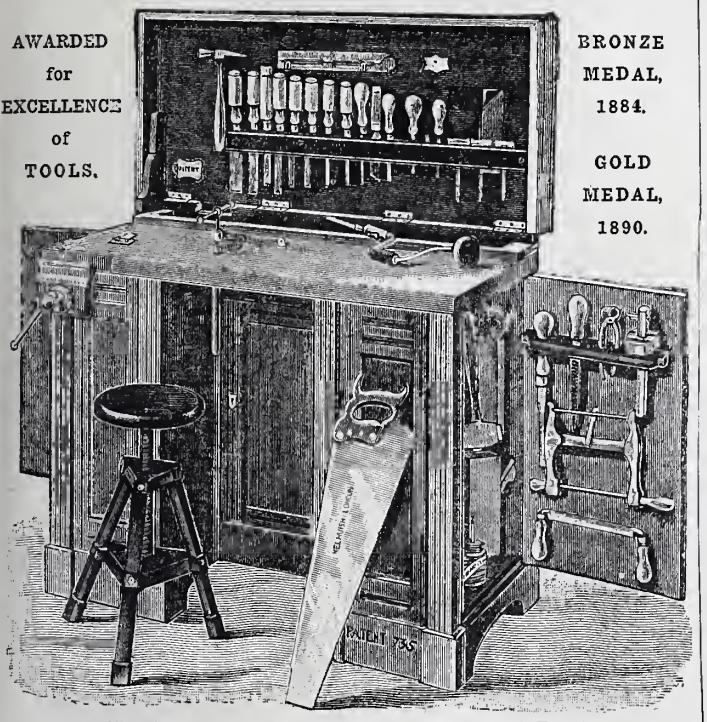
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

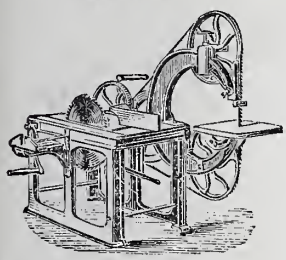
Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

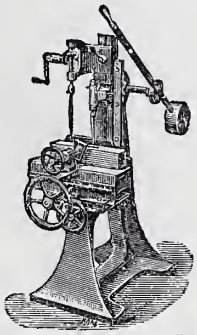
LEWIS & LEWIS,



ENGINEERS,

CAMBRIDGE HEATH,

LONDON, N.E.



THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,

For Hand or Power, will take in 22 in. Circular Saw, and will cut by hand-power up to 5 in. deep

THE "HACKNEY" MORTISING & BORING MACHINE.

With 8 Chisels, 1 Coredriver, Key, 3 Augers, and 3 Drills.

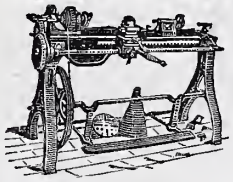
FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,

TOOL MAKERS, DUBLIN.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Road, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.

37, CHANCERY LANE, LONDON, E.C.

Monthly,] CASSELL'S TIME TABLES. [*4d.*

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

Post free on application.

CASSELL'S CLASSIFIED CATALOGUE.

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

60th Thousand, price *1s.*; post free, *1s. 3d.*

Cassell's Shilling Cookery. This new and valuable Work contains 364 pages, crown 8vo, bound in limp cloth.

"This is the largest and most comprehensive work on the subject of cookery ever yet published at the price." —*Christian Age.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

ASPINALL'S ENAMEL.

INCOMPARABLE,

COLOURS

BEWILDERING,

BEAUTIFUL.

PRINCESS.

TO AMATEURS.

The roughest proscenium, or fittings, knocked up for the occasion in Hall, School, or Country House, may be made not only beautiful, but very like the real thing by a pot or two of ASPINALL'S ENAMEL at the cost of a few shillings, and the success of a show is frequently enhanced by bright surroundings. *Verb.sap.*

SOLD EVERYWHERE,

In Tins, or post free, 7d., 1s. 6d., and 3s.;
For Baths, 9d., 1s. 9d., and 3s. 6d.,
FROM
WORKS, LONDON, S.E.

ASPINALL'S EBONICA,

A JET BRILLIANT BLACK, FOR
Cycles, Basket Carriages, Bedsteads, &c.
Sample Tin, 9d., post free.
COLOUR CARDS POST FREE.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6d. OR FOR 7 STAMPS
BIRMINGHAM. [33

GRATEFUL—COMFORTING.

EPPS'S COCOA

BOILING WATER OR MILK.

Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic WEAKNESS speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be Healthy and Strong permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,
52, OXFORD ST., LONDON, W.
(Corner of Rathbone Place).
All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 63.] SATURDAY, MAY 31, 1890. [PRICE ONE PENNY.

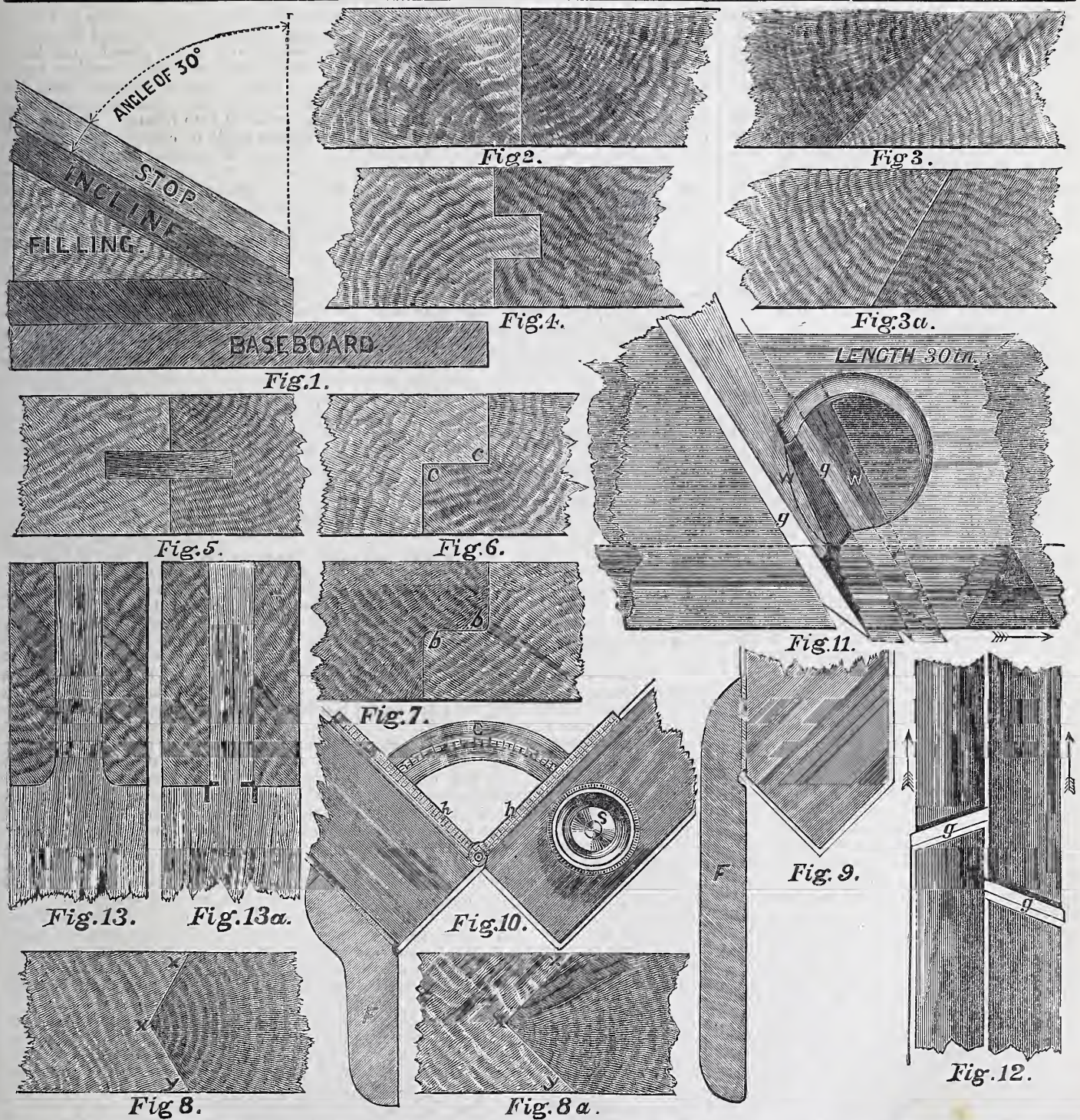


Fig. 1.—Shooting Board for Slape Jointing at 30° (¼ full size). Fig. 2.—Jump-Joint. Fig. 3.—Bevel Joint, 45°. Fig. 3 A.—Ditto, 60°. Fig. 4.—Groove and Tongue. Fig. 5.—Groove and Loose Tongue Joint. Fig. 6.—Rebated Joint. Fig. 7.—Ditto, rounded, *b b*. Fig. 8.—Double-Bevel or V-Joint at 60°. Fig. 8 A.—Double-Bevel Joint at 45°. Fig. 9.—Section of Plane for Double-Bevel Jointing with Fence, F. Fig. 10.—End View of Twin Plane for V to fit Groove, with Fence, F, and Hinges, *b b*, Quadrant, G, and Thumb-Screw, S, for adjusting to Exact Angle of Bevel Groove. Fig. 11.—Side View of Twin Plane for V to fit Bevel Groove. Fig. 12.—Plan looking up of Twin Plane, *g, g*, Irons. Fig. 13.—Good Mortise and Tenon Joint. Fig. 13 A.—Bad Mortise and Tenon Joint: Saw cuts too deep. Figs. 2 to 13 A full size.

CONSTRUCTIVE STRENGTH IN WOODWORK.

BY JOHN WHITFIELD HARLAND.

JOINTING—JUMP - JOINTING—SHOOTING BOARD—GROOVED AND TONGUED JOINTS—REBATED JOINTS—DOUBLE-BEVELLED OR V-JOINTS—TWIN PLANE—MORTISES AND TENONS.

I HAVE frequently met with practical workmen who know perfectly well how to go about almost any job—that is, know where to mortise and tenon, where to dovetail, and where to halve, where to "jump joint," and where to "groove and tongue," where to "house" and to "flush-shoulder"—but who have never troubled to think whether the ordinary modes of performing these operations cannot be very greatly improved upon. They are content to go on making their framings as they have been taught to do, without seeking to find out the strongest possible way of putting them together, or to think out for themselves how to avoid weak points in these several methods. In dovetailing, for instance, how often do we see the angle so acute as to weaken the joint so made; and in scarfing, fifty weak forms are found to one strong form.

I will endeavour, by criticising and pointing out weaknesses in each, to upset this "rule of thumb" way of going about work, and show that if a more scientific way is substituted, equal strength with less material can be attained.

Firstly, let us consider some forms of jointing.

Jump-Jointing.—By far the commonest joint is that which is known as "*jump-jointing*," *i.e.*, shooting two edges perfectly true and rubbing out the glue; and it is the custom to shoot the edges as nearly square as possible. Let us analyse this method, and take inch boards as our instance, say 3 feet long. If jointed square, and the glue is well rubbed out, we have an area of 36 sq. in. only. As these joints depend upon atmospheric pressure, chiefly, for their adhesion, and not upon the cohesion of glue to any great extent, it follows that, other things being equal, the greater the area the greater will be the cohesive strength. To attain this, if the edges instead of being square were shot perfectly straight at an angle of 45°, the superficial area of the joint would be increased proportionately — viz. (Euclid, Book I, 45th Prop.), "The square described on the hypotenuse of a right-angled triangle is equal to the sum of the squares of the other two sides." It therefore follows that, in this case, the surface (in section) at an angle of 45°, subtended by the two sides, of an inch each, at right angles to one another, would give a diagonal very nearly 1½ in., so that the area of joint-surface would be nearly half as much again. Now a square joint offers no lateral resistance to the subsequent warping or winding of the wood should it not have been previously thoroughly seasoned, but a joint at an angle does offer a resistance in *one* direction—that is, the underlapped board could not rise, though it might shrink off. From this reasoning it is clear that a joint shot at an angle is stronger than one shot square. Too great an angle will entail much trouble in rubbing out the glue, as, of course, it is more likely to slip. Indeed, in rubbing out, two strips of stuff should be fixed in the bench-screw with the bottom piece, the angle falling towards them, to prevent slipping off—one at each end, about 4 or 5 inches off. If the shooting board be made at a proper angle to the plane instead of flat (*see* Fig. 1), no more difficulty in shooting would be found. Of course, in long joints the shooting board can play no part, and the square joint becomes imperative. It has been objected to me by practical workmen that there is a waste of stuff in bevelled joints, but I can prove there is not any waste sufficient to counterbalance the gain in strength, for ¾ in. stuff gives on the bevel as much cohesion as 1 in. stuff on the square. My own theory is that an angle of 30° is the best and strongest jump-joint that can be made. I have heard this jump-joint called a "slape" joint in the north of England.

Grooved and Tongued Joints.—In this form of jointing the joint is strengthened (?) by either a groove being ploughed in one board and a tongue cut in another, or by a groove ploughed in both and a loose or, as it is often termed, a "false" tongue glued into both grooves. This joint, if the proportion of the grooves be carefully calculated with respect to the thickness of the stuff, evidently offers a far greater cohesive area than the former, either in the case of "matched" tongues or loose ones; and, of the two, I prefer loose ones if the direction of the grain of the tongue be athwart the grain of the boards to be jointed. By thus crossing the grain, we have in reality a long *mortise and tenon*, which is the strongest means of uniting two separate pieces of wood. I admit that the extra surface entails almost a disproportionate co-efficient of labour in rubbing out, but the gain is indisputable in point of strength. If this joint be well made—the grooves not being too shallow, nor too wide for the thickness of the stuff; and the tongues are cut with accuracy, so as to fit well down to the bottom of both grooves—no stronger means of uniting two boards sideways can be devised. But it is very hard work; and the glue, unless very hot, cannot, unless two men assist, be rubbed properly out, owing to the extra friction offered by the surfaces in contact. My proportions for inch stuff are $\frac{3}{16}$ths groove, $\frac{5}{8}$ths deep in each board; tongue, 1¼ in. (bare) long in the grain; $\frac{3}{16}$ths (bare) in thickness, and put in in widths of 8 to 12 in.—preferably of wood harder than the boards to be jointed. Thus, for mahogany—oak or, still better, beech tongues; for rosewood—ebony or boxwood tongues; for pine—honduras, etc. But the inverse is also true; for extra hard woods, the tongues should be softer. For lignum-vitæ, boxwood, lancewood, etc., birch or honduras form the best tongues; and for this reason, that in soft wood the tongues, if hard, bruise it into a close fit. In hard woods resilience of the tongue is necessary, as one or other must give a little, owing to the glue swelling the wood whilst wet, which afterwards contracts again. This is really the only disadvantage of this form of joint; its shrinkage in drying requiring the tongue to be so tight a fit that one can hardly rub the glue thoroughly out by manual strength; whilst if the tongue is a thin, easy fit, one has to rely on glue more or less thick for its cohesiveness, which is bad.

Rebated Joints. — These consist of rebating the two edges of the boards equally, and making the joint by reversing them (*see* Fig. 6), so that the rebate of one fits the reveal of the other. This is a very strong joint, especially in thick stuff, say 1¼ in. and upwards, as the area of cohesion is added to by the surface of the depth of the rebate. But to make this joint well demands a special plane—a combination of the "trying" or "jointer" plane with the "rebate" or "rabbet" plane; or to be more explicit and correct, a steel-faced "rebate" plane of twice or thrice the usual length, which should be provided with a "fence," like a "plough," so as to make the reveal as straight as the faces of the joint. In rubbing such a joint you have the reveal to rub against, pressure downwards making the other part of the joint. My theory, say for 1 in. stuff, would be to make the rebate ½ in. by ½ in., which gives a cohesive area of 1½ in. multiplied by the length, whilst the reveal opposes resistance to either board warping or buckling. A rub with No. 1 glass-paper on the "arris" of each at *c c*, just to round it slightly, should be resorted to, to ensure that these internal angles should not add friction in the rubbing out of the glue by not being cut down exactly to a sharp true right angle, as it is almost certain, however sharp the blade may be, that something may hang in the corner of both rebates. In theory, if the interior angle or corner were hollowed, and the reveal rounded, the joint would be stronger still (*see* Fig. 7, *b b*). After gluing this form of joint, handscrews should be employed all along to force the reveals together; afterwards, cramps should be applied to force the faces into contact. When dry, the boards would split anywhere except the joint, if they give at all. And here let me remark, in passing, that workmen, as a rule, believe as an article of faith that a normally dry atmosphere and a medium temperature are the only essentials for seasoned work to stand. My own observations and experiments go to prove that there is a third factor—*light* (or more probably actinism), if not a fourth (electricity), which affects to a very great extent the warping tendencies of even long-seasoned timber. And I have carefully observed the tendency, especially of signboards, to become, in bright light, round on the face, and hollow where the back is kept almost entirely in the dark; and am convinced that this is *not* due to the heat of the sun's rays, as it has occurred in north aspects where the direct sunlight never falls to as great an extent, even bending 1 in. battens by its force. Where signboards are 6 in. or so away from the wall I have not noticed much warping. I, therefore, put it down to the action of actinism, by which is meant that portion of the ray of light which has been proved to affect chemically minerals, plants, and animals. I have also sawn up and planed up portions of live oak that for two or three centuries had been rafters in a church roof, with the intention of making up picture-frames of the well-known "Oxford" pattern, and in a day or two have found them as much warped and twisted *towards the light* as new, green wood would have been. Further, by turning them round the opposite side to the light, I have got them very nearly straight again.

Double-Bevelled or V-Joints. — There is another mode of joining edges of board together, which I have myself tried with success, and which I consider very strong and durable, though I never yet met with it in any one else's work; and that is the V-joint (*see* Fig. 8). Whilst I admit that it has one great disadvantage—that the two edges cannot be planed up with the same tool, but require two distinct and different planes—I think it a very strong, efficient, and workmanlike job; very easily rubbed, capable of resisting all warping tendencies in either board, requiring no lateral clamping, whilst the cohesive surface area is about 1½ to 1 of the square jump-joint. At a glance, it will be seen that in rubbing

no side slip is possible; and if the two angles, *x x* and *x y*, are equal and true, the joint can be made as perfect as any other. I should prefer, if having much jointing to do, to make a plane of section as in Fig. 9, with a fence, F, to keep the V-groove straight, and of three times the length of a moulding plane for one edge; and a plane with two blades, one placed an inch behind the other at the proper angles to each other to make the other edge; also with a fence to keep it straight. Again, an angle of 30° would be my choice. In Fig. 10 I give section, and in Fig. 11 side view, of such a plane; and in Fig. 12, view showing how the two blades finish the feather edge where the two angular or bevelled surfaces join. There would be no difficulty in sharpening the blades of either of the planes, nor of setting the double blades to the same angles of the single one to ensure perfect fit; and the joint would answer for end grain to side grain if the V were cut on the end grain wood, and the hollow V or groove in the side grain stuff, thus forming a clamp, instead of the groove and tongue joint now generally used. Messrs. Moseley and Sons, 323, High Holborn, have made from my designs these planes, and also an adjustable shooting-board on the same principle as Fig. 1, but which can be set to any angle.

Mortises and Tenons.—Passing now from joints to the consideration of mortises and tenons, let me point out that they are of two kinds—tenons passing through and afterwards wedged from the outside, and those where the tenons only go part through into mortises, also only partially cut through. The former, being the strongest, are used wherever practicable; but in the case of muntings, the latter only can be resorted to. The former, also, are more easily made true, as being mortised half through from one side, and half through returned from the other, the mortise is more easily kept square both ways; whilst the wedges driven in afterwards keep the shoulders well up and prevent the tenons drawing out. Of course, the tenoning machine cuts mortises equally true, whether part through or right through. In wedging up muntings, "fox" (a corruption of the Norman-French and modern French *faux*, false) wedges are used, their heads resting at the bottom of the mortises, forcing them up as the tenon is driven home; but very frequently this is omitted, and cannot be found out after the framing is put together. There are two very general faults in mortise and tenon joints—viz.: (1) In sawing the tenons sufficient care is not taken that the saw-cut stops short of the shoulder, and (2) that in sawing the shoulder the cut stops short of the tenon. In the first case it looks bad, but, beyond unsightliness, does not matter much. The second is a much more serious matter, and attacks the strength of a tenon in its weakest point; exactly where any strain would be most likely to break it—viz., at the neck. A little extra care and trouble would add great strength to tenons, made as in Fig. 13—where the saw is stopped short of the shoulder and short of the tenon by one eighth of an inch each way, and the wood cut away after with a gouge to the curve of a quadrant of a circle; the mortise edges being rounded with a paring chisel to receive it. A tenon ¼ in. thick would thus be as strong as an ordinary ⅜ in. one, simply and solely because the strength is in the right place—just where any strain would fly to—because it is just where the mortise can give the tenon no support at all, and where the shoulder, moreover, forms the fulcrum of leverage. In mortising spokes into the naves of wheels the extra time and trouble of making the tenons would be well repaid, even when the spokes are not only tenoned but housed as well; indeed, it is regretable that it is not practised in all tenoning.

MODERN FORGING.

BY J. H.

FORGES, ANVILS, HAMMERS.

HAVING made reference to the mediæval art of forging, I shall now commence the treatment of the modern practice of smiths' work.

In this article I will, however, dispose of some primary matters which must needs be dealt with briefly.

There are three conditions under which the smith works, each of which ought properly to receive separate treatment. These are: first, when he works alone without the assistance of a striker, or of steam power, or of dies; second, when he has the assistance of a striker or hammer-man, but is still destitute of steam power; third, when he has the help of a hammer-man, and has also the use of a steam hammer, and dies of various kinds. Amateurs and many country and jobbing smiths come under the first category. Men in small workshops come under the second. The third class embraces all the men in our large engineering and general iron works. I fear that I cannot devote special attention to either without neglecting the others. But yet it is obvious that the particular circumstances under which work has to be performed must often modify the methods adopted. For example, a man who has command of a steam hammer will almost invariably adopt a method of swaging or drawing down, when such is practicable, in preference to upsetting and welding. Again, a man who has command of dies and steam hammer, will not have to spend so much time in finishing and smoothing the surfaces, the angles, and corners of his work upon the anvil, as the man who can put his roughed work between a pair of dies, and finish it with a few blows of the steam hammer. Then the man who has no help from a striker will be greatly handicapped in all classes of work except the very lightest. All heavy work where the sledge is required must needs be abandoned. Iron of nearly the finished sizes and sections wanted will have to be used. No extensive drawing down can be done, no large welds made; little, in fact, beyond such delicate manipulation as can be done with the hand hammer. The top swages, the flatters and fullers, the chisels and gouges—except the anvil cutters—are of scarcely any use when there is only one pair of hands available for holding the work and the hammer or other tools. There is little chance to impart finish to the surfaces other than can be done with the hammer itself. The class of work, therefore, that comes within the range of the unassisted smith is entirely different from that of his brethren who are more favoured in the matter of assistance and tools. But there is all the wealth of ornamental work, like that done by mediæval smiths, possible; all tool work—almost anything, in fact, where the sections of iron and steel do not exceed, say, 1 in. to 1¼ in. in diameter.

Obviously, the choice of forges, tools, and so forth, as well as methods of work, will be different under these several conditions.

Notwithstanding that the forge is so common an appliance, there are few articles that exist in more diverse types. A brief notice of some of the principal of these will be useful as a guide to the choice of one. We take first the portable bellows forges, which are made in both rectangular and circular forms. These are made in a great many sizes, and are adapted both for amateur use and for the workshops. Sizes and prices can be obtained from makers' catalogues. One with a hearth measuring about 25 in. by 18 in. is sufficiently large for a single-handed workman. Such a forge is large enough to heat a bar of iron about 1 in. or 1¼ in. square. For heavier work, requiring the aid of a hammer-man, the hearth may measure 33 in. by 26 in., and range thence up to 39 in. by 30 in. for the largest work. The proper forge for average and occasional heavy work is the common rude form built of bricks or stone.

For those who cannot afford to buy a portable forge, nor to build one in masonry, I refer to a sketch of a forge already given in Vol. I., p. 733—in reply to a correspondent—that is easily and cheaply made. It is built of angle iron, flat bars, and thin sheets.

For blast, a bellows, or a fan, or a blower will be used. The old-fashioned bellows hold their own in country shops; but in modern establishments a fan blast or a blower is used in preference; and either of the latter is superior in all respects to the bellows. There is now so very little difference in the cost of blowers and fans, that I should give preference to a forge fitted with a Roots blower—one of those made by Thwaites, of Bradford, or by Samuelson, of Banbury. Fig. 1 shows a forge with hand blower attached, and Fig. 2 an enlarged view of the blower and gear, the revolvers being shown in section. These revolvers embody the latest improvements introduced by Mr. Roots. The smallest made cost between £7 and £8, the hearth measuring 20 in. by 14 in., and the blower being equal in power to 24 in. bellows. If cheapness is sought, then get one of the fan forges (Figs. 3, 3A), sold by the Britannia Co., of Colchester, at half the price.

The blowers are undoubtedly the best. The blast pressure is under perfect control, and is of the nature of a positive current, that is, one definite in amount. A soft and continuous blast is superior to one that is spasmodic, variable, and intermittent; and the blast from a blower or fan is for these reasons better than one from bellows. The cost is not exceptionally high; and considering the neatness of the arrangement, and the good results attainable, this type of portable forge is the one which should be recommended to an amateur or to a private workman.

There are several kinds of blowers used in portable forges, and on behalf of each some superiority is claimed over others. I will not pretend to settle contending claims; but, if I may express an opinion without getting into hot water, I should say that though each possesses perhaps some practical features which are not possessed by its rivals, yet there is not very much to choose between the *average* working value of each. Beyond this I will not venture.

In workshops a row of forges will be supplied with blast from a single fan or blower, each forge being furnished with a throttle valve in its tuyere pipe.

In small forges the tuyere is simply a tube and nothing more. But in all large forges operated by powerful blast, a water tuyere is used. That is, the tuyere is

surrounded with water, which protects the nose from the destructive heat of the fire. There are several forms of such water tuyeres. The commonest are shown in Figs. 4 and 5. In the first, a cast-iron tank (A) contains a supply of water, which also fills up the annular space (B) around the nozzle (C). In the second (Fig. 5) —made both in wrought and cast iron—a supply of water enters the annular space by the pipe (A) and leaves it by the pipe (B), so maintaining a constant circulation of cold water.

In small forges the simple thickening-up of the nozzle serves to preserve it from destruction for a very long period, and the casting when burnt away is replaced.

The anvil (Fig. 6) used by smiths ranges from about two to four hundredweights in weight, and is made of wrought iron—steel-faced. The conical end (A) or "beak" is used for turning bars upon, and the hole (B) is for the reception of the anvil chisel, and various bottom tools. Bruising of the edges of the anvil should always be guarded against as much as possible.

The anvil is supported upon a stand so that its face is about 22 in. high from the ground. The stand is often made of a block of wood, upon which the anvil is prevented from slipping sideways with spikes driven into the wood close alongside the anvil-feet. For neatness, a casting is often substituted (Fig. 7). An iron stand is better than one of wood, because it is much firmer; and, as the expense is only incurred once, it is better to have the stand in iron.

The anvil becomes worn hollow on the surface in the course of time, and the edges rounding. The longer this is delayed the better, because the truth of an anvil is valuable when flatting over large surfaces and square corners.

Occasionally, but very seldom, the beak becomes broken off; but, unless it is faulty, it would need very rough usage to cause such a fracture.

The hammers used by smiths are of two kinds—the hand hammer and the sledge. The first-named weigh from ½ lb. to 1 lb., and are of the form shown in Fig. 8. The ball pane (Fig. 8) and the cross pane are used for fullering and drawing down. The flat pane is used for striking heavy blows, and for finishing surfaces. The sledges are of one of the two forms in Figs. 9 and 10, and weigh from 4 to perhaps 14 lbs.; one of from 6 to 8 lbs. weight being about the average. To swing a sledge constantly without making the hand sore, the handle is kept very smooth. Any roughness is at once removed with glass-paper. The head must needs be well secured to prevent possible flying off. Fig. 11 shows how it is wedged on. Hammer handles are properly kept in stock in a dry place for several weeks previous to use; because, if not well seasoned, they shrink with the heat of the smithy, and are apt to work loose on their heads.

The miscellaneous small tools used by the smith, though numerous, are resolvable into a few broad types. They consist very largely of tools for moulding or shaping metal into diverse forms. Like the tools used in many other trades, these accumulate in large quantities, being made as occasion requires.

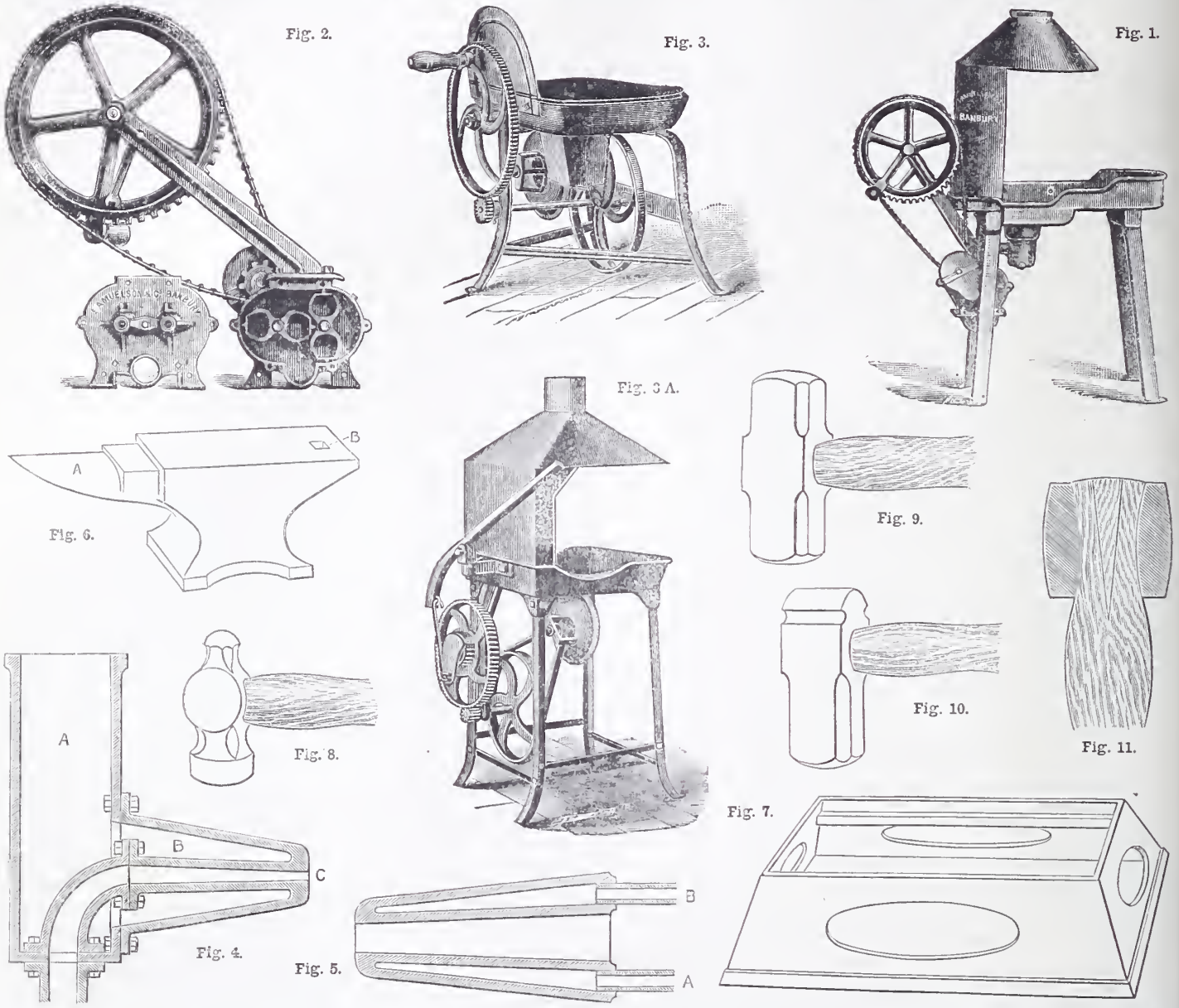


Fig. 1.—Samuelson's Forge with Hand Blower attached. Fig. 2.—Enlarged View of Blower and Gear. Fig. 3.—Britannia Company's Fan Forge without Hood. Fig. 3A.—Ditto, with Hood. Figs. 4, 5.—Water Tuyeres. Fig. 6.—Smith's Anvil. Fig. 7.—Iron Casting for Anvil Stand. Fig. 8.—Ball Pane Hammer. Figs. 9, 10.—Sledge Hammers. Fig. 11.—Mode of Wedging on Hammer Head to Shaft or Handle.

A workman is familiar with the forms and uses of these tools, an amateur is not. As I write in the interest of both, I will adopt a method of compromise. Instead of occupying two or three chapters with the description of these tools—uninteresting to the first, interesting and useful to the second—I will describe them in connection with the processes and operations for which they are used, so spreading this section over the entire series of articles. In pursuing my subject I shall introduce at the same time the distinctive tools and appliances used in the operations described, and in that way I hope to omit nothing of any material interest or importance.

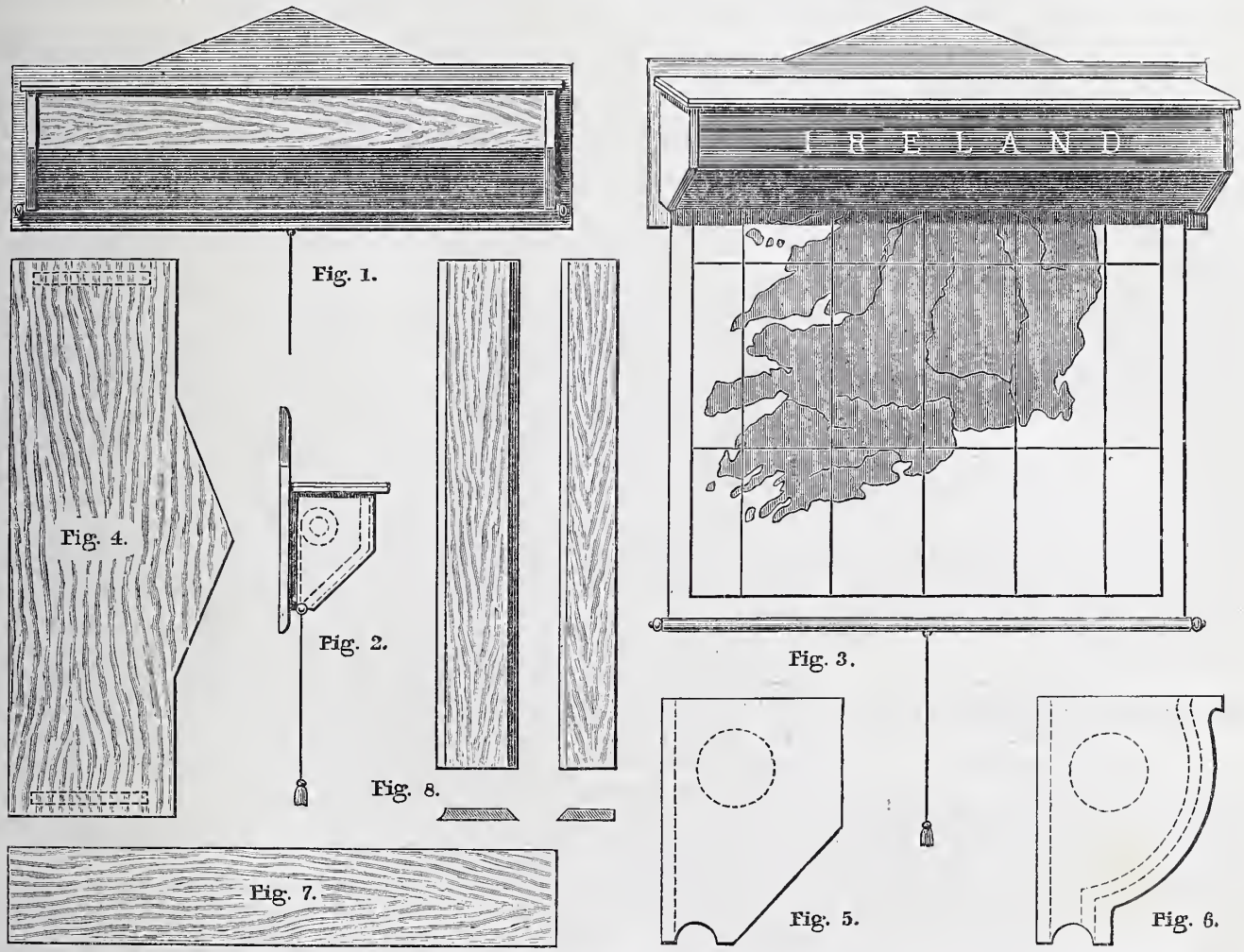


Fig. 1.—Front Elevation, showing Map rolled up. Fig. 2.—Side Elevation. Fig. 3.—Sketch showing Map exposed. Fig. 4.—Backboard. Fig. 5.—Shape of Bracket. Fig. 6.—Alternative Brackets. Fig. 7.—Top Cover. Fig. 8.—Front Cover in two portions, showing Section of each Piece. (Scale, 1 in. to 1 ft., except Figs. 5 and 6, 2 in. to 1 ft.)

A MAP HOLDER: HOW TO MAKE IT.

BY OPIFEX.

Those who have frequent occasion to consult maps, charts, etc.—if not already supplied with something of the same kind—may find the subject of this paper useful, as by this means the map is kept clean and fresh, besides occupying far less space than when hung upon a wall in the usual way, and also saving the wear and tear consequent on rolling up by hand or stowing in portfolios.

In the country it is often very desirable to have a map of one's locality to which reference may easily be made; for example, in the case of that ever-increasing class of cyclists, what is more convenient than a good road map of the country or county, provided with a spring holder, hanging in the hall or other suitable place?

I do not, of course, lay any claim to novelty for my subject, but finding it most useful and also very easily made, I offer the result of my experience for the benefit of any readers of Work who may need an article of this kind.

I would suggest oak or mahogany for the main parts of the holder. The former will be most suitable for amateur workmen, as, in my opinion, it requires less skill in the art of polishing to turn out a creditable piece of work in oak than in any other wood. Should the workmen, however, prefer it, pitch pine will suit admirably, or even pine or red deal stained and varnished need not be despised.

The dimensions of the holder will, of course, depend upon the size of the map for which it is intended. The accompanying illustrations are, therefore, merely suggestive as to shape; and, with the exceptions of Figs. 5 and 6, being drawn to a scale of 1 in. to a foot, represent a holder to suit a map about 30 in. wide and of average length.

Fig. 1 represents the holder with map rolled up; Fig. 2 shows side elevation, while Fig. 3 shows the map exposed.

Fig. 4 is the backboard, which, as it serves for a foundation for the whole, should be got out first. This should be of $\frac{3}{4}$ in. stuff, and of some such shape as indicated, being about 14 in. deep, and of sufficient width to suit the maps, etc., for which the holder is intended, *i.e.*, about 5 in. wider than the map.

The wood should be carefully cleaned up, finished with scraper and sand-paper, and the front edges chamfered, etc., according to fancy.

Fig. 5 shows shape of the two brackets, which serve to carry the roller, support the top cover, and to which the ends of the front covering are also attached.

These are also of $\frac{3}{4}$ in. stuff, and should be carefully cut and finished so that both may be exactly the same. They are let into grooves in the backboard (see dotted lines, Figs. 4 and 5), to which they are secured with a little glue, and two screws to each bracket driven from the back; but first, the position of the mountings for the spring roller should be decided upon, and the roller cut to the required length. I have used Hartshorn's patent blind rollers, and find them work admirably, and their price is exceedingly low, being only a shilling each, including roller with patent spring arrangement and the requisite fittings.

The front cover may next be got ready, and may be composed of two pieces, Fig. 8 arranged as at Fig. 2, or better, of one curved piece, as in the alternative shown at Fig. 6. In either case, the front cover should be let into suitably shaped grooves about

¼ in. deep in the brackets, to which it is secured by gluing. Care should be taken to ensure that the lower edge of the front cover may correspond in shape with the semicircular portion of the brackets — which should be about an inch diameter.

This arrangement is meant to allow of the round roller, which is to be attached to the lower side of the map (see Figs. 1 and 2), to fit close when the map is rolled up and so close the aperture so that no dust may enter.

The top cover (Fig. 7) may be of ⅜ in. stuff, and should be made to hinge to the backboard, being fastened in front with a small lock, or at the ends with small brass hooks and eyes, or it may be screwed on but not glued. This is necessary in order that access may be had to the roller, etc., at any time, either to remove the map, or in case of repair, etc.

The map should be mounted on stout calico, and should be attached to the spring roller like an ordinary window-blind, but *very* short tacks should be used to avoid interfering with the internal arrangement of the spring, etc.

The lower edge of the map is attached to a round roller of pine, or some other light wood, which should be long enough to project slightly outside the brackets at each side (see illustrations).

To the centre of this roller a cord is attached of sufficient length to suit the height at which the holder is hung.

To fix the map in position for working, roll it rather tightly round the spring roller until the lower roller is pressed into the semicircular part of the brackets; it may then be pulled down by the cord, and will remain in any desired position by simply slackening the cord, and will run up upon receiving a slight jerk.

Two small brass "eyes," by which to hang the holder upon the wall, complete the construction of this useful article, which should be polished, varnished, or painted, according to the description of wood employed, and the fancy of the maker.

SET OF PLATE SHELVES FOR KITCHEN.

BY DAVID DENNING.

For illustration showing set of plate shelves the reader must be referred to that accompanying the remarks on a kitchen dresser in p. 117, Vol. II., of Work. Much that was then said is equally applicable to our present subject; indeed, the dresser and the shelves are so intimately connected, that had the exigencies of space permitted they might fairly have been regarded as parts of a whole. At the same time, separated as they are in these pages, so may they be treated in actual existence, for it by no means follows that the two must be used together. The dresser alone must be regarded as a complete piece of furniture, and so may the set of plate shelves. These may be hung on any part of the wall that may be most convenient; but without some sufficient reason for not doing so the most natural position seems to be just above the dresser, to which they may in some respects be regarded as furnishing an appropriate back. In our illustration just referred to it will be noted that the shelves are quite independent of the dresser, to which they are not attached in any way; but intelligent readers, *i.e.*, all readers of these pages, will easily understand that there is no reason why the dresser and the shelves should not be more intimately associated. The shelves and their supports may, in other words, be as much part of the dresser as the back of a sideboard is to its lower portion.

Before, however, treating of the shelves as forming part of the dresser, they must first be considered as separate when the various modifications which may be necessary will be dealt with. At the outset it should be stated that everything that was said about size in connection with the dresser refers with equal force to the back. It is, therefore, not so much with dimensions that we have now to do as with formation, but in case the reader may want a few hints, some remarks on the former may not be considered out of place, and will perhaps give confidence to the novice in setting out his work.

The total height will naturally be one of the chief points which will engage the maker's attention, and we may therefore take it first. That the height cannot be greater than that of the wall it is to occupy goes without saying, and in a low room the available space may not be great. It is accordingly in a lofty room, where for all practical purposes the space may be regarded as unlimited, that any embarrassment may be felt. It is, however, one which soon vanishes when common sense is appealed to, for, remembering that the shelves are more for use than ornament, the absurdity of making the top one too high to be reached with comfort is at once apparent. What "too high" may be must be for each man to determine for himself, or perhaps, as the kitchen is generally ruled by the female portion of the household, it will be better to take others into council before deciding. Some may not think the top shelf excessively high if it can be reached with the aid of a chair or step-ladder, while others might wish to reach it without climbing. Perhaps if we take 6 ft. to 6 ft. 6 in. as a fairly convenient height in the latter case we shall not be far wrong, and unless in a very lofty room the shelves will not appear too dwarfed. It may be well here to note that we are talking of the height of the top *shelf*, and not of the extreme height to the top of the cornice, which may be any reasonable distance above.

In connection with the space between the highest shelf and the top, we may take into consideration the number of shelves and the spaces between them, for the maker must determine them on the same principles. He must ascertain what the shelves are to hold, not only the quantity but the sizes of the articles for which they are destined. These, we may assume, are pieces of crockery, but not entirely plates, as the name of the contrivance may seem to indicate it is intended solely for. There will be some dishes, probably. Well, set two or more of the shelves at a convenient distance apart to receive these larger articles, and regulate the others in the same way. Perhaps some readers might prefer to have definite measurements given, while others may think that the foregoing remarks might have been dispensed with altogether, because they see that the rules, or, rather, the hints, for regulating measurements are so simple that every maker would have thought of them for himself. Those who hold the latter opinion I am sure will forgive the infliction on their patience when they remember that the hints are given just as reminders for those who might have overlooked some of the considerations which should guide them in knowing what to do. For those who want detailed measurements, let me suggest that a very small amount of calculation will enable them to overcome any difficulty in setting out their work.

Every one who wishes to make a set of plate shelves will, I take it, now be able to start fair and square. The wood will be the same as that for the dresser, and of the same substance as the principal parts of it. The width of each shelf will be the same, and here again the maker may please himself what it may be. As the plates and such like things will be placed to lean against the wall, the shelves need not be more than sufficiently wide to let the crockery slope backwards; but usually a little more than this bare necessary width is allowed, as the extra width of the shelves then allows various small articles to be kept on them if desired. It may accordingly be considered that a 5 in. or 6 in. shelf will do, while those who prefer may have it wider.

Whatever the width of the shelves, the ends supporting them should be at least equal, while, if a strip to form a ledge is to be placed along the front of the former, they should be a trifle wider to allow for the ends of strip coming within them. In any case, it will not be objectionable for the end pieces to be a little wider than the shelves, so that the fronts of these lie back a little within them.

The shelves may be fixed to the ends with nails, the heads of which should be well punched and the holes afterwards stopped; but very possibly there are some makers who would not be content with this simple method, though it is thoroughly reliable. The mortise and tenon joint may be used instead, or the attachment may be the same as that for the drawer bearer of the dresser. If this latter construction be chosen, the effect will be neater if the groove be stopped a short distance from the front and the dovetail cut away for the same distance. The shelves, of course, will then have to be inserted from the back. Such elaboration is, however, quite unnecessary so far as strength is concerned. The stretcher or rail which is shown below the bottom shelf might then be regarded as superfluous, for if dovetailed to the ends its principal object is to bind them together. A board either nailed or dovetailed to the tops of the ends keeps them together there. This board, by the way, is not visible in the illustration, being concealed by the moulding which is afterwards planted on. A narrow piece of wood across the top will answer for the stay, but if it be made the full width of the ends it forms in reality another shelf available in case of need.

The moulding referred to is merely intended as a finish, and may be omitted altogether without affecting the utility of the set of shelves. Its depth or members are of quite secondary importance, and a suitable piece will be obtainable from most builders. At the front corners it should be mitred. Some may fancy that the moulding alone will have a paltry look and think that the appearance would be improved by a frieze. For the benefit of those who do not know what is meant by this it may be explained as a border of plain wood extending some three or four inches below the moulding. Full details of a construction which may be adopted for this part will be found in Vol. I., p. 23, of Work in the article on "Artistic Furniture."

The upright piece at the back of the shelves is put to prevent them "sagging" under the weight of their contents, and in a very small set might be omitted altogether. If simply nailed on behind it would clearly be awkward and keep the shelves themselves away from the wall. The proper way will be to cut spaces in each shelf within which

it can fit, when a few screws or nails will hold all fast.

In order that plates and dishes may not slip down, each shelf should have either a groove cut in it, or a piece of beading fastened on from end to end at a sufficient distance from the back, to allow of crockery being securely put up. In some respects the groove is more convenient than the beading, which is apt to be in the way if plates, etc., are laid down flat. With a strip planted along the front of each shelf neither the bead nor the groove is so necessary as it otherwise is. A few cup-hooks on the edges of the shelves will, no doubt, be considered a necessity, and when they are added the set of plate shelves may be regarded as made and finished, unless, indeed, staining is considered as an improvement.

Now for the few modifications which may be adopted, and are in some degree necessary if the shelves, instead of being fastened only to the wall, are to be attached to the dresser. The most evident alteration will be in the lower parts of the ends, in which the shaping would be out of place. They should be left square to rest on the dresser top. Then the background of the dresser and the bottom rail of the shelves will be one and the same thing. It will, of course, be placed between the ends so that it lies on the dresser top, to which it will be fastened by means of screws driven in from below the dresser top, which, it will be remembered, was described as overhanging a little at the back. If, however, the back of the plate shelves is of wood, it will be as well to carry it down behind the top. This method of enclosing the back will give the set of shelves a far more important appearance than they will have if left open, but, of course, the amount of material will be greater. It may perhaps be necessary to say that the boards should be placed perpendicularly and not horizontally, and that if they are glued together to make one solid piece of the necessary width the back will probably split. It should, therefore, be mounted or panelled. It may be suggested that match-boarding will form a very suitable material, especially if there is a beaded edge to "break the joint." With the concluding remarks that if the back is fastened on behind the dresser top a space equal to the thickness of the back wood should be prepared for it to fit into, and that the easiest way to manage this will be to rip off a piece from the entire length of the dresser top and then glue short ends on again, it may be assumed that all necessary directions for the construction of dresser and plate shelves have been given.

BORING HOLES IN GLASS.

BY P. B. H.

In order to drill a hole in glass, the principal factor necessary is to have an exceedingly hard and well-tempered drill, at the same time keeping the glass and drill well moistened with turpentine. Menders of porcelain use the same means for boring the holes in which to insert their rivets and cramps.

To drill holes of small diameter, an ordinary steel drill is used, the secret of success being in the temper given to the tool.

In order to obtain the necessary degree of hardness, the drill must be heated to a dull red, and then plunged into mercury. The metal thus becomes very hard. It is, however, necessary to anneal the shaft of the drill, as, in this state, it would be too brittle. The question is, "How to do it without destroying the temper in the point." The method is this:—Before heating the drill, bore a hole with it in a piece of lead, leaving the point hidden therein. You can now raise the temperature of the shaft of the drill by means of a blowpipe till it attains a blue colour nearly to the point. The drill and lead together are now immersed in cold water. The drill will now be found of the required temperature, the point exceedingly hard, while the shaft, being annealed to a certain extent, is less hard, but tougher. This tool, when mounted in holder and the point moistened with turpentine, will attack glass rapidly. Do not press too severely when working the drill, and, if possible, drill from both sides successively. To enlarge a hole thus obtained, the operator must use a rat-tailed file soaked in turpentine.

To drill a hole of a larger diameter, take a simple tube of copper or bronze, the outside diameter of which equals the diameter of the hole required in the glass. The edge of this cylinder must be kept revolving in

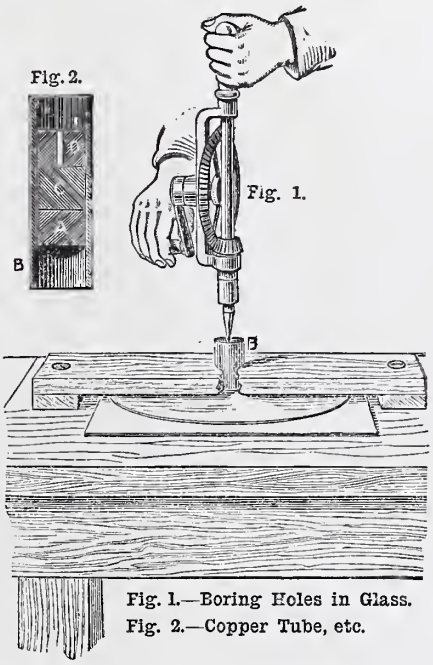


Fig. 1.—Boring Holes in Glass.
Fig. 2.—Copper Tube, etc.

the same place while being supplied with turpentine and fine emery.

Some precautions are necessary, however, to ensure the glass from breakage.

To mount the tool, drive a wood block, A (Fig. 2), past the centre of the copper tube, B (Figs. 1 and 2), to be used as a fulcrum to turn it. On this lay a piece of indiarubber, C, and above that fit in another piece of wood, D, with a hole in centre. This hole is for receiving a three- or four-cornered reamer, or other suitable tool, fixed in the drill, in order to rotate the tube.

The indiarubber between the blocks of wood gives the necessary amount of elasticity, without which the glass might be easily broken. During the process of boring, only press very lightly on the tool.

It will be also found necessary to guide the last-mentioned tool by some special means, as, without guide, it could not be kept revolving in the same groove by the most expert manipulator. A block of wood, as shown in sketch, is taken, raised on two pieces of wood at each end, the thickness of which depends on the work to be drilled. In this block a hole equal to the outside diameter of the copper tube is drilled (this, in sketch, is shown broken), and this constitutes an excellent guide. This block is fixed at each end either by cramps or screws. The glass, laid on several thicknesses of paper to correct any inequalities in the table, is placed in position under drill. This paper, with the indiarubber above, gives the necessary amount of elasticity to prevent breakages.

Nails placed round the circumference of the sheet of glass will keep it in its place. It can also be pressed down by means of wood wedges inserted carefully between the block of wood serving as guide and the glass.

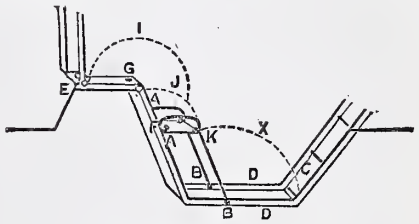
By conforming scrupulously to these rules, success is certain to follow, even when glass of the thickness shown in sketch has to be drilled. The piece of glass here shown is for an electric machine.

CRICKET SEATS FOR CARRIAGES.

BY J. C. KING.

This is the name of a small additional seat in a vehicle, and is more familiarly known in some old farm-houses as the stool in the chimney corners for children to sit on, the name doubtlessly suggested by the companionship of the crickets that mostly abound in such places.

In English carriages they are applied to broughams and victorias, chiefly in victorias, the panel at the back of the coachman's boot opening down as a desk lid to the



Cricket Seat for Carriage.

horizontal position, forming a seat for two extra riders. It is held up by two strong hinges and chains, straps, or quadrant-stays. For broughams a hinged prop-leg serves to uphold this seat.

Cricket seats on a different method of adjustment are in use in France, and for the purpose simpler and stronger. The victorias that ply for hire in the street have their extra seat folded up against the heel-panel of the seat, C, as shown by diagram of part of a victoria. Two iron legs are fixed by joint-screws to the bottom edge-plates at B B, and to the edges or ends of the cricket seat, K, so that at one motion the seat, C, is turned over into its position for use at A K. It is very cheap to make, and the cushion part is kept clean by being shut against the panel, C, and cannot be used as a foot-rest for riders on the back seat. The dotted line, X, shows the movement. For victorias for private use a larger and more commodious seat is used. The space under the coachman's seat, E G, is recessed, and a seat frame with side guards is hinged at G. The coachman's seat is hinged at E to allow of it opening as a box-lid when the cricket seat is to be folded down, which is done with the aid of two sets of joints; one set at G serve to turn the supports down (the dotted line, I, shows this movement), and the cushioned seat, A K, and side guards turn down from joints in the supports, as shown by the dotted line, J. It is a capital contrivance for a serviceable seat—the invention of M. Chaillon, Paris, and was awarded a prize at the Exposition, 1889.

PAINTING DECORATIVE PANELS.

BY FRED MILLER.

WITH regard to hanging cabinets, having recesses closed in with doors, it may be suggested that the panels should be either carved or painted. In the present number of WORK I give designs (Figs. 1 and 2) for painted panels. As will be at once apparent, these designs are modifications of Japanese designs. My reason for giving Japanesque designs is twofold. Many readers of WORK can procure books of Japanese designs, or study Japanese painting and decoration for themselves, and, as occasion requires, adapt such to suit the special work they may have in hand, for the opportunities for studying Japanese work are now considerable, either by referring to examples in our museums or private collections, purchasing books of Japanese designs such as are sold at Liberty's, in Regent Street, or Batsford's, in Holborn; or referring to books such as Cutler's "Grammar of Japanese Art," "L'Art Japonaise," etc. etc. And, in addition to the facilities for studying the subject, Japanese work is full of suggestions to the designer, and is a good school for the decorator to study in. No nation is more skilful than the Japanese in utilising plant form to decorate a surface, whether it be a lacquer box or tray, a sword hilt or screen. To begin with, they are excellent draughtsmen, with strong individuality, and keen perception for the characteristics of the plant, or bird, or whatever it is they draw, putting down with a facility and precision all that is most noteworthy. The casual observer is too apt to think of Japanese art as always grotesque. It is strongly tinctured with the personality of the nation, but it is, at the same time, work of quite unique excellence. A Japanese can not only draw a flower, bird, or insect with a freedom and ease that shows him to be a master of his materials, but what is of equal importance, he knows how to simplify and omit all that is purely adventitious and casual, in order to fix down the real character of the object under his view. A good many people draw, as they think, very literally, but are so taken up by purely individual peculiarities that the real character of the plant, those traits which differentiate it from all other plants, are confused or passed over. Take the way a Jap throws a sprig of wild cherry or plum across a panel. He gets all those striking angles in the stem that are so decorative a feature, and he just breaks his blossom over these, apparently always in the right place, and the whole thing is put in with a crispness, ease, and nervousness that show the artist *felt* what he was doing. No hesitancy, bungling, clumsiness, but directness, simplicity, and delicacy of draughtsmanship that give the Japanese work a charm that is not possessed by the handiwork of any other people. Their painted work, too, is very suggestive, and the reverse of laborious. Notice, for instance, in putting in leaves, how it seems to be done by pressure exerted on the brush as it touches the paper. This is the cleverest kind of brush work, for it needs great certainty to suggest a form accurately by the varying pressure exerted upon the brush; and the effect, too, is far before stippled or highly-wrought painting, as the colour, flowing on freely, forms a kind of light and shade of its own, and a certain accidental quality is obtained that is always more effective than where the effect is produced by deliberateness and mathematical precision.

A word may be fittingly said as to this quality artists term "accidental." We must recognise the fact that nature cannot be imitated. If you attempt to put in every vein in the leaf and every serration of the edge, every spine on the stem and stamen in the flower of a rose, we produce a hard, lifeless, mechanical-looking thing. We only challenge comparison with Nature by attempting to imitate her, a comparison

Fig. 1.—Design for Painting Door of Hanging Cabinet.

greatly to our disadvantage. But if we can give the effect of the growth of the leaves by a few clever brush marks, we at once think of the skill of the artist rather than his limitations. The Japanese sometimes adopt a purposely conventional method, especially where the design has to be reproduced by a means that is in itself laborious, such as raised lacquer or inlay. Then you simply take an agreeable series of lines whose curves and angles are pleasantly opposed to each other, and you merely insist on a few well-marked features of the plant, such as the growth and shape of leaves and flowers. Elaborate foreshortening, which always depends on the management of the light and shade, cannot be attempted, nor can the appearance of infinity be given, seeing that every object is done with deliberateness and preciseness. Much has to be left out; nature has to be simplified; but what you do put down see that it does not tell a falsehood, either through carelessness or ignorance.

The system of outlining all the forms in decorative panels is to be commended in conventional and ornamental work where a few simple forms alone are reproduced; but I think that the outlining was carried to excess a few years since, and the result was, in many cases, hard and mechanical—the very reverse of decorative. The outline was supposed to give the work character, and so it does, if it is put in with feeling which comes of skill and knowledge; but a clumsy, unsympathetic outline can add no charm to one's work.

Very pleasant decoration can be produced by painting direct from nature a branch of apple, spray of wild rose or blackberry, or other decorative plant whose growth is free and whose leaves, etc., are not too complicated. Select as far as possible specimens that are themselves simple, and such as are not too full of leaves and flowers, and in painting the panels, bear in mind to keep your work simple in design and treatment, rather than lose yourself by trying to put in all you see. It may seem strange to some readers to be told not to try and see too much, but it is, nevertheless, the best advice I can give you. Lowell says that the great writer knows what to leave in the inkpot, and, in the same way, the artist trains himself to see what is essential to the exclusion of much that he knows is there before him. Get into the habit of half-closing your eyes when you draw or paint from nature, so as to shut out insignificant details in order that you may see *mass*—*i.e.*, the general form and arrangement.

Coming to the design given with this article, it will be noticed how gracefully the spray of rose falls over the pieces of bamboo supporting it, and how it seems to occupy the space without filling it. A large part of the panels have nothing on them, and yet the general effect is one of completeness. The introduction of birds is always a good feature in decoration, for it not only gives a feeling of life by suggesting movement, but introduces a spot of colour quite distinct from anything else in the scheme. The birds figured are the wren and blue-tit. Insects, too, can with advantage be introduced, and the spider's web I have shown in the right-hand panel gives great character to that panel. Don't attempt to introduce any accessories without reference to nature. Get a few butterflies, beetles, or bees, or else make studies of them in a museum, in colour, so that you have something to guide you when painting them on your panels. It requires considerable skill and wide knowledge to draw largely upon the memory for such accessories, and even the man whose memory is clear and precise misses a certain quality that intercourse with nature would have given his work. You can draw upon your inner consciousness when you arrange your material, so as to make it occupy the space agreeably, but don't lose touch of nature, for you get a suggestion by painting from nature that is invaluable.

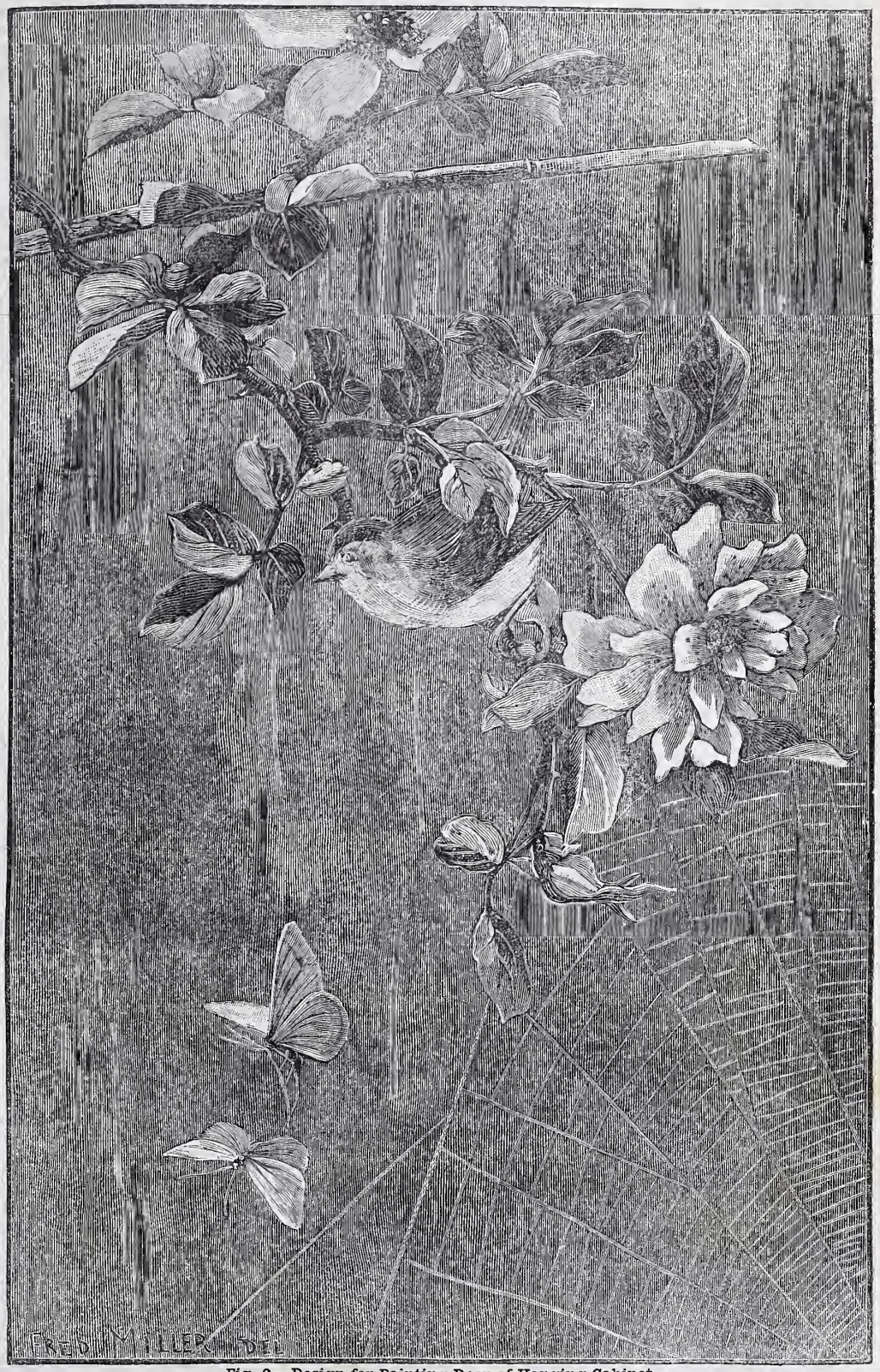


Fig. 2.—Design for Painting Door of Hanging Cabinet.

If the cabinet is to be stained black, you might paint on the black panels. The wood should be stained and *slightly* polished, just to prevent the sucking of the wood. When the decoration is quite hard (use as little medium as you can with the colours; no oil), the panels can be finished, being polished. Decoration under the polish has a brilliant look, and, of course, the polish preserves the work. Keep the colour as thin as possible on the wood, for if the paint is put on thickly, it makes the polishing of the panels difficult, and the paint is apt to crack after a while. Painting under the polish will stand well, witness the old painted satin-wood furniture of the last century.

Gold grounds are often used in decoration, and very effective they are. The panels must be gilt (imitation gold does not do), and the colour can often be used transparently with advantage. Such colours as burnt sienna, Antwerp blue, raw sienna, gamboge, Indian yellow, French ultramarine, and rose madder, can all be used pure and in combination, transparently on the gold. Mix with a little copal and poppy oil, and put on more or less thinly, and the gold grinning through the colours gives them a most beautiful effect. Of course, for the greys and whites solid colour must be used, but the combination of transparent colours with solid is to be commended.

Avoid crudity in your colour, especially on black grounds, and introduce three or four tones of colour only, such as a grey for the back of the leaves, a rich green for the dark leaves, a yellow green for those where the light shines through them, and a very bright grey for those leaves catching the light. This is not a purely arbitrary arrangement, but is founded upon a careful observation of nature, for if we look at a spray of rose in the light, we shall see that the colours of the leaves are much as I have suggested. Painting on gold grounds is not generally polished.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

20.—"Painting, Graining, and Decorating, to Prevent Blisters."

This is the title of a new work, which appeals chiefly to professional house painters and grainers, written by Mr. Edward Mathieson, of Ardrossan, near Glasgow. The author, who is a practical man, and who furthermore is connected with a firm of colour makers at Ardrossan, claims to have overcome the blistering effect to which ordinary oil paints are liable when exposed to intense heat. The volume under notice deals in a lucid and practical manner with every phase of the annoyance, from the cause and explanation of blisters to the completion of work, the condition of which the tradesman can be responsible for a twelvemonth. The author's conclusions are not the result of chemical analysis and theory only, but are further founded upon the successful results which his process has given when tested by time and both solar and artificial heat. The subject of "blisters," although of much importance to the general community, is one that particularly concerns provincial painters and country residents. Many instances of master painters obtaining customers upon the assurance of non-blistering work has come to our personal knowledge, but we have never seen the promise fulfilled by the ordinary methods of oil-painting. Mr. Mathieson obtains success by working on special lines, and with special, but not inconveniently so, materials. A valuable reputation could soon be built up by a master grainer upon the non-blistering qualities and durability of his work, and viewed in this light, the price of the volume (10s.) would soon be repaid to him a hundredfold. Besides the treatise on blistering, the work contains special chapters on oak graining, and is, further, a valuable acquisition, on account of recipes for making enamel oil paint, enamel oil, and damp-proof liquid, the two former, at the present time of perishable spirit enamels, being simply invaluable to provincial or colonial masters. The publishers are Dale and Reynolds, 24, Wellington Street, Strand, and John Menzies & Co., Edinburgh and Glasgow.

21.—The Britannia Company's Ornamental Slide Rest.

This is a very successful attempt to produce for £15 a slide rest (Fig. 1) which shall be solid and substantial, neat in appearance, and perfectly accurate, and it is certainly the best rest yet produced at the price. The sole plate is 12 in. long by $2\frac{1}{2}$ in. wide, planed below and at the sides, and fitted into a gun-metal cradle, securing its position at right angles to the back of the lathe. It is clamped by an eccentric instead of the ordinary bolt and bow nut. At the top of the stem of the main frame is a graduated circle of good size and very legible reading against a steel index point, and below it is an elevating ring of gun-metal, milled for the better grasp of the fingers. This is $3\frac{1}{2}$ in. in diameter, the divided circle being almost equal in size. The stem, or tenon, of the main frame is $1\frac{1}{2}$ in. diameter, by which it will be seen that this rest is no mere toy, but a substantial affair fit to stand any amount of work. The frame of the main slide is 11 in. between the ends, 12 in. out and out, by $2\frac{7}{8}$ in. wide, and the eleven inches are graduated and figured in inches and tenths. The main screw is of ten threads to the inch, and its head is also graduated. The stem or tenon has two vertical grooves into which the rounded point of one of two screws in the pedestal fits accurately. These serve for the adjustment of the frame in two positions, either parallel with the lathe bed or at right angles to it, a second screw securing it when thus adjusted. This supplies the place of the usual set studs, or stops. The tool slide is 5 in. by 2 in. at the base, where it slides as usual between adjustable steel guides, but the receptacle does not reach the entire 5 in., but occupies $2\frac{3}{4}$ in. of the length; and instead of two separate tool clamps, there is a long one with two screws, this fitting being otherwise arranged according to the usual plan. This gives the clamp a bearing of $2\frac{1}{2}$ in., and it is very firm. The advancing screw of the tool slide is in front instead of at the side, and is very ingeniously fitted. It is tapped (with twenty threads to the inch) into a collar on the under part of the slide, and near its end is a groove into which a little slide or flat bolt fits, preventing, when slid forward, the end-long movement of the screw. When thus held it works the tool slide, but on drawing back the bolt, the tool slide is at once set free, to be actuated by a lever. This arrangement answers admirably, and well supplies the place of the usual bridle, which has to be detached to free the slide, to the danger of losing its screw. The slide is, moreover, instantaneous in its action, and there are no loose parts that can be mislaid. The advancing screw has a reading collar very cleverly arranged, but as the divisions are somewhat difficult to see, there is a division plate also upon the upper part of the bed of the tool slide. The fitting of all parts is excellent, and the Britannia Company deserve much credit for the production of so good a rest at a low figure.

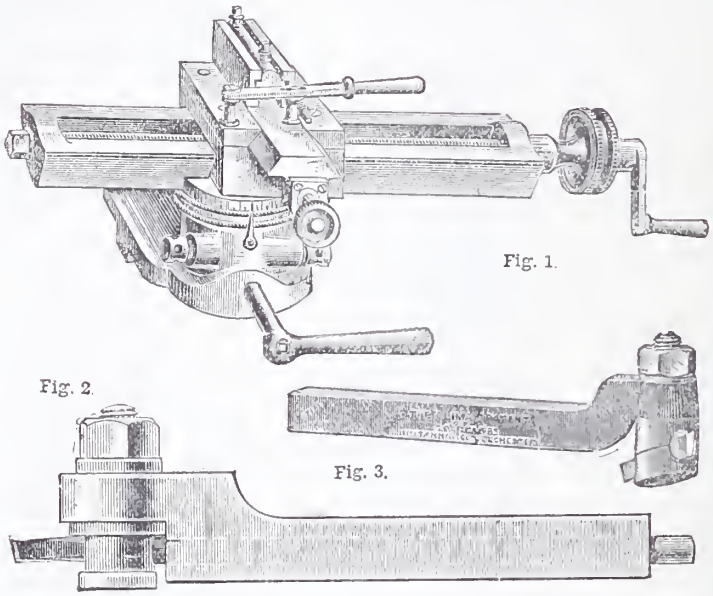


Fig. 1.—The Britannia Company's Ornamental Slide Rest. Fig. 2.—Bent's Patent Tool Holder. Fig. 3.—The "Climax" Tool Holder.

22.—Bent's Patent Tool Holder.

This excellent tool holder, which was invented by Mr. B H. Bent, B.A., Demonstrator of Applied Mechanics in the University of Cambridge, and is manufactured and supplied by the Britannia Company, Colchester, is one of the best that can be bought for boring and cutting internal threads. The cutters or tools may be made of rounded rod, which can always be easily obtained. They are held firmly in the tool holder, and in boring it is very easy to adjust depth of cut. Various sizes of steel can be held in the same holder. It is an economical tool, no skilled smith being required to forge the cutters, and it can be used for ordinary turning, sliding, and surfacing. The tool holder is made in six sizes, ranging from $\frac{3}{8}$ in. to 1 in., and supplied, post free, at prices varying from 9s. 6d. to 17s. 6d.

23.—The "Climax" Tool Holder.

The "Climax" Tool Holder, a useful all-round cutting tool for lathes, shaping and planing machines, etc., will cut straighter irregular work, and into corners and face either right or left without altering its position in the slide rest. It is invaluable for screw cutting, as the cutter can be canted to suit the angle of any thread, whether V-shaped or square. It is made entirely of steel, the bolt, etc., being case-hardened. The cutting tools are of uniform section, and are made from the finest cast steel that can be got. For the two largest sizes cutters of Mushet's special self-hardening steel can be supplied. The sizes of shank vary from $\frac{9}{16}$ in. square to $\frac{7}{8}$ in. square, and sections of cutters from $\frac{5}{16}$ in. by $\frac{1}{8}$ in. to $\frac{7}{8}$ in. by $\frac{3}{8}$ in.; prices ranging from 13s. 6d. to 20s. Prices of best cast steel cutters per dozen range from 4s. 6d. to 8s. 6d.; Mushet's cutters being 8s. and 11s. per dozen.

The tool holders described in this and the preceding notice will be found to be reasonable in price and serviceable in every respect by those who buy them, whether amateur or professional.

The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

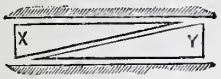
I.—LETTERS FROM CORRESPONDENTS.

Invalid's Bed Tray and Æolian Harp.—J. B. (*Stonham*) writes:—"The invalid's bed tray described on page 13, Vol. II., of WORK, will be found much more convenient if made with a half circle cut out of hind part thus—

Invalid's Bed Tray.

as the invalid can get closer to the articles on tray. I have made two, one of which is in constant use and very handy. I have also made an Æolian harp, double action, and would advise any one making same to put sound-posts in body similar to those in violin, as mine would not sound much until I did so; now it goes well."

Mitre Cramp.—H. J. L. J. M. (*Ealing*) writes in sequence to KILBURN, Vol. II., page 43:—"My account of my mitre cramp is rendered less intelligible by two printer's errors—'lined' in line six should be 'planed,' and 'unhinge' should be 'impinge' (line 20). If KILBURN will try wedges inserted lengthwise in the space between D and E in this way, and gently tapped with a light hammer at the ends marked X and Y, he will find they will give plenty of pressure. If he had read my short article carefully, he would have seen that I said my plan answered very well for gluing up frames. If he wants to nail them he can do so when the glued joint is dry. For small gilt frames nails are not required, and look unsightly."



Mitre Cramp.

Weight of Wood.—A. R. (*Scorrier*) writes:—"The following figures will give the average weight in pounds per cubic foot of twelve kinds of wood, which may be useful to buyers, carriers, and even to some who have had long experience in a timber yard:—

Cedar ...	.. 35 lbs.	Ebony ..	.. 83 lbs.
Yellow pine	.. 34 ,,	Logwood	.. 57 ,,
White pine	.. 34 ,,	Red hickory	.. 52 ,,
Red pine ..	.. 37 ,,	Ash ..	.. 53 ,,
Spruce ..	.. 31 ,,	White oak	.. 54 ,,
Chestnut ..	.. 38 ,,	Well seas'd pine	30 ,,
Lignum vitæ	.. 83 ,,		

Weight of Iron.—A. R. (*Scorrier*) writes:—"In looking over the 'Shop' columns I find that a reader has been asking a question in reference to weight of iron. Perhaps the following table may be of benefit to more than one reader of WORK, which gives the weight of square and round iron in pounds per foot length, from 1 in. to 3 in. square, and from 1 in. to 4 in. diameter:—

1 in. square ..	3-33 lbs.	1 in. diam. ..	2-60 lbs.
$1\frac{1}{8}$,, ..	4-21 ,,	$1\frac{1}{8}$,, ..	3-31 ,,
$1\frac{1}{4}$,, ..	5-20 ,,	$1\frac{1}{4}$,, ..	4-9 ,,
$1\frac{3}{8}$,, ..	6-30 ,,	$1\frac{3}{8}$,, ..	4-95 ,,
$1\frac{1}{2}$,, ..	7-50 ,,	$1\frac{1}{2}$,, ..	5-89 ,,
$1\frac{5}{8}$,, ..	8-80 ,,	$1\frac{5}{8}$,, ..	6-91 ,,
$1\frac{3}{4}$,, ..	10-29 ,,	$1\frac{3}{4}$,, ..	8 1 ,,
$1\frac{7}{8}$,, ..	11-71 ,,	$1\frac{7}{8}$,, ..	9-20 ,,
2 ,, ..	13-33 ,,	2 ,, ..	10-47 ,,
$2\frac{1}{8}$,, ..	15-05 ,,	$2\frac{1}{8}$,, ..	11-82 ,,
$2\frac{1}{4}$,, ..	16-87 ,,	$2\frac{1}{4}$,, ..	13-25 ,,
$2\frac{3}{8}$,, ..	20-80 ,,	$2\frac{3}{8}$,, ..	14-76 ,,
$2\frac{1}{2}$,, ..	25-20 ,,	$2\frac{1}{2}$,, ..	16-36 ,,
3 ,, ..	30-00 ,,	$2\frac{3}{4}$,, ..	19-79 ,,
		3 ,, ..	23-56 ,,
		$3\frac{1}{8}$,, ..	25-56 ,,
		$3\frac{1}{4}$,, ..	27-65 ,,
		$3\frac{3}{8}$,, ..	29-82 ,,
		$3\frac{1}{2}$,, ..	32-7 ,,
		$3\frac{3}{4}$,, ..	36-81 ,,
		4 ,, ..	41-88 ,,

One cubic foot weighs 486-75 lbs.; 4-59 cubic feet, one ton.

Gongs.—W. A. Y. (*Cambridge*) writes:—"May I remark that the thin plates referred to by W. E. W. (see page 78, Vol. II.) are probably Martineau & Smith's 'Campanels.' M. and S., whose address is Holloway Head, Birmingham, would send him particulars if in the trade, otherwise W. E. W.'s ironmonger could get him particulars. The plates are round, about $\frac{1}{8}$ of an inch thick, and are bell metal, copper coloured, and have a rich deep hue."

Time Alarum Fitment.—F. S. (*Islington, N.*) writes:—"My clock is only a common alarum clock, from which I took away all the alarum works, excepting the small figured piece in the centre of dial. Of this piece I made use in the following manner, shown in the sketch. Fig. A is the piece looking at the back of it. The chain line shows how it was, and the plain line shows how I have altered it, and what I have filed away, leaving only a small piece (B) projecting. This I have bent out a shade, as shown in Fig. 2; then I bent a thin piece of sheet

Fig. 3.

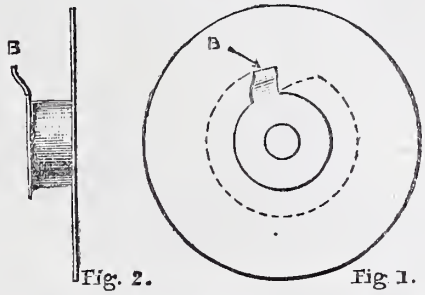


Fig. 2. Fig 1.

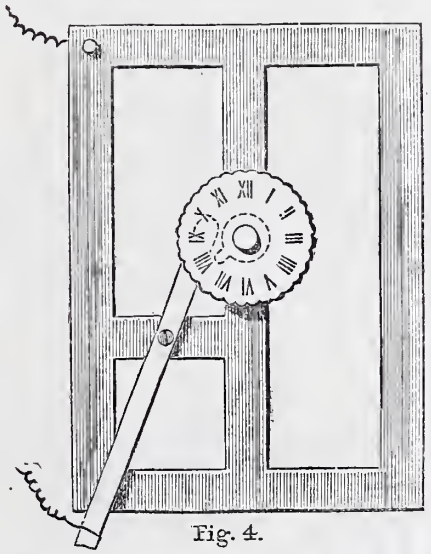


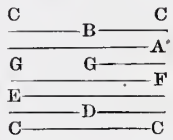
Fig. 4.

Time Alarum Fitment. Fig. 1.—Figured Piece. Fig. 2.—B, Projecting Piece. Fig. 3.—A, End which will contact with projecting Piece. Fig. 4.—Position of Fitment.

brass about $\frac{1}{4}$ in. wide and $2\frac{1}{2}$ in. long in the shape of Fig. 3. This is very thin, and forms a weak spring. I made a hole in this, and fastened it to frame of clock works, with a screw through the hole that the winding up spindle came from, merely putting a small screw through and a small piece of wood at the back to act as a nut; also a leather washer between the spring and frame to insulate it from frame. Fig. 4 shows the position it is placed in. The dotted lines show how the small figured centre piece will contact. One wire leads from the other and from this spring, and the other wire from the frame the clock works. Of course you want a switch with this, but I daresay you can see the idea, and fellow-readers may be glad to know that it works well. When I set my clock I turn the hands to the time I wish it to go off, then gently turn the figured piece round until the bell starts ringing; then I put the clock right time. It is simple enough if you saw it, and it only took me a matter of two hours to fit it up. If any one cares to see it, I should be glad to show it them at 38, Spencer Street."

Learning Marbling, etc.—R. A. D. (*London, S.E.*) writes:—"In WORK, No. 50 (Vol. I., page 797), I notice a reply to W. H. (*Newington Butts*) signed F. P., respecting where to learn marbling and graining at small cost. The advice is given to go under a clever marbler and take lessons, which, I venture to say, is bad advice. Marbling and graining, I take it, are imitations of the respective woods and marbles, but how many of our present day marblers and grainers take this view of the subject? If he went under a marbler, he would but learn his teacher's view of what nature was, and a view which nature never possessed, a view which is often but the outcome of an ingenious and inventive mind, and the fruitful cause of the abominable rubbish which we see about passing as woods and marbles, and which have done more to ruin the trade than any other thing that I know of. There is one thing I noticed with pleasure in the reply, and that is, 'In any case, you will have to devote a large amount of time and patience to it.' If the student is willing to set out with this idea firmly established in his mind, and to start at the beginning, and not think he can learn it in a month or so, but remember it is only by close study and hard work that he can ever hope to be a workman worth his salt, then I should strongly advise him to join the House Decorating Class at the City and Guilds of London Institute in Kennington Park Road. There marbling and graining is taught from nature, as it ought to be taught, and not from an other man's view of what it is or what it ought to be. They have there a very fine collection of marbles and woods for the use of students and individual instruction. The fee is but 2s. 6d. per month of three nights a week and two hours each night; and in addition to this, the school finds colours and paper, making it but a mere nominal fee. It is the only class of its kind in the United Kingdom, and only wants to be further known to be extensively used. I have, of course, no interest in wanting any to join beyond the fact that I have benefited by it, and wish others to do the same. You do well to recommend the Dutch work you speak of: it is the finest work on the subject ever brought out. It is written by the brothers A. R. and P. Van der Burg, who are most undoubtedly thoroughly practical men. The work is issued by Crosby Lockwood & Co., and is translated into the English language. The plates and instructions are generally excellent, and a painter could not make a better investment than to purchase a copy of it. I did so some time ago, and have never regretted it, but consider I have been repaid over and over again for my initial expense. It may be tiring perhaps to hear the one string, 'Copy from nature,' harped upon, but I believe it to be the only thing that will make good workmen in whatever trade almost they may be, especially in trades where there are any pretensions to artistic effects. If we follow it we can never go far wrong—not so far, at any rate, as if we went unguided but by our own tastes."

Cutting Music for Organette.—B. A. B. (*Hampstead*) writes in reply to AMATEUR MUSICIAN (see page 814, Vol. I.):—"I can give but scanty information in the overcrowded columns of 'Shop,' but will try to give AMATEUR MUSICIAN a little help. First, there are three sets of chords in every key: one on the keynote itself, one on its fifth ascending, and one on its fifth descending—or its fourth; these are important in the order they are placed, the keynote chord being of the greatest value. With chords on these three notes, any note of the scale can be harmonised, as AMATEUR MUSICIAN may see, thus:—



These can be inverted, transposed, some notes strengthened in the octave below, or omitted, according to the taste, skill, and knowledge of AMATEUR MUSICIAN. The two most binding rules are that no consecutive fifths or octaves are permissible, and the last chord must be a keynote chord. This applies to the major mode. For the minor I expect other notes absent on AMATEUR MUSICIAN'S instrument would be required."

Re-waxing Meerschaum.—ONE WHO IS NOT A SMOKER writes:—"A. H. (*Sydenham*) (page 750, Vol. I.) inquires how to wax meerschaum pipes. The process is as follows:—They are first soaked in wax, then in tallow, and finally polished with shave grass or crape. The latter is used to remove scratches. But I doubt if you can get shave grass in England, as I have never heard of it, and they are polished in Germany. If you succeed, I should like to know through 'Shop.'"

Boat-building.—J. R. (*Newcastle-on-Tyne*) writes:—"In reply to BOAT HOOK (*Manchester*) (see page 38 of WORK, Vol. II.), it is evident that the reason of his boat being so crank and unsteady in the water is because of its being too sharp and lean in the bilges. A boat with sharp bilges will be very unsteady, while a fuller mould of bilge will make a very steady and safe boat. If he will fasten a bilge rail or keel on each bilge of his boat, in a line with the keel at about a foot distance from it, it will greatly add to her stability, bilge rail to be about six feet long, two or two and a half inches deep, one inch thick, tapered to a sharp point."

Exhibitions of Craft Work, etc.—T. J. M. (*Manchester*) writes:—"I have derived much profit and instruction from exhibiting and examining the exhibits of others in various craft shows during the last year or two; and I should be glad if readers of WORK would make known to their fellow subscribers in good time any such exhibitions coming on."

II.—Questions Answered by Editor and Staff.

Dovetailing.—Dovetail (*London, N.E.*).—I am afraid anything that can be said in "Shop" about dovetailing, or rather making a box, will not help you very much, for I imagine you are not familiar with joinery. It is a pity you did not say what the box is for and give some idea of its size, as then it would have been easier to answer in a way that would be more useful to you. Not knowing what kind of a box you want to make I can only give the following general directions:—After having planed up the stuff plane one edge straight. Work from this for lengths and make to width required. Then set your gauge to thickness of wood and gauge on ends of pieces. Do so on both sides. Next set out for the dovetail pins. Saw down to the gauged lines and chop out the waste wood with chisel, cutting from both sides of the wood with a slight inclination inwards. Then mark off on the other pieces the sockets for the dovetails; saw and chop out the waste. To ensure close fitting, saw outside lines for the dovetails and inside lines for the sockets. This compensates for the saw kerf.—D. D.

Index to Work.—J. G. (*Stockport*) and numerous other readers are informed that an Index to Work has been prepared, and has been on sale for some time. See notice on page 828, Vol. I. It can be had from the publishers or through any bookseller, price 1d.—Ed.

Battery for Electric Lamp.—Volta (*Rochester*).—Your 12-volt 5 c.p. incandescent electric lamp is made to be lighted with a current having an E.M.F. of not less than 12 volts. This can be obtained from six single fluid chromic acid cells arranged in series. The cells should contain two carbon plates and one zinc plate in each cell, and this should hold at least one pint of liquid if the light is to be maintained for three hours at a time. In my articles, "Model Electric Lights," which will appear shortly, I have given full instructions for making and charging such batteries. You will also learn much from my replies to other correspondents.—G. E. B.

Technical Work on Dynamos.—F. A. (*Wandsworth*).—Have you seen Professor Thompson's book on dynamo electric machinery? If you have not, I should advise you to get it, and study up the principles of construction as therein laid down. Then you will be able to more fully understand how a dynamo is constructed. Surely that book will not be too elementary! You will also find some technical information on dynamos, and also electro-motors, in "Electricity in the Service of Man," now being issued in monthly parts by the publishers of this paper. I am not sure, but I think Professor Perry was one of the first to construct a motor to run at a perfectly uniform speed under varying loads.—G. E. B.

Electrical Questions.—R. B. (*Laurencekirk*).—(1) The Fuller cell is now in general use, and may be made up by any person. (2) I do not know of any good book dealing exclusively with galvanic batteries. (3) Apply to Trübner, foreign bookseller, Ludgate Hill, E.C., for price of Cazin's work on electric or galvanic batteries. (4) See reply to G. L. (*Pimlico*). Try Spon, publisher, Charing Cross, London, for list of books on electric lighting.—G. E. B.

Securing Copyright.—J. C. (*Smethwick*).—Your letter is not very explicit, but it is presumed that you wish to secure copyright for a label or some such business matter which does not come within the definition of a trade mark. It is probable that you will find the forms supplied for that purpose from Stationers' Hall perplexing. It will be better to call there or get some friend in London to do so, and have the forms filled in by the official.—C. C. C.

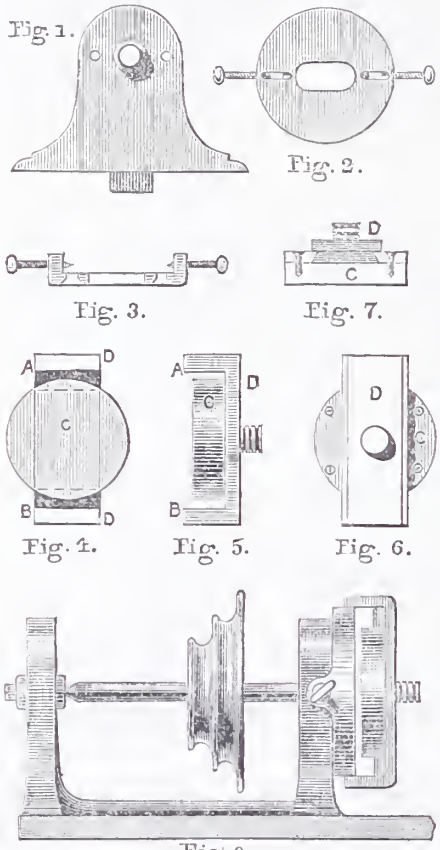
Payment of Royalties under Patent.—Patent (*London*).—The ordinary practice in the writer's district is for the licensee to pay Royalties monthly. The January Royalty, say, would be calculated and audited by some person agreed upon by both parties; payment being made to the Patentee on the 21st of February, and so on. If the licensee fails to meet his payments the usual stipulation is that the licensee shall revert to the Patentee. But, of course, these things are matters for agreement between the two contracting parties. The auditor's expenses are shared; he is the joint servant of both parties, and being usually an accountant who has a professional reputation to maintain, the system, as a rule, works smoothly.—C. C. C.

Taking out a Patent.—A. H. (*Portsmouth*) has invented an improved instrument, but before taking out a patent he wishes to learn whether he is first in the field with this improvement. He should go to a Specification Library—there is one, free, in most large towns—and search the index for the instrument in question. Let us suppose that this improved instrument is a level. He must look in the index for the word "level," and if he finds any patent on the subject, read the specification, and see if the invention clashes with his own; continuing his search backwards through the volumes of as many years as will satisfy him one way or the other.—C. C. C.

Correspondence in "Shop."—W. H. G.—Every correspondent is entitled to express his views on matters relating to construction and decoration freely in "Shop," which is intended to serve as a means of imparting information on all appropriate subjects, respecting which inquiries are made, and to promote discussion, which often tends to draw out much useful knowledge and suggest ideas.

Staircasing and Handrailing.—W. H. G.—These subjects will be dealt with in due course, but papers on them cannot appear at present. The carpenter who was to have written on his own method, and has handed me two diagrams with a very brief description, has quitted the neighbourhood to undertake a good job in one of the Western counties.

Oval Chuck.—A. S. H. L. (*Walworth*).—The small sketches sent will, I hope, make the oval chuck clear to all, but there are some details which can hardly be explained by sketches. (1) If the ordinary chucks come near the headstock casting, then the plate, Figs. 2 and 3, *must be thin enough to clear chuck.* (2) Upon this depends projection of A and B in Figs. 4 and 5; they must clear the headstock casting when revolving. (3) The screws in Figs. 2 and 3 grip the headstock and are to be kept clear of A and B. (4) Probably C will have to be filed off almost to the dotted lines to allow enough movement to take place. (5) The rectangular portion of the chuck is dovetailed to C as in sketch, Fig. 7, and must fit well. (6) In using chuck the tool must always cut at the same height from lathe bed, or every variation will cut an ellipse having greatest diameters not coincident, which is to be avoided.



Oval Chuck Fittings.

As A. S. H. L. does not give size of lathe, this is not to scale. Fig. 1, face of headstock, showing two screw holes to fix plate. Fig. 2, plate to fix on headstock elevation. Fig. 3, section of plate; the face screws hold plate on headstock and edge screws adjust amount of eccentricity. Fig. 4, the chuck (back); the rectangular portion, D, slides accurately between guides on C, which is fitted to mandrel nose as usual. The stops, A and B, must be exactly the diameter of Fig. 2 apart. Fig. 5, edge view of same (references the same). Fig. 6, front of chuck having an exact copy of mandrel nose *fixed* in centre upon which ordinary chucks can be used. Fig. 8 is a sketch of the whole in position, showing how Fig. 2 fixes on headstock, and Fig. 5 is compelled to follow its eccentricity.—B. A. B.

Veneering, etc.—G. W. D. (*Ventnor*).—I cannot altogether agree with your remarks about the use of toothing plane and smoothing plane in connection with burr veneers. Certainly the former requires a little less care in use than the latter, but I do not know that that is any recommendation. If a man is of the "slap dash" order of humanity, perhaps he will do better to confine himself to the toothed plane; but if he is one who wants to turn out his work in first-rate style, and to become proficient in handling his tools, I think most people who know would prefer the smoothing plane. As you are practically acquainted with every detail of the cabinet line, you will, no doubt, understand the reasons without their being specially given. I wonder how you can have learned so much in a decade, for ten years is a very short time in which to have acquired a knowledge so extensive. I should like to see you, for one of the cleverest cabinet makers I know told me recently that though he has been at the bench for thirty-five years he is always finding that there is something fresh. With regard to the veneer hammer, all I can say is that different workers use different tools, and if you like one without iron by all means use it; but I think those who have used both sorts prefer one with an iron, as it is considered to work sweeter. As it is generally a home-made tool, veneering hammers are found in considerable variety, and I daresay you know that the hammer may be only a piece of board without any handle. Yours must have seen some service, since it was made more than half a century ago, and I do not wonder at your being attached to it, for I have a tool of about the same age which I would not willingly part with on account of its associations. I should like to ask if you have ever known an iron veneering hammer to stain the veneer when it has been properly used? I never have. I must confess I am rather surprised at any one of your experience asking for names of wholesale houses for such everyday articles as handles and for prices of glass. However, as I wish to be helpful to you, I may say that Grew and Bridge, Summer Row, Birmingham, supply the former, and that prices of the latter will be sent by any of the wholesale plate-glass houses if you write. Have you never heard of the "trade" papers? Sorry you object to the articles on hinges, but then everybody who reads Work has not got your vast experience, and I am sure you will be pleased to learn that the instructions given have been much appreciated by many who are not so well informed. You will see articles some time about making a rule joint and butler's tray, but I hardly think that one showing how to use a veneering hammer is necessary. If you or any one else wants to know I shall be pleased to tell you, for the intention of all concerned is just to make Work what you call it, viz., "a mine of usefulness in practice and theory, teaching hands to labour with greater skill in art, craft, and science, and at all times for both young and old a treasure for thought." I hope to hear from you again, for though we don't agree quite, interchange of opinion is beneficial for all workers.—D. A.

Handrailing.—W. G. H. (*Bury*).—I have much pleasure in acknowledging your letter. Handrailing will be treated in due course, but not on stereotyped lines, and when I am satisfied with papers sent in on the subject they will appear in print. This will be a sufficient answer to your letter.—Ed.

Registration.—Hertford has evidently overlooked the information which he requires in Work. He will find it in Vol. I., No. 37, page 578.—C. C. C.

Licensee under Patent.—Little Vulcan, saddled as he is with his inactive licensee, is much to be commiserated. Unless by his agreement the licensee is bound under penalty to do a certain amount of business, we do not see what remedy the Patentee has, unless at Equity. But he will understand that we are giving no opinion on the law of the matter, and that it would be quite out of the province of Work for us to do so. If he feels it necessary to act under his grievance he should consult some trustworthy solicitor. For such a book as he requires he had better apply to a law-stationer, or to a bookseller with a legal connection.—C. C. C.

Model Locomotives.—J. W. (*Bolton*).—Eventually we shall, but not yet a while, owing to pressure of other matters.

Monumental Brass Engravings.—Monument (*Walton, Liverpool*) wishes to know the qualifications of a first-class monumental brass engraver. The main qualifications are equal skill with either the chisel or graver. But monumental work is not wanted every day, so that Monument must be able to engrave other kinds of work found in the situation he wishes to fill. If the situation he desires is a brass manufacturer's, the work will be most varied, but pretty constant, and will be found to be rather hard work, which doubtless he is prepared for. With regard to his studies of Gothic ornament, he will find them useful. I recommend him to look through R. W. Billings, Esq.'s, books on the subject of "The Infinity of Geometric Design Exemplified," and "Power of Form as applied to Geometric Tracery." Also "Original Geometrical Designs," by D. R. Hay, Esq., as they include many splendid designs for church work. In conclusion, I would suggest that Monument will hardly find the berth he wants in London; I think he would stand a better chance in Birmingham, that city being the centre of the brass trade, and from which place tons upon tons of ornamental brass work are sent away to be sold as London manufacture. The volumes referred to will, doubtless, be found in the reference department of the Liverpool Free Library.—N. M.

Handrailing—Work Numbers.—R. A. (*Manningham*).—The handrailing has to wait. No number of Work is out of print. Send us the name of any newsagent who says so.

Cabins.—Paterfamilias.—Yes; I hope to have from a man who lives in Florida a description of the way in which houses are built there. A villa was discovered at Brading, Isle of Wight, a few years ago, which was fully described and illustrated in the *Illustrated News* and other pictorial papers, and perhaps a search in a file of *Illustrated London News* would bring this to light. I do not know of any detailed description of a *restored* ancient Roman villa.

Chair Cane.—A. B. C.—This is procurable in quantities of not less than ¼ lb. The price is for

"Crossing," 2s. 4d.; fine, 2s. 6d.; finest, 3s.; "setting," 3s. The quantity required for recaning half a dozen chairs would be about 1 lb. "crossing," ¼ lb. "setting." S. J. Eaton & Co., of 131, Great Titchfield Street, W., undertake to supply this article on remittance. But A. B. C. would do better to reseat his chairs with Austrian perforated bottoms costing about 6d. each, and devote his time to some pursuit more calculated to call forth his ingenuity. The Austrian perforated bottoms strengthen the framework, and can be screwed on in a few minutes.—F. D. B.

French Polishing.—J. F. (*Kelvinside*).—As you do not say of what wood your cabinet is made it is impossible to give you more than general directions, but you may possibly pick up a few hints which will be of use to you by reading answers which have already appeared in "Shop." If the wood is of a light colour and you wish to make it resemble some other, of course you must stain it, but if you only want to darken the present tint oiling may do. Wood, as a rule, does not require staining to give it a "respectable appearance," and whether it is improved or not is altogether a matter of taste. To polish, oil, fill in, body up, and finally spirit off, different kinds of wood, however, require different treatments, and as you do not say what kind you have used I am unable to help you further at present.—D. D.

Registration. — DIAMOND (*Falmouth*). — There are many patent agents who are reliable business men, and if we quoted a firm here it would appear that we were advertising them to our readers. If, however, you will send us a stamped and addressed envelope we will enclose to you the address of a patent agent who, we believe, will give you every satisfaction.—ED.

Delta Metal.—JACOBUS.—Delta metal is an alloy of copper combined with iron. Iron is dissolved in melted zinc till the zinc is saturated. This iron-zinc alloy is then used in proper proportions in making brass. To prevent oxidation in remelting and the resulting variation of quality, a small amount of phosphorus is added, in combination with copper. The density of delta metal is 8·4, its melting point 1800°. It can be worked hot or cold. It can be brazed. Cast in sand, it has a tenacity of about twenty-one tons per square inch. Forged at a dark red heat the tenacity is thirty-three or thirty-five tons per square inch. Hammered cold its tenacity is forty tons per square inch. It can, therefore, be made as tough as wrought-iron and as strong as steel. The writer has seen it used for the spindles of cranes for gunpowder factories, and he has also seen castings of wheels made from it. When required in sufficient quantities, these castings can be made in dies, and are then practically as cheap as the best gun-metal castings, while possessing the accuracy of machine-cut work. One great advantage of delta metal is that it resists corrosion better than iron, steel, or gun-metal, and is, therefore, serviceable for use in sea water, mines, and chemical works. It is used for nearly all purposes: propellers, cranks, Kingston valves, pump rods, plungers, valve spindles, bolts, nuts, studs, tubes, liners, condenser plates, cog wheels, ornamental work, and many others. It will be seen, therefore, that, according to the proportion of mixture and method of preparation adopted, delta metal possesses the advantages of cast, wrought-iron, and steel, without their disadvantages.—J.

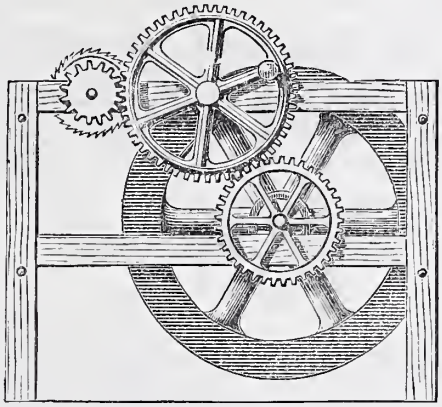
Forge Fan.—J. G. (*Wirksworth*).—It is not at all difficult to make a fan to work by hand, with blast powerful enough for a blacksmith's fire. You can make the vanes either square or tapering, concentric or eccentric. In a small fan I do not think there is anything gained by eccentricity, though it increases the efficiency of large fans. The vanes may measure ten or twelve inches across the tips, the openings in the sides four or five inches diameter. The size of the fly wheel need not be much more than the size of the fan casing, say, from twelve to fifteen inches diameter. Multiplying gear would have to be used to get up the necessary speed. I should not go to all this trouble, because you can buy a forge fitted with fan complete for from £2 to £4, or a forge fitted with a Roots blower for about £7.—J.

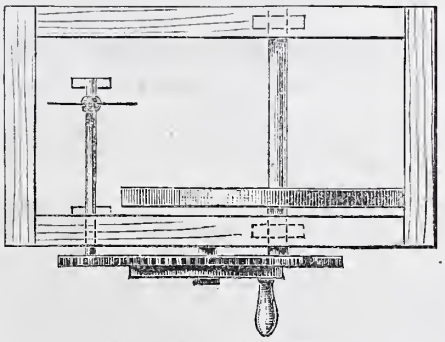
Plate Camera.—J. H. T. (*Herts*).—The description of parts, and instructions how to put them together, were as explanatory as it was possible to make them. Your best plan would be to carefully look at a camera already constructed—one by G. Hare, for instance. No doubt you then would gain more information than any amount of writing would convey. All these diagrams and instructions presuppose a certain amount of constructive and carpentering skill, without which it is useless to attempt putting work together. The firm you suggest has been recommended in these columns three or four times during the past year. No special names can be given to bits of brass-work that do not explain themselves, as hinges, screws, etc.; the use to which they are applied is their explanation.—E. D.

Plaster of Paris.—MOULDER (*St. John's Wood*).—We know of no means by which plaster can be made to set a second time, or even a first time if it has been long exposed to the air, unless, possibly, by re-burning, which would cost as much as new plaster. The only use to which old plaster can be put is by using lumps of it to strengthen the outside of moulds, and thus save new. But even this is scarcely worth the doing, when one considers the very small cost of the coarse plaster used for backing up.—M. M.

Drilling China.—W. H. S. (*Willaston*).—You will find no difficulty in repairing your pitcher, providing it is not broken into too many pieces. The drills and diamond bits can be bought at several places in London, but I can strongly recommend Mr. E. Clarkson, Tower Street, King's Lynn, or you can make a drill for yourself, especially if you have a lathe. If you would like to do so, let me know through "Shop," and I will give you full directions and drawings. Drill your holes as deep as the thickness of the pitcher will allow. Take a piece of brass wire, flatten one side with a file or old knife, turn down one end with a pair of nippers, place this in one of the holes, and carefully mark and then turn down the other end. When you have made all the holes and rivets, proceed to fix the latter in their proper holes, taking care to see that each fits tightly; then fill up with plaster of Paris mixed with water.—M. D. W.

A Hand Circular Saw Bench.—E. C. M. (*London, W.*).—Frame of deal 4½ by 3, the two sides being mortised through, the end rails slightly tenoned and bolts close under rails. The height of bench 3 ft. 6 in. Driving wheel is to gear into fly wheel spindle and also into saw spindle, both of which are brought through frame to carry a cog wheel for that purpose. The fly wheel would then revolve





Hand Circular Saw Bench.

rapidly (unless fly wheels do this they are of little use). The saw revolves still more rapidly, and being geared to driving wheel slip, the bane of saw benches, is prevented. This machine would take some starting, but would work well if the three cog wheels were well fitted. The fault of all manual power machines driven by belts is either slip, or a tight belt causing great friction and strain. Although I do not think it within the scope of WORK, I will try and ascertain prices of fittings. Fuller description would be too long for "Shop."—B. A. B.

Door Fastener.—J. G. (*Brimpsfield*).—You do not give sufficient particulars of the fastening to enable me to judge who would be the best firm to recommend you to. In any case, it would be advisable to get a provisional protection for it before showing the specifications to any maker in the trade.—T. W.

Bamboo Purchasing.—C. C. (*Birmingham*).—S. J. Eaton & Co., 3 New Inn Yard, Tottenham Court Road, W., are prepared to supply all the canes necessary for making bamboo furniture or other work at prices *pro rata* of the quantities ordered. If C. C. will state what quantities he requires and what thicknesses, S. J. E. and Co. will send him some at the lowest market prices. It should be understood that the prices vary very much according as the market may be bare or glutted. Now, and for twelve-months past, prices have ruled high consequent upon the greater demand caused by the increasing favour shown by the public to this elegant and useful branch of manufacture. A few leading items of information as to sizes and prices may be conveyed here as a general guide. Bamboos for furniture are imported and sold in lengths of 6 ft. 6 in. without roots, and in thicknesses varying in diameter from ⅜ in. to 1¾ in., and rising in price per stick from 7½d. to 11d. These are fairly equal in diameter from end to end. If they taper the cost is slightly decreased. Long *tapering* sticks 13 ft. by 1½ in., 1¾ in. diameter, may be had for 1s. 9d. each. Also 4 ft. lengths with roots from ⅝ to ⅞ diameter at 3½d. and 4½d. each, and ½ in. "grec" for inserting transversely, etc., at from 1½d. to 2½d. each. A reduction of from 5 per cent. to 10 per cent. is made when a dozen of a sort is taken. The fine white matting, best quality, 1s. 1d. per yard. Whangees: these pale straw-coloured canes with the knots at nearly equal distances, now so much in vogue for screens, frames, etc., mounted on a timber framework, are costly. Thick, 2 ft. 6 in. long, and thin, 3 ft. long, are 5d. each; 4 ft. 6 in. long are 8½d. each. They are not equal but tapering. Cane, best white, 1s. 1d. per lb. These are the pith peeled, and uniform in thickness. Rattans, thick, 8d. per lb. These are unpeeled. Black varnished, 8 ft. 6 in. in length. These range progressively through 17 gauges from ⅛ in. to ⅝ in. diameter, and in price from 1s. 9d. to 8s. 6d. per dozen. Tonkins: these are the commonest kind, and resemble somewhat our reeds in appearance. They are, however, useful for certain purposes, particularly in the conservatory and garden. Many light and pretty articles may be contrived with them, and they are cheap. In length from 42 to 46 in., and varying in diameter from ⅜ to ⅝ in.; Various in colour and marking, some even in diameter, others tapering from one end to the other; the price is, mixed, for 100, 2s. 6d.; selected, for 100, 3s. Where necessary an extra charge is made for packing, but all these articles, nearly, can be sent tied. S. J. Eaton & Co. will furnish any desired information on receipt of stamped and directed envelope.—F. F. B. B.

Aluminium, etc.—E. G. (*Bolton*).—You can get aluminium at Johnson, Matthey & Co., Hatton Garden, E. C., for 70s. per lb., or 4s. 6d. per oz. The impurities of commercial aluminium are chiefly silicon and iron, for which you can test as follows:—Dissolve a piece of the metal (not larger than a threepenny piece) in dilute hydrochloric (muriatic) acid, and one or two drops of nitric acid, in a porcelain dish; evaporate to dryness and heat gently at a temperature a little above that of boiling water until it no longer smells of acid. Now add a little hydrochloric acid and boiling water and warm; all the aluminium and iron will dissolve, leaving the silicon as silica or sand, which can be filtered off. To filtrate, add a solution of potassium ferrocyanide (yellow prussiate of potash), which will form a blue coloration or precipitate of Prussian blue if iron be present. Or, instead of this, add to the filtrate from the sand a solution of potassium sulphocyanate, which gives a blood-red coloration with iron. These tests only show the presence or absence of silicon and iron, a more elaborate process being necessary for their estimation, which, however, I shall be pleased to describe if you require it. Aluminium bronze is made by melting 90 parts of copper in a crucible made of plumbago, or some other highly-refractory material, and then adding 10 parts of aluminium, the two metals uniting with the evolution of intense heat. With these proportions the maximum degree of hardness, strength, and tenacity is obtained, a larger proportion of aluminium making the alloy weak and brittle.—F. B. C.

Electro-plating Model Dynamo.—W. F. (*Edinburgh*). — There are few parts of a model dynamo that can be electro-plated without doing injury to the machine in the way of impairing its usefulness. You might nickel-plate the binding-screws, connectors, brass or gun-metal bearings and fittings, but I should not advise you to plate the ironwork of the machine. This is best ornamented with paint, varnish, or coloured lacquer. A very pretty contrast is effected by coating the exposed parts of the iron with black japan, the wires with sealing-wax varnish, the brass bearings with gold lacquer, and nickel-plating the terminals and brush holders. The steel spindle should be left bright. Instructions in silver- and nickel-plating will be given in WORK in due time. The article on "The Dulcimer and How to Make it" was published in No. 31, Vol. I., page 490. When you write a letter to us again, do not seek to evade the letter rate of postage, but prepay the postage with a penny stamp. Letters may not be sent for a halfpenny, even when loosely folded and not sealed.—G. E. B.

Winding Dynamos.—PERPLEXED ONE (*London, S.E.*).—In a series-wound machine the field magnet coils are connected in series with the armature coils, the work being done in the outer circuit. The magnetism in the fields, therefore, varies as the resistance of the circuit, being less when the resistance is high than when it is low. In a shunt-wound machine the field magnet coils have their resistance proportioned to that of the work to be done in the outer circuit, and the coils are connected by a shunt through the brushes as well as to the terminals of the machine. There are, therefore, two paths open to the armature current: one through the F.M. coils, and the other through the work to be done in the outer circuit. When the resistance in the outer circuit is lower than that of the F.M. coils and shunt, more current goes by way of the outer circuit than goes round the coils, and the intensity of the magnetic field is reduced in consequence. On the other hand, when the resistance of the outer circuit is higher than that of the F.M. coils and shunt, more current goes by way of the coils, and this raises the magnetic intensity of the fields. The effect of this is to raise the potential of the current, and enable it to overcome

the extra resistance. In a compound-wound machine the F.M. coils are of thick wire, connected in series with the armature coil. Over these thick coils, or side by side with them, is wound a very long thin wire of high resistance. This is connected in shunt with the armature coils, consequently a certain portion of the armature current is always passing around the fields, maintaining them at a constant magnetic intensity, and giving to the machine a constant potential. Each style of winding has its own peculiar advantages, adapting it to the kind of work to be done by the machine. Carbons are soft cored to give them additional burning qualities, and increase the brilliance and steadiness of their light.—G. E. B.

Moulding Composition.—J. B. C. (*Worstead*).—This material can be obtained of the London Rubber Printing Co., 33, Cheapside, London; or of Mr. Lindner, 170, Fleet Street, London.—QUI VIVE.

Engravers' Wax.—INVICTA (*Stepney, E.*) wishes to know where he can obtain engravers' wax for filling in the lettering of brass plates, having been unable to find an oilman who sold the article. Perhaps INVICTA did not try in the right direction. The most likely shops would be amongst the engravers' and printers' district—Farringdon Street, Holborn, and Farringdon Road to Clerkenwell. But I give a few names of makers of sealing-wax, some of which will, no doubt, make engravers' wax; and before he goes further into the matter, I beg to direct his attention to the third column of page 596 of WORK, December 7th, 1889:—H. Allen, 17, Ironmonger Row, E.C.; Waterson & Sons, 9, Rose Street, Newgate Street, E.C.; G. Dove, 13, Southgate Grove, Southgate Road, N.; J. Finlayson, 144, Bermondsey Street, S.E.; G. Owen, 214, Cable Street, E.; P. Hinds, 37, Ashford Street, Hoxton, N.—N. M.

Book on the Magic Lantern.—H. S. (*Uxbridge*).—The Magic Lantern, by Hepworth, price 1s., published by Chatto & Windus, 214, Piccadilly, London.—F. J. C.

Preparation of Brass Plates for Engraving.—To. Po (*London, W.*) wishes to learn the process of truing up brass plates as from the metal dealers, and I have to say that unless he is an expert flat hammerer, he will fill his plates with hammer marks, which will give him unlimited trouble to remove; and, like myself, will, no doubt, consider a shilling or so well spent by having the plates flattened by a man who is up to his work. However, To. Po.'s intention is laudable enough, so I will give him the required information. He will require a "stake," that is, a flat steel head about two inch diameter firmly fixed in a cylinder of wood, which is driven tightly into the ground, a silversmiths' flat hammer, and a straightedge. Place the plate upon the stake, and, commencing at the outside edge, work towards the centre, trying now and then its truthfulness with the straightedge. Considerable judgment must be exercised as to the general condition of the plate before hammering, as it often happens that a few blows in the right places will set true a plate in the course of a few minutes. Or he may procure a pair of heavy planishers, with which he may accomplish his purpose most easily. After the plate is made flat, put it in the vice with clams, take a twelve-inch flat safe edge file (keep this file for brass-work only), not too coarse a cut, and true up the edges (and bevel if desired). Next drill and countersink the holes at the corners. Now take a large piece of pumice-stone with water and scour away until something like a face is obtained, and finish with water of Ayr stone, now called "Tam o' Shanter" hone.—N. M.

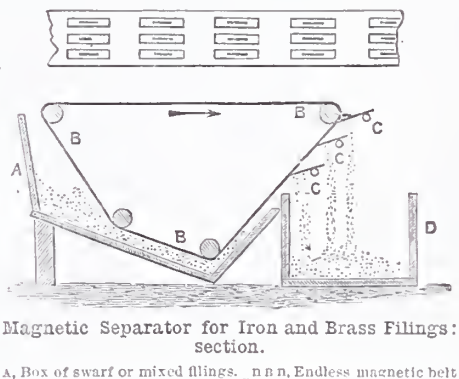
WORK Back Numbers.—S. E. A. (*Hooley Hill*).—All the back numbers of WORK, price one penny each, are still in print and can be had by order of any bookseller, or direct from the publishers by post for three halfpence each.

Air-Pump.—W. F. H. (*Dartford*).—I should think a double acting pump with a piston packed with metal rings would suit your purpose, of course it must be well lubricated. The valves may be ordinary light stalk valves with indiarubber seats to prevent concussion; but to advise you fully I should want to know the quantity of air required per minute, for in designing such a pump speed is a most important factor. The temperature of the air will rise very considerably during compression, perhaps higher than is consistent with the use of indiarubber if the speed is very great, then a different form of valve must be used. If you want the air at 30 lbs. *when cold*, you will be pumping against a higher pressure. If you send full particulars I can give you a design.—F. C.

Umbrella Patent.—J. L. (*Wandsworth*).—Your invention is undoubtedly good and useful, and should be a "blessing to housekeepers." The only question is if the capacity of B is sufficient, but this may be enlarged. In patenting this you should deposit a "complete" Specification (£4), because, until that is accepted and your patent sealed you cannot proceed against imitators, and so if you put your invention upon the market under "Provisional" protection only, other people can make and sell the article without hindrance, until you get your seal, and then you can only recover for *future infringements*. Therefore first perfect your invention and then prepare a carefully drawn Specification for deposit.—F. C.

Choice of a Profession.—J. L. (*Wandsworth*).—Unless you have a leading position an engineering draughtsman's position is not lucrative. There are many men walking about, who have been apprenticed or articled to the profession, who would accept £2 a week willingly, and for £3 3s. a week many of the practising "Civil Engineers" nowadays expect to get men competent to *design machinery and structural ironwork*, in fact not merely draughtsmen but engineers. If you have friends or influence to force you into a good position that is another matter. One reason why there are not so many chances as in former years is that many of the civil engineers practically leave the designing of the work to the contractors, giving only outlines, they themselves doing the financing and company-forming part of the business. You would not be able to do much as a draughtsman until you have had some practical experience on works or in the shops, and this means giving up time, which at your age is a serious thing to contemplate, unless you have private means. Of course if you have the influence alluded to competence does not matter much, as a subordinate would probably be put to do the work for which you would take the credit. This advice is the result of over thirty years observation in close connection with all branches of the profession. Some men certainly have risen from nothing to the highest positions, but they have begun young in the shops when there was much to invent and before technical education became so widely spread as to put the great majority on a level in point of knowledge. If you are making a living out of clerkship I should advise you to cultivate that for a subsistence, and keep engineering for a hobby.—F. C.

Electro Magnet for Cleaning Brass Filings.—BRASS (*Wolverhampton*).—If I had the job to clean the "swarf" from iron filings, I should try what could be done by means of a magnetic separator, and thus avoid the expense of making a dynamo and a magnetic machine such as you describe. My idea is expressed in the accompanying sketch, which shows a magnetic separator in section. The two top rollers must be made to revolve and thus



Magnetic Separator for Iron and Brass Filings: section.

A, Box of swarf or mixed filings. B B B, Endless magnetic belt passing around rollers. C C C, Brushes of bass fibre. D, Box for iron filings swept off by brushes. M, Belt of webbing, with magnets sewn on to surface.

carry the endless belt round. The two lower rollers of wood are fixed in the box of swarf. This box is inclined as shown to facilitate the descent of the filings by gravitation, and counteract the effect of the belt's motion on them. The belt should be of webbing, or a cotton belt will do, and the permanent magnets sewn on to this with tough brass or copper wire. The magnets may be 2½ in. to 3 in. lengths of crinoline steel, magnetised. The brushes may be made of bass fibre, and these brush off the iron filings, which then fall in a box as shown in the diagram.—G. E. B.

Boring Organ Soundboards.—W. J.—(*Bedford*).—The sizes of the holes in the soundboards depend entirely on the scale and power of the pipes to be blown. For an ordinary chamber organ stopt diapason the holes should be about as follows: C C, 1 in.; tenor C, ⅞ in.; top G, $\frac{9}{16}$ in. Open diapason: C C, ⅞ in.; tenor C, ⅝ in.; top G, $\frac{9}{16}$ in. Smaller scaled stops may be a trifle less, but roughly take as a guide the diameter of the open diapason pipes, and make the holes for pipes of the *same diameter* the same size as for those pipes. For the larger pipes on the soundboard it is usual to bore two holes side by side, and take out the intervening wood, thus forming an oblong hole. A slip of thin mahogany is glued over this opening in the stock board and a round hole bored in it to receive the pipe foot. By this method a hole is made large enough to admit plenty of wind without its being wider than the channel over which it is bored. The latter part of your query is not intelligible. What do you mean by "split" pallets?—M. W.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. H. W (*Pimlico*); S. G. N. (*Manchester*); NO FAD; S. S. S.; H. S. (*Chesterfield*); L. A. C. (*Wigan*); INCUBATOR; H. A. O. (*London, N.*); E. H. M. (*Portsmouth*); R. T. (*Durham*); A NEW SUBSCRIBER; JACK OF ALL TRADES; J. A. (*West End*); T. J. W. (*Stoke Newington*); ACID; J. B. (*Bradford*); E. T. (*London, S.E.*); H. L.; ORGAN BUILDER; A. B. (*Ashford*); E. J. (*Leith*); G. W. W. (*Surrey*); G. R. G. (*Ennis*); T. P. (*Islington, N.*); R. D.; S. G. H. (*Oldham*); W. S. T. (*Blairgowrie*); A. B. F; INDEX; J. M. (*Glasgow*); J. S. F. (*Swindon*); W. H. N. (*Birmingham*); W. C. (*Peterhead*); BRASS; J. M. (*Durris*); OLCAR; IRON GIRDER; A CONSTANT READER; BAZAAR; D. M. (*Glasgow*); H. V. A. (*Newton Abbot*); G. D (*Woolwich*); C. H. (*Finsbury*); F. G. H. B. (*Cradley, Staffs.*); ENQUIRER (*Jersey*); W. S. (*Watford*); SPARROWBILL; S. B. (*Nottingham*).

Trade Notes and Memoranda.

THE average daily water supply delivered to London from the Thames during February last was 79,095,922 gallons; from the Lea, 58,487,010 gallons; from springs and wells, 21,941,414 gallons; from ponds at Hampstead and Highgate, 327,352 gallons. The last is used for non-domestic purposes only. The daily total was therefore 159,851,698 gallons for a population aggregating 5,631,229, representing a daily consumption per head of 28·38 gallons for all purposes. The relative proportions of the supplies from the above various sources were as follows:—From the Thames 49·48 per cent.; from the Lea, 36·59 per cent; from springs and wells, 13·73 per cent; from ponds, 0·20 per cent.

AN important point in railway practice to which considerable attention has been given in the United States, is that of electric lamps for engine headlights. Mr. G. H. Prescott, superintendent of the Vandalia Works, is said to have pronounced the electric head-light that they have been testing on two of their engines for three months a perfect success. It throws the light from half to three-quarters of a mile ahead—far enough to stop a train running sixty miles an hour in time to prevent an accident. Another advantage the light has is that the light is thrown directly in front of the locomotive, and does not illuminate to any extent on either side of the track. Twelve of the Vandalia engines will be equipped with this light.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	.. .. ..	1s. 8d.
6 months, "	.. .. ..	3s. 3d.
12 months, "	.. .. ..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL AND COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [24 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

Repoussé Work.—Tools, Materials, and Designs. Price List post free.—C. POOL, The Mechanics' Tool Depôt, 27, Hockley, Nottingham.

Tools for Carpenters, Joiners, Cabinet-makers, Gas-fitters, Plumbers, etc. List one stamp.—POOL, Nottingham. [17 R

Glass Silverer and Beveller.—EDWIN HAMMOND, Junction Road, Romford, Essex. Please state requirements. [19 R

Machinery and Tools.—Largest Stock in London. BRITANNIA Co., 100, Houndsditch. Cash or Hire Purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks and Dies, Forges, etc. Catalogue of new, 6d.; second-hand, 2d.—BRITANNIA Co., Colchester.

Best Book on Lathe, Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester [21 R

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured.—ETHELBERT HENRY, Alvaston, Derby. [22 R

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 sheets, 2s. 6d. All post free. Lists free.—F. COULTHARD, 113, Old Christchurch Road, Bournemouth. Note change of Address. [1 S

51 Metal and Wood Organ Pipes, 9 inches to 2 feet. Will exchange for Clarionet.—FERGUSON, 34, Railway Road, Darwen. [2 S

Picture Moulds. — 9 ft. (2¾ in. gilt), 9d.; others equally cheap; special trade terms. — DENTS, Importers, Tamworth. [23 R

Water Motor (¼ horse power); price 10s.—WALTON, 9 Queen Anne Street, Stoke-on-Trent. [3 S

Ewart's Lubricant Brilliant for French polishers to use in place of oil; pint tins, 2s. 6d. post free.—W. EWART, Heckmondwike. [4 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases o **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Stephens Stains FOR WOOD.

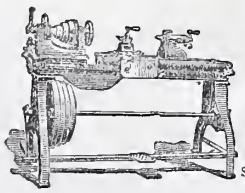
Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, [illegible] Aldersgate St., London, E.C.

JOHN AARON,

Engineers' Tool Merchant,

GAOL LANE, HALIFAX, YORKS.



Lathes, Pillar and Bench Drills.
SAWBENCHES.
SHAPING AND PLANING MACHINES.
All kinds of Tools, Chucks, &c.
SPECIALITIES IN AMATEURS' LATHES.

Catalogues free on application.

All inquiries have prompt attention.

TOOLS TOOLS
MOSELEY & SON.
323. HIGH. HOLBORN.
200 PAGE-CATALOGUE
BY POST 6P
ORDERS OF 10/- CARRIAGE PAID

WATERPROOF FLUID GLUE.

(Patent.)

By post, 1s. 3d. *and* 8d.

WATERPROOF GLUE CO.,
62, Dale Street,
LIVERPOOL.

60th Thousand, price 1s.; post free, 1s. 3d.

CASSELL'S

Shilling Cookery.

This new and valuable Work contains 364 pages, crown 8vo, bound in limp cloth.

Cassell & Company, Limited, Ludgate Hill, London.

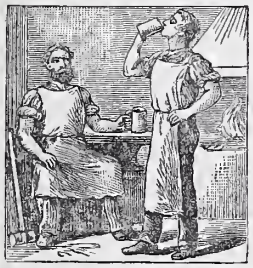
TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.
37, CHANCERY LANE, LONDON, E.C.

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

RECENT SERIALS.

Monthly, *7d.*
Gleanings from Popular Authors, Grave and Gay. With 400 Original Illustrations.

Monthly, *6d.*
The Dictionary of Religion. Edited by the Rev. WILLIAM BENHAM, B.D., F.S.A.

Monthly, *7d.*
Science for All. With Numerous Illustrations.

Monthly, *6d.*
The World of Wonders. With upwards of 500 Illustrations.

Monthly, *3d.*
Farrar's Life of Christ. In large type, with upwards of 300 Illustrations.

Monthly, *6d.*
Canaries and Cage-Birds. With Exquisite Facsimile Coloured Plates.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

THE POLYTECHNIC SERIES.

Consisting of practical Illustrated Manuals specially prepared for Students of the Polytechnic Institute, Regent Street, London, and suitable for the use of all Students.

FIRST LIST OF VOLUMES.

Elementary Chemistry for Science Schools and Classes. By ROBERT AVEY WARD. 128 pp., crown 8vo, cloth, **1s. 6d.**

Forty Lessons in Carpentry Workshop Practice. By CHARLES F. MITCHELL. Revised by GEORGE CAMPION POPE. **1s.**

Practical Plane and Solid Geometry, including Graphic Arithmetic. Vol. I. ELEMENTARY STAGE. By Prof. HENRY J. SPOONER, C.E., F.G.S. **3s.**

Forty Lessons in Engineering Workshop Practice. By C. F. MITCHELL and E. G. DAVEY. Revised by J. ROGERS, M.A.S.E. Price **1s. 6d.**

The Polytechnic Technical Scales. Ten Scales printed on card, in Case, **1s.**

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NOTICE!!!—*Your attention is invited to our Large Stock*

at **100, Houndsditch, London.**

PLANING, DRILLING, SHAPING MACHINES, LATHES, &c. &c.

SEND FOR LIST OF **NEW**, AS MADE FOR THE BRITISH GOVERNMENT, 6d.

Send for List of SECOND-HAND Engines and Tools, 2d.

We have always a demand for good SECOND-HAND ENGINES and TOOLS, and are open to Exchange.

Workshops fitted up with Gas or Steam Engines. Shafting and Tools of every description.

BRITANNIA CO., COLCHESTER.

Terms:—CASH OR HIRE PURCHASE. *BEST BOOK ON LATHE WORK*, 3s., *POST FREE.*

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET

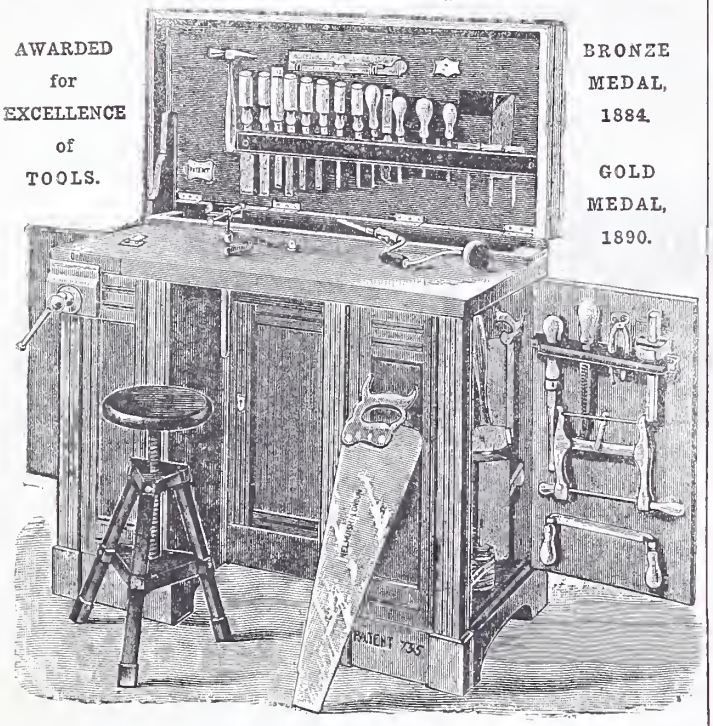
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

Bovril

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril**

WILL KEEP ANY LENGTH OF TIME.

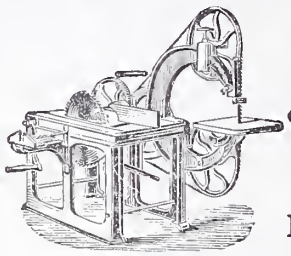
SOLD EVERYWHERE.

LEWIS & LEWIS,

ENGINEERS,

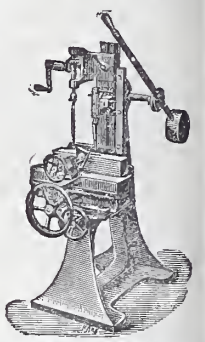
CAMBRIDGE HEATH,

LONDON, N.E.



THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,

For Hand or Power, will take in 22 in. Circular Saw, and will cut by hand-power up to 5 in. deep.



THE "HACKNEY" MORTISING & BORING MACHINE,

With 8 Chisels, 1 Coredriver, Key, 3 Augers, and 3 Drills.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic **WEAKNESS** speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place).

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 64.] SATURDAY, JUNE 7, 1890. [PRICE ONE PENNY.

HOW TO BUILD A TRICYCLE HOUSE.

BY H. B. P.

I SHALL endeavour in this article, and by the aid of the accompanying drawings, to make it an easy task for readers of this paper to construct a tricycle house or shed for themselves at much less cost than having to buy one.

It has been my aim to make it as portable as possible, compatible with strength. When once built, it can be taken to pieces and refitted easily within the hour.

When asunder, the separate parts of the shed consist of only eight pieces: viz., the two sides, the two transverse stays above and below door, the back, the floor, the roof, and the door, the whole being held together by eight bolts and nuts, with the exception of the roof, which is held in position by four hard wood catches.

For the convenience of those who may not be able to understand the drawings so easily, I have marked each of the eight parts, as well as the pieces composing those parts, by block letters, so that it can be seen at a glance to which part of the shed the pieces belong if the drawings do not show it distinctly.

The right-hand side of shed, seen from the front (as shown in Fig. 1), is marked A; the left-hand side, B; the top transverse stay above door, C; the bottom stay, D; the back, E; the floor, F; the roof, G; the door, H.

The dimensions shown on the drawings are of a house originally built for a light Humber roadster with wheels 40 in. diameter, but having since got a Safety bicycle, I find I can, by removing one wheel from tricycle, place the two-wheeler in as well. The first thing to be done by the builder is to take the extreme width, length, and height of his machine, and work from those dimensions. Should the size of shed shown in drawing be found large enough, it will be found a very convenient size. Do not cramp it much if there is plenty of room for it to stand in, as there are sure to be extras to be placed in it besides the machine. If the house has to be much larger than the one shown, the scantlings must be increased in section.

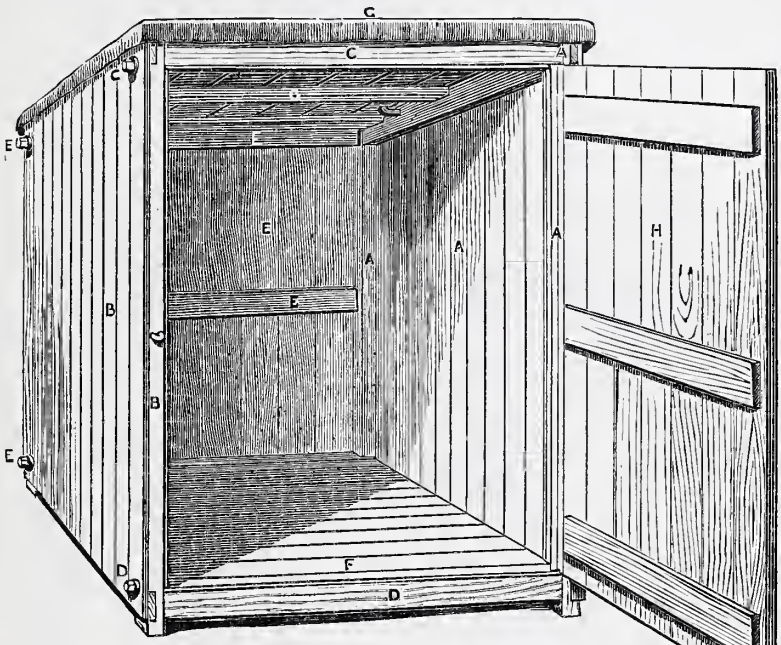


Fig. 1.—Perspective View of House with Door open, showing Interior.

All the scantlings are $1\frac{3}{4}$ in. × 3 in., the roof and flooring boards $\frac{7}{8}$ in. thick, butt-jointed. The boarding for the door, sides, and back of the shed are $\frac{1}{2}$ in. planed: that is about $\frac{7}{16}$ in. thick, grooved and tongued.

To proceed with the building of a shed as shown on drawings: commence with the sides, which, being similar, except that one is right hand and the other left, if we describe one it will be sufficient. Take a scantling 6 ft. 3 in. long, equal to the total length of the shed: this is for the bottom horizontal stay. Now cut two others, 5 ft. 2 in. and 4 ft. 2 in. long, for vertical posts at

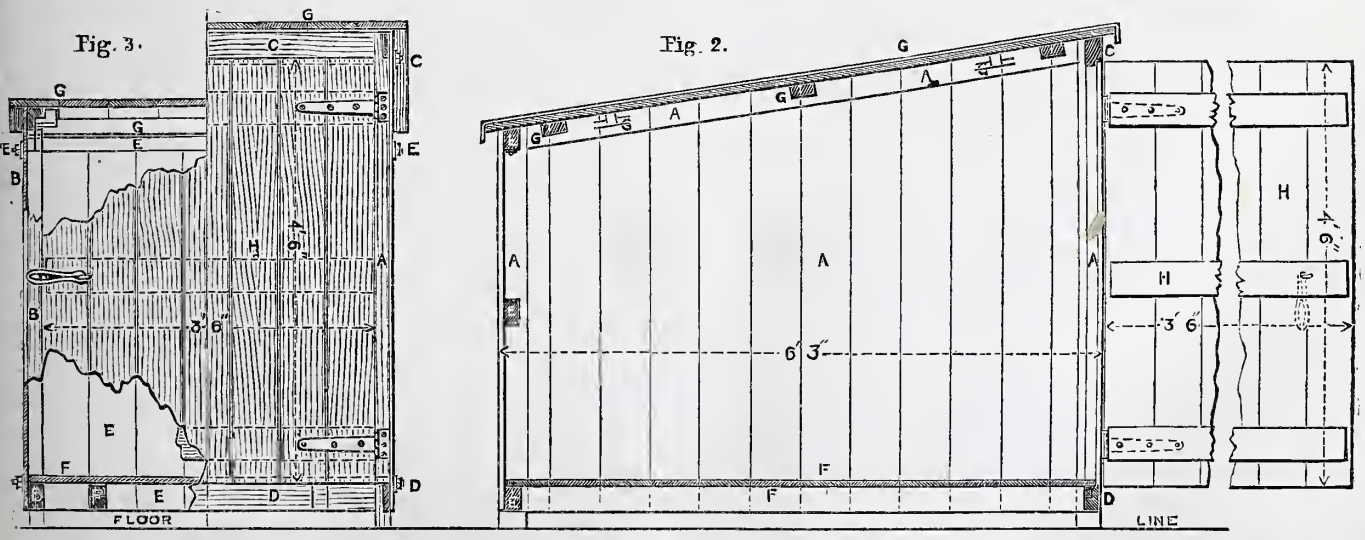


Fig. 2.—Longitudinal Section through *a b* in Fig. 4: for Joint in Upper Right-hand Corner at G, see Figs. 8, 9, 10; for Details of Construction in Upper Left-hand Corner, see Figs. 5, 6, 7. Fig. 3.—Front Elevation, partly in Section. (Scale of Figs. 2 and 3, $\frac{1}{2}$ in. to 1 ft.)

front and back respectively. These must be fitted by means of half-lap joints to the ends of the horizontal stay and at right angles to it; not forgetting to leave the two inches below stay for feet. Remember also that the half-lap of the horizontal stay comes outside or against the boarding when fitted up. Having fitted these and fastened them temporarily in position, the sloping stay on which the roof rests can now be measured. It must be fitted in a similar manner, the half-laps of stay again being outside. Three recesses, $1\frac{3}{4}$ in. × 3 in., can be now cut in the top for the roof scantling to rest in; also two slots on the inner side for roof catches to turn in. The positions of these can be measured in Fig. 2, or in the larger scale details. Having done this, the other side can be made exactly similar, but the opposite hand to the first.

We must now calculate the length of the transverse stays. The door in this case is 3 ft. 6 in. wide; this gives the distance between the vertical side posts, back and front; but in order to keep the stays solid we must allow $\frac{7}{8}$ in. at each end for letting into vertical posts of sides. This gives us a length of 3 ft. $7\frac{3}{4}$ in. Cut five scantlings to this length, two for front and three for back. The front and back joints vary slightly; we will therefore describe the former first, taking as example the top right-hand joint above door first (in Figs. 8, 9, 10). Cut out from end of stay a piece $\frac{3}{4}$ in. deep by $\frac{7}{8}$ in. long (see Fig. 10). This leaves on the end of stay a projecting piece $\frac{7}{8}$ in. long, by 1 in. wide, by 3 in. deep. A slot must now be cut in the vertical post of side to admit of this tongue, and that the front of stay and vertical post are even, as shown in Fig. 10. The left-hand top corner joint can now be done in the same way.

The two front corner joints below the door are similar to preceding, with the exception that the lower longitudinal side scantlings are horizontal, and not inclined. When the joints are completed, cut in this bottom stay facing the interior of house and 6 in. from the vertical side posts two recesses, $1\frac{3}{4}$ in. long by $1\frac{1}{4}$ in. deep, and $\frac{3}{4}$ in. from the front. These are to carry the two floor beams (as shown in Figs. 2, 3, 4). They are placed near each side, so that they will support the two large wheels of cycle.

Having completed the four front corner joints, there will be no difficulty with the back ones. In cutting out the recesses for stays, allowance must be made for the boards, which in this case are flush with the outside of the vertical posts (see Fig. 7). The tongue on end of stay in this case is not flush with one side, as in front ones, but more in the centre of end of stay. Having cut these tongues on the ends, the corresponding recesses must be cut in the vertical side posts, allowing, as I mentioned before, for the boarding to come flush with the end. The four back joints are similar, so there will be no difficulty. In the bottom stay, at back, the slots must be cut for carrying floor beams as in the front one.

The middle stay at back is simply recessed in the vertical posts, and not held by bolts or nails. It is to strengthen the back and prevent the boards being knocked out should the machine be pushed in too vigorously. Having cut all the recesses in the side frames, they can now be nailed together thoroughly and then boarded; the boards, $\frac{7}{16}$ in. thick, grooved and tongued, should be flush with the top and bottom scantlings and side posts, the boards covering up the ends of the recesses in top scantling, thus preventing roof working sideways.

The bolts (Figs. 13 and 14) can now be screwed to the ends of transverse stays. In the case of the top stays, back and front, the bolts are underneath the stay. In the bottom ones they are above. Holes must now be bored through the sides, and the recesses slightly enlarged to allow bolt to pass: this should be done carefully, to allow as little play as possible. The bolts (shown in Figs. 13, 14) are drawn to scale, and are $\frac{1}{2}$ in. diameter, flattened out and drilled for three screws.

When the bolts are fitted through the sides the nuts and washers can be put on and screwed up, not forgetting to put the middle stay at the back in its place. When screwing up, care should be taken that it does not produce any warping.

The back can now be boarded, using the same kind of boards—namely, grooved and tongued boards— as used in the sides.

The two beams, $1\frac{3}{4}$ in. × 3 in., for carrying floor, can now be inserted, and the boards

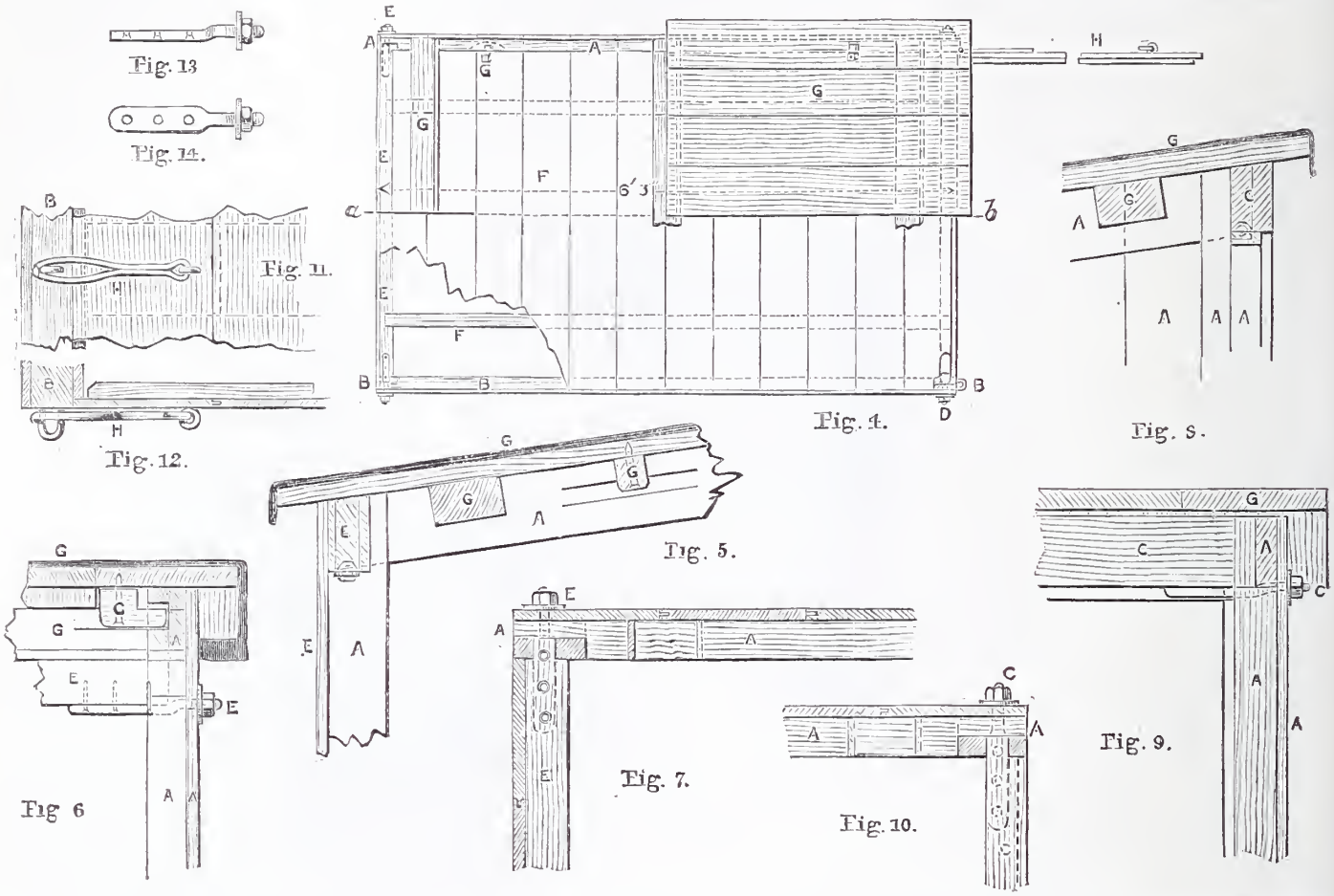


Fig. 4.—Plan of House, showing Roof Boards removed in Upper Left-hand Corner; Felt removed in Upper Right-hand Corner; Section on Vertical Side Post in Lower Right-hand Corner; Floor Boards broken to show Scantlings to carry them in Lower Left-hand Corner. (Scale, $\frac{1}{2}$ in. to 1 ft.) Figs. 5, 6, 7.—Longitudinal Transverse Sections and Plan respectively of Top Right-hand Corner of Back of House. N.B.—Lower Joints at Back are similar, except that Longitudinal Side Stay is square, not sloping. Figs. 8, 9, 10.—Longitudinal Transverse Sections and Plan respectively of Top Right-hand Corner of Front of House. N.B.—Lower Joints are similar, except that Longitudinal Side Stay is square, not sloping. Figs. 11, 12.—Elevation and Plan of Door, showing Fastening Arrangement. Figs. 13, 14.—Bolts for holding Shed together. (Scale of Figs. 5 to 14 inclusive, $1\frac{1}{2}$ in. to 1 ft.)

forming the floor can be nailed down, care being taken that the nails only enter the two longitudinal beams inserted for that purpose, otherwise the house could not be taken to pieces without some trouble.

Commence boarding from the back. The first board will have to be fitted over the bolts, and the last board also, which must stop $\frac{7}{16}$ in. from the front of house. It will thus act as a jamb for the door when closed. Strips of wood $1\frac{1}{4}$ in. wide by $\frac{1}{2}$ in. thick can now be nailed up the two front posts and across the top stay, to act for the same purpose: each end of top strip to be cut out for bolt.

For the roof, cut three beams $1\frac{3}{4}$ in. × 3 in., to drop between the side boarding into the recesses already cut in the top longitudinal scantlings, the tops of same coming flush with the top of sides. The roof boards, $\frac{7}{8}$ in. thick, can now be nailed on, allowing them to overhang the sides and ends $1\frac{3}{4}$ in. Four hard wood catches (seen in Figs. 2, 3, 5, and 6) can now be cut and fastened by wood screws into roof, in such positions that when turned the tongues on same will catch into recesses on side scantlings. When the house is permanently fitted, these screws can be tightened to prevent catches working round and roof being carried off.

Felting should now be nailed on the roof boards, allowing it to hang over the sides and ends, as shown, to prevent the drippings falling on the woodwork. It should now be well tarred, to make it impervious to rain.

The door hardly needs any description, being composed of $\frac{7}{16}$ in. boards, grooved and tongued, and held together by three battens, $\frac{3}{4}$ in. × 4 in. The size and style of hinges are clearly shown in Fig. 2, and the arrangement for fastening door, when closed, to a large scale in Figs. 11, 12, front elevation and plan respectively.

The whole can now be well painted to any colour to suit the builder's taste; a good slate colour will be found serviceable.

The house can be placed in a yard just as it is. If on earth, a brick should be placed under each foot.

BRICKLAYERS' WORK.

BY MUNIO.

Concrete.

Concrete is a mixture of ground lime or Portland cement with broken stones and gravel, and is used to form an artificial foundation on soft ground, or on ground that is not of one uniform hardness.

It was formerly the custom to tip it from a high staging, as it was supposed to be more solid when thus tipped; but it has been found that this system causes all the rougher parts to run to the outside, leaving the finer in the centre, and consequently the material is not so strong. It is now nearly discarded, and the concrete is either run into the trenches, or tipped from as low a level as possible.

In commencing the concreting of foundations, a level platform of 3 in. deals should be laid down; the lime, as it is received from the kilns, is ground in a mill till of the requisite fineness, and must be kept dry after being ground; the stones must be broken to pass through a 2 in. ring, and should be sharp, angular pieces—smooth round pebbles are not suitable; the gravel should have the fine sand screened out of it; a box of suitable size without top or bottom must be provided; this is laid on the platform and filled four times with broken stones, then twice with gravel, and once with ground lime; the whole is then pulled down, and thoroughly mixed together; water is then sprinkled on, and the whole turned over and mixed till it is thoroughly incorporated. Too much water must not be put on, but every part must be wetted; if broken bricks are used, they will take more water than hard stones. It is then wheeled into the trenches, and tipped to the full depth at one operation; when up to the top it is levelled over and well rammed down.

In leaving off for the night, three or four feet are laid in at half the full depth to form an overlapping joining for starting on the next day.

If Portland cement or lias lime be used, they are mixed in the same manner as described; the proportion of broken stones and gravel is varied to suit different circumstances; in some cases a less quantity is used, and in some more—as much as ten to one of lime or cement; but the proportion given will make a fair average concrete which will set in a day or two.

When concrete is laid in a stream or running water, it is mixed dry and filled into bags which are tied up and sunk, the bags preventing the finer parts of the cement from being carried away before it is set.

The system of packing in concrete, which consists of laying large stones in the mass, is not looked on with favour, as although in some cases, if the packing is solidly bedded and evenly distributed, it might be adopted, yet there is such a temptation to put too much in, that its use is now generally forbidden.

When lime is used for concrete, it should be grey stone lime, fresh burnt, and ground as soon as received.

Mortar and Cement.

The mortar used by the bricklayer is composed of one part of grey stone lime to three parts of clean sharp sand; chalk lime is not suitable for building purposes.

As the lime is received from the kilns, it is turned over and sprinkled with as much water as will slake it, and covered up with sand to keep the steam and heat from escaping; when cool, it is mixed with three parts of sand to one of lime, and put through a fine screen or riddle; it is then mixed with water, and turned over and beaten to a proper consistency, or it may be ground in a mill till of the requisite fineness and consistency. The proportion of sand varies with different limes, some not carrying so much as others.

For damp situations, blue lias lime is used; it is mixed in the same manner, but does not carry quite so much sand. Lias lime is obtained principally from Aberthaw in Wales, and Barrow in Leicestershire.

Portland cement is used in damp situations, and where great strength is required. It is manufactured in various parts of this country; it is mixed with three parts of sand to one of cement, generally, although for different purposes the quantity of sand is varied; the less sand that is used, the quicker the cement sets. It should not be mixed in larger quantities than can be used in one day, as it soon stiffens, and when remixed with water is much weaker. Good Portland cement should weigh about 112 lbs. per bushel, and should bear a tensile strain of from three to four hundred pounds per square inch. It is generally tested by a machine, but an approximate test may be made as follows:—Mould a bar of cement, say 2 in. square, and when thoroughly set, suspend it by one end; then fix a box to the other end, and gradually fill it with sand till the bar is broken; the weight of the box and sand, divided by four, will be the breaking-strain per square inch.

Portland cement expands in setting, and this quality should be taken note of in using it.

Roman cement is similar to Portland cement, but sets quicker; it will set in running water; it is not much used now.

Parian, Keen's, and Martin's cements are used by plasterers for skirtings, mouldings, and other inside work.

Drains.

In commencing to lay the drains from a house, the depth of the outlet into the main sewer should first be ascertained, and the trenches cut to a uniform fall; if this plan is not adopted, some parts will have a great fall, while other parts have scarcely any, which soon causes them to be stopped up; the pipes should never have less fall than $\frac{1}{4}$ in. to the foot; the bottom of the trenches should be neatly sloped, and a hole made for the socket of the pipe; the joints should be made with puddled clay, and should be made perfectly watertight; sometimes the joints are made with Portland cement, but where junctions occur it is advisable to use clay, as if a pipe should have to be taken up, if the joints are cemented, the pipes will have to be broken to get them out; whether cement or clay is used, care should be taken that none squeezes through the joint to the inside, or it will cause a stoppage; the inside must be left quite smooth and clear. No drains should be laid under the floors of a house, except there is no other outlet, and they should then be bedded and covered with cement concrete to prevent any possibility of sewer gas escaping, and an inspection chamber, or manhole, should be made outside the house large enough for a man to go down, and work a cleaning brush in case of a stoppage; the manhole should be lined with 9 in. brickwork, and should have a close fitting iron door on the top and a concrete bottom, with at least half a pipe depth formed in it with the concrete.

All branch drains should have properly-made junctions, and no pipe of larger size should run into a smaller. Various forms of drain pipes, junctions, etc., are shown in Figs. 8, 9, 10, and 11; a syphon trap (Fig. 12) should be fixed in the drain between the main sewer and the house, to prevent the sewer gas arising from the main sewer. All waste pipes should be trapped with a trap similar to Fig. 13, and all waste pipes and down pipes should deliver over a gulley trap (Fig. 14), fixed outside the house, and none of them should be connected to the drains. When the drains are laid in soft or wet ground, the pipes should be bedded on bricks or flat stones, and the lower half of the trench filled in with cement concrete, and well rammed down.

Footings.

In commencing to build brick walls, the lowest courses are built wider than the wall which is to come upon them, and are called footings; the courses should not be set back more than $2\frac{1}{2}$ in., as if set back $4\frac{1}{2}$ in., if there should be any settlement, the ends of the bricks are liable to be snapped off, and thus destroy the object of the footings, which is to give a larger bearing surface to the walls. Fig. 15 is a section of footings for a brick and half wall; when a half brick

Fig. 8.

Fig. 11.

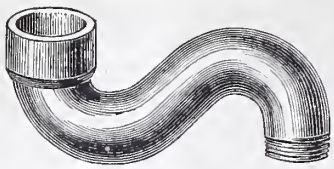


Fig. 13.

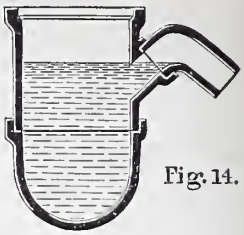


Fig. 14.

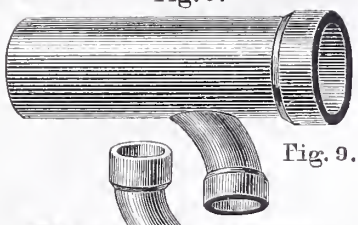


Fig. 9.

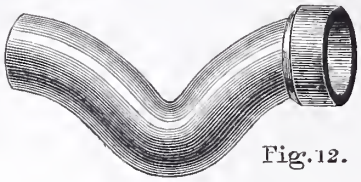


Fig. 12.

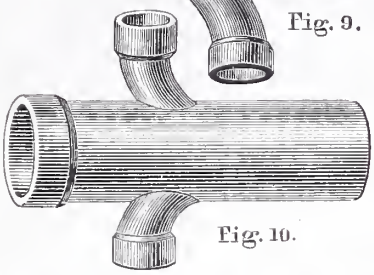


Fig. 10.

Fig. 25.

Fig. 26.

Fig. 27.

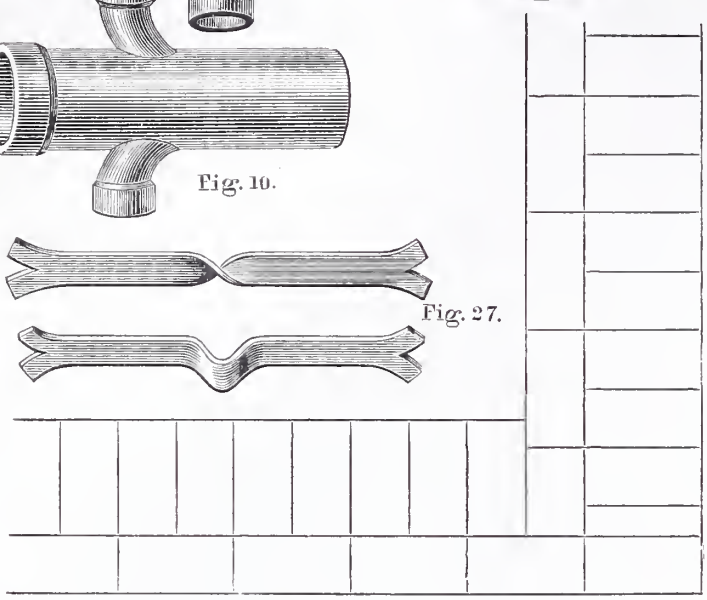


Fig. 17.

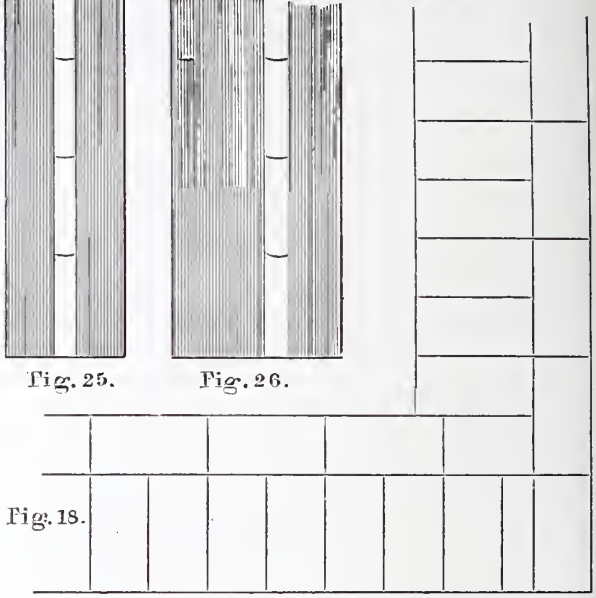


Fig. 18.

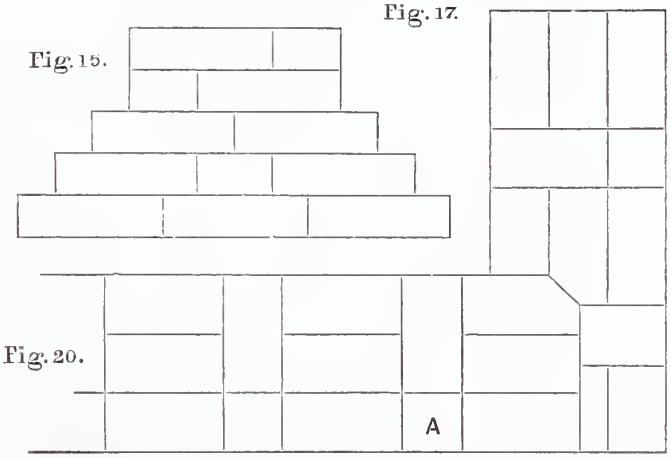


Fig. 15.

Fig. 20.

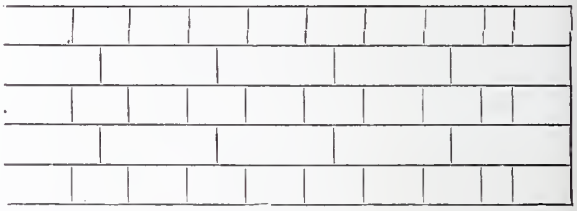


Fig. 16.

Fig. 23.

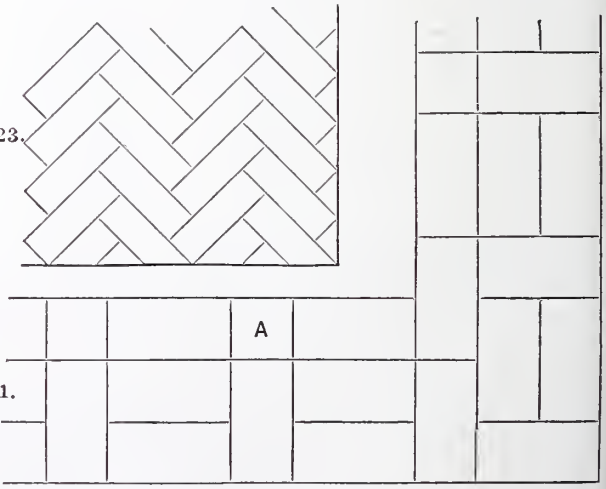


Fig. 21.

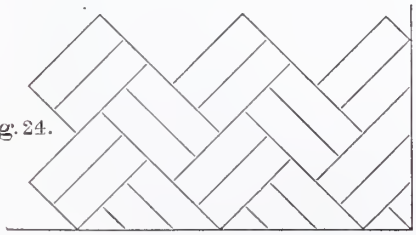


Fig. 24.

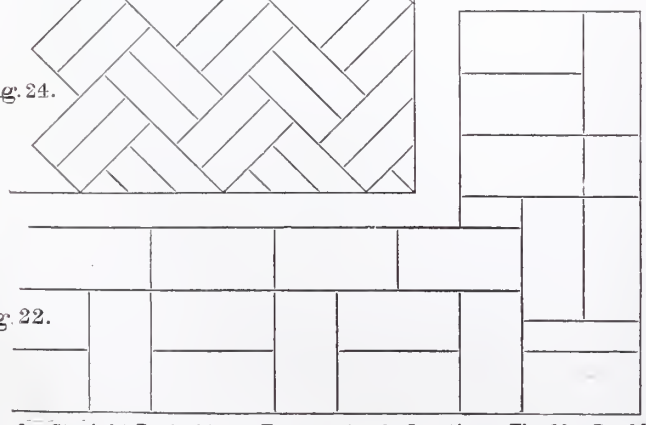


Fig. 22.

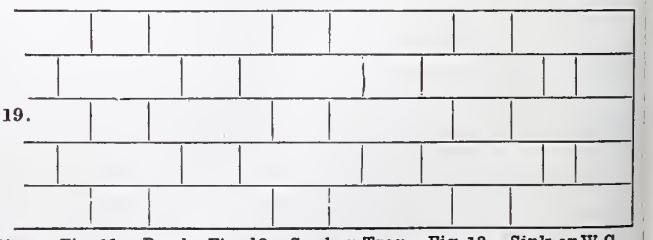


Fig. 19.

Fig. 8.—Straight Drain Pipe. Fig. 9.—Simple Junction. Fig. 10.—Double Junction. Fig. 11.—Bend. Fig. 12.—Syphon Trap. Fig. 13.—Sink or W.C. Trap. Fig. 14.—Gulley Trap. Fig. 15.—Footings. Fig. 16.—Old English Bond; elevation. Figs. 17, 18.—Ditto: sections. Fig. 19.—Flemish Bond: elevation. Figs. 20, 21.—Ditto: sections. Fig. 22.—Ditto, with Old English inside. Fig. 23.—Herring-Bone Bond. Fig. 24.—Double ditto. Figs. 25, 26.—Hollow Walls. Fig. 27.—Wall Ties.

occurs in the footings, it is laid in the centre of the wall. The footings should be at least 9 in. wider than the wall which comes upon them.

Bond of Brickwork.

The bonding of brickwork is one of the most important parts of bricklaying; it consists in laying the bricks in such a manner that the bricks in each course cross or overlap the joints of the course immediately below them not less than 2¼ in. The bricks built with their ends into the walls are called headers, and those built lengthways are called stretchers; the proper method of keeping the bond right is to make all the cross joints run straight through the wall, and to commence the quoins or angles right. The young bricklayer should carefully study the proper method of bonding at first, as a bad method in this, as in anything else, is not easy to unlearn. The two principal bonds used in this country are Old English and Flemish bonds.

Old English Bond.

Old English is considered the strongest bond; it consists of alternate courses of headers and stretchers; Fig. 16 shows the face or elevation of a wall in Old English bond, and Figs. 17 and 18 sections of the joints in two courses of a brick and half wall. It will be observed that each heading course has a quarter-brick inserted at the quoin, and that the cross joints in the wall run right through; every brick, therefore, overlaps the joint of the brick below it by 2¼ in. For a thicker wall, the joints must be set out in the same manner, observing that the bricks are headers at one side of the quoin, and stretchers at the other side.

Flemish Bond.

Flemish bond consists of alternate headers and stretchers in each course; it is generally used for house fronts, but is not so strong as Old English bond; Fig. 19 is an elevation of a wall in Flemish bond, and Figs. 20 and 21 sections of two courses in a brick and half wall faced on both sides. It will be observed that every second course is commenced with a three-quarter brick, and the cross joints are carried through the wall; the cut headers, A A, are called snap headers, and do not break joint with the stretchers immediately under and over them, making three straight joints; the snap headers are laid at each side of the wall alternately to get a better bond; if two three-quarter bricks were used, instead of a whole brick and a half brick, the joint would be covered; Fig. 22 is a section of a brick and half wall, with Flemish bond face and Old English inside; in this case, snap headers occur, which is a source of weakness, and often more snap headers than are really needful are used, the facing bricks being of a superior quality to the inside bricks.

Garden Wall Bond.

This is generally used in walls one brick thick for yard and garden walls; it consists of three stretchers and one header alternately in each course; as the bricks vary in length, and the wall is faced on both sides, it is difficult to get headers all of one length; a smaller number are therefore used. Another kind of garden wall bond, which is not much used except in the north, consists of three or four courses of stretchers to one course of headers.

Heading Bond.

Heading bond consists of headers only in each course; it is generally used for the fire-brick lining of kilns, furnaces, etc., and sometimes in circular work; but for any quantity of circular work the headers and stretchers are moulded to the curve; the stretchers are called compass bricks, and the headers, which are narrower at one end than the other, are called bull heads.

Herring-Bone Bond.

This bond is used for filling in panels and under arched recesses; Fig. 23 is an elevation; the bricks are cut to a small set-square with an angle of 45°, and must be all of one length, the setting being regulated by a larger set square; Fig. 24 shows another form called double herring-bone bond.

Hollow Walls.

Walls are now often built with a 2 or 2½ in. cavity, to keep out the damp; Fig. 25 is a section of a one brick, or rather two half-brick, wall with a 2 in. cavity, making the finished width of wall 11 in.; the two portions of the wall are tied together with iron wall ties (Fig. 27); these should be of wrought iron, galvanised or tarred while hot to keep them from rusting; in building the wall, a lath the width of the cavity with a cord attached to each end is laid on the ties; this prevents the mortar dropping to the bottom of the cavity and filling it up; the lath is drawn up as the next row of ties are reached; the ties are fixed 18 in. apart longitudinally and 2 ft. vertically; the cross joints should be well filled with mortar. Fig. 26 is a section of a brick and half wall with 2½ in. cavity; the 9 in. work is generally built inside to give a better bearing to the floor joists.

CHIP CARVING.

HOW TO SET OUT PATTERNS, AND THE USE OF THE TOOLS.

BY M. E. REEKS,
School of Wood Carving, South Kensington.

Chip carving has now become a popular pastime, especially among ladies; it has many things in its favour: it entails little expenditure either of strength or money, and it can be worked at an ordinary table, making neither noise or mess. I shall devote this paper to the description of the instruments and tools required, and to explaining the best methods of setting out patterns and the manipulation of the tools.

Patience is indispensable to the chip carver, and those who do not already possess it will find the pursuit of chip carving an excellent means of cultivating this desirable virtue.

Here is a list of implements required:—Two pencils, an H H for ruling with, and an H B or even B B for drawing in freehand lines, a straightedge or flat ruler, two set-squares, angles of 45° and 60°—for the benefit of those of my readers who have had no experience of geometrical instruments, I give a sketch of a set-square angle 45° (Fig. 1)—and a good pair of compasses; and here I should like to warn students against buying cheap compasses or cheap boxes of instruments: they cause no end of annoyance and waste of time; you will never regret giving a good sum for compasses. I am convinced that nothing worth having can be bought under 2s. 6d., and I should advise a 3s., 4s., or 5s. pair if the student can afford it. All these things can be purchased at any well-known artists' colourmen, such as Rowney and Co., Winsor and Newton, or Lechertier, Barbe & Co.

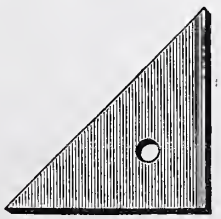


Fig. 1.—Set-square, 45°.

I now come to the tools: two are quite sufficient, although four different ones are sometimes used for the very elaborate patterns; an oil-stone and a strop complete the outfit; these last are for sharpening the tools when they get dulled with use, but at first it is better to have them ready sharpened; they can be obtained at the School of Art Wood Carving, the City and Guilds Technical Institute, Exhibition Road, South Kensington, for 1s. each; the whole outlay will cost about 8s.

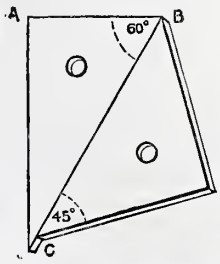


Fig. 2.—Diagram showing Mode of Using Set-squares.

I wish to impress strongly on students the necessity of setting out their patterns very carefully with pencil and compasses before beginning to cut with the tools; those who have learnt geometry, as far as the standard required for the second grade art examination, will have no difficulty in doing this correctly; but a great number of "would-be" chip carvers have never had to do with this kind of drawing, and find the setting out of their patterns the most troublesome part of the work. For their benefit I shall devote a large part of the present paper to the working out of a few simple geometrical problems, which will be found always useful, such as finding the centre of a circle, dividing a line into equal parts, dividing angles into equal parts, constructing an equilateral triangle, and making such figures as pentagons, hexagons, and octagons. And now, before I begin these problems, a word or two about the proper way of using the drawing instruments will not be amiss.

In using the set-squares, the longest sides should be placed against each other, as shown in Fig. 2. By holding them in this position, pressing down one firmly with one hand and sliding the other along its edge, you can draw any number of lines parallel to each other along the side marked A B, whilst lines drawn along A C will be at right angles to the former. By using the set-squares you can avoid the confusion caused by having to draw so many lines, as would be the case if you constructed lines parallel to each other, or at right angles to each other, by the geometrical method. Compasses should be held firmly by one hand only, and the hand should be placed at the top of the instrument, the first and second finger and the thumb being used (as shown in Fig. 3). Enough has now been said about the way of holding the instruments, and the student, after a very short time, will become quite at home with them. We now come to the problems.

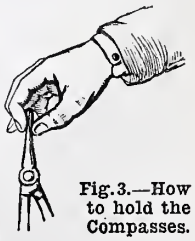


Fig. 3.—How to hold the Compasses.

Problem 1.—How to divide a line into two equal parts, or, to speak more technically, to bisect a given line. We will suppose that A B, Fig. 4, is the given line; from the two points, A and B, at each

extremity of the line you mark off with the compasses two arcs or parts of circles (see Fig. 6): these circles may be any size, but they must be both the same, and also they must be larger than half the line; where these circles cut above and below the line, D and E, are two points; draw a line, connecting these, and it will cut the line, A B, into two equal parts at point C.

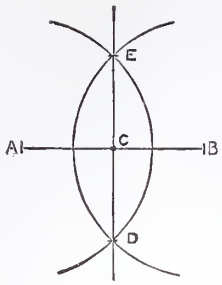


Fig. 4.—Bisection of Straight Line.

Problem 2.—To divide a line of a given length into any number of equal parts. A B is the line, and I will suppose it is to be divided into five equal parts; A B may be any length, from an inch up to any number of feet; it could always be divided in this way: From A or B—it does not signify which—draw a line, A C, at any angle to A B, then mark off along that line, starting from point A, the number of equal parts (five in this case) you wish A B to be divided into. The parts may be any size, but must be equal; join the fifth part to point B, and then with the set-squares (see Fig. 2) draw a series of parallel lines from the other points up to line, A B, and they will divide it into the number of parts required.

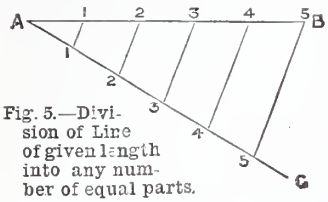


Fig. 5.—Division of Line of given length into any number of equal parts.

Problem 3.—I will now explain the different parts of a circle as far as is necessary for a chip carver. The outside or bounding line is called the circumference (Fig. 6). Any part of this circumference, as from point A to B, is called an arc; if you refer back to Fig. 4 you will see how the term arc is used. A line drawn right across the circle and passing through the centre is known as the diameter (C D, Fig. 6).

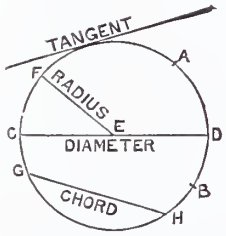


Fig. 6.—Terms used for Lines connected with Circle.

When you speak of a circle of a certain radius, you mean the distance between its centre and its circumference, as F E, Fig. 6, and all lines drawn from its centre to its circumference are called the radii. A line drawn across the circle from one point in the circumference to another, without passing through the centre, is called a chord, and divides the field of the circle into two segments (G H, Fig. 6). When a line or another circle touches the given circle without cutting it, it is said to be tangential to the circle.

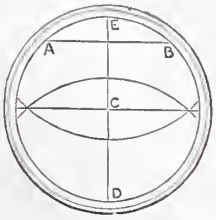


Fig. 7.—Mode of Setting out Table.

I will now suppose the student has to set out a pattern on the top of a round table, and as the table will not have the centre marked, the first thing will be to find it. Draw a line right across the table anywhere (A B, Fig. 7), then bisect it (see Fig. 4) by line, E D. The centre of the circle will fall on this line somewhere, but to find the exact spot, bisect this line, E D, and the centre of this line will be the centre of the circle and table, C; both these lines will be useful, as they form the diameters of the table.

Now I will suppose that we want our table divided into eight parts, and as it is very awkward to deal with the outside edge of the table, we first of all determine the size we wish to make the centre pattern, and describe this smaller circle; for if this is divided, and the lines drawn out to the edge of the table, the whole table will be divided. Bisect angles, A C B, Fig. 8, and D C B in the following manner:—From A and B and D describe four arcs equal in radius to each other; they will cut each other in points 1 and 2; then draw lines through these points and through the centre, continuing them right across the table, which will thus be divided into eight equal parts, making what is known as an octagon. It would be just as easy to divide it into six parts (Fig. 9); it could also be divided into five, though this perhaps is not quite so simple.

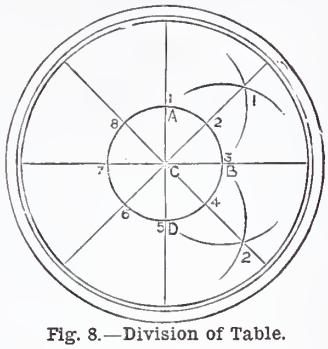


Fig. 8.—Division of Table.

Fig. 9 shows the method used for the division into six equal parts, or hexagonal division; but I have only shown the small centre circle, as the lines have merely to be extended to divide the whole table. From any point on the circumference mark off with the same radius as the circle a series of arcs, cutting the circumference in a series of points, which, if continued all round until you arrive again at the point you started from, will divide the circle into six equal parts.

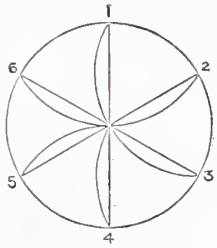


Fig. 9.—Division of Circles into six equal parts.

To divide a circle into five parts, draw one diameter (A B, Fig. 10), and at point A draw a line at right angles to it by the set-squares (as shown in Fig. 2), and make this line equal in length to A B; then (by the method shown in Fig. 5) divide line, A B, into three equal parts, 1, 2, 3; from C draw a line to point 2; this line will cut the circle in D. Mark off the distance, A D, along the circumference, and from these points draw lines to the centre, and these lines will divide the circle into five equal parts.

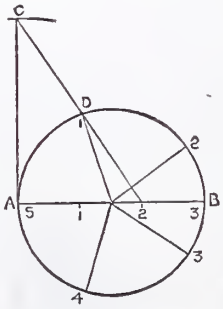


Fig. 10.—Division of Circles into five equal parts.

Triangles play such an important part in chip carving that I shall devote a little space to their description; every single chip that is cut is triangular, though not always equilateral.

To construct an equilateral triangle, after determining the size you wish the side to be—say ½ in., as A B—from the two extremities, A B, describe two arcs with A B as radius; and where these arcs cut each other will be the top or apex of the triangle, and lines drawn from this point to A B will form the two other sides of the figure. The centre of the triangle will always be required, but as the triangles are usually so small, I think it better to judge of this by the eye instead of using the geometrical method of getting it; of course the point we require will be at an exactly equal distance from each of the three sides. Draw lines from A, B, and C to this point, and these lines will divide the triangle into three equal parts; it is these sections of the triangle or pocket that form the little wedge-shaped chips of which chip carving is composed. What I have said about equilateral triangles applies equally to all triangles, except that the other kinds do not have equal sides. When two sides only are equal, the triangle is known as an isosceles, and when neither of these sides are the same length it is a scalene triangle. The only other geometrical figure I need explain is the square, and this is such a well-known one that it will not be difficult to understand. It has four equal sides, and to find its centre we have only to draw two lines, which are called diagonals, from one corner to the other, and here again we find the triangles appearing. I give the geometrical way of constructing a square, as occasionally—though this seldom happens—it is impossible to use the set-squares. Let C D be a given side of a square; from point D or C describe an arc of any radius, cutting C D in 1, then from point 1, with the same radius, cut this arc with another in point 2; from this point again, with any radius, describe another arc cutting the first one in point 3, then from point 3, with the same radius as the last, describe another arc; and where this arc cuts the one made from point 2 will be a point through which a line is drawn from D; this line is then made equal to C D, and forms the second side of the square. From point, B, with C D as radius, describe an arc, and from point, C, with the same radius, another, cutting it in point, A; lines drawn from B to A and from C to A form the other two sides, and complete the square, of which A D and B C are the diagonals.

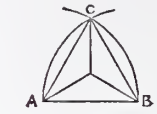


Fig. 11.—Construction of Equilateral Triangle. (Sides, ½ in.)

Fig. 12.—Isosceles Triangle.

Fig. 13.—Scalene Triangle.

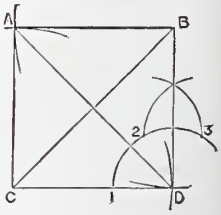


Fig. 14.—Construction of Square.

I have now finished all that it is necessary to say about the setting out the single geometrical figures, which, when combined, form the immense variety of patterns open to the chip carver, and will turn my

attention to the tools and their manipulation. Two tools are sufficient for all patterns with only straight lines, and by clever hands even the slightly-curved ones can be managed with the chisel; but if the student can afford one more, I should advise what is known as a flat $\frac{3}{16}$ths of an inch in width: it is very like the chisel, but is only sharpened on one side, and very slightly curved.

The chisel and this other tool are used in the same way, except that the chisel is for straight lines and the gouge for curved ones. The best kind of tool is a "spade" or "fish-tail," $\frac{1}{4}$ in. across the top. Then we have a tool known as a "veiner": it is a very small gouge, and if held quite upright the mark it makes is thus U. The tools must be very sharp and ground thin, so that they may glide easily under the chip they are cutting, and leave no scratch on the surface below the chip.

Fig. 15.—Spade or Fish-tail.

The "spade" tools are used in the formation of the "pockets," and the "veiner" for marking in the outlines of the pattern, and also sometimes making what are known as notches or "nicks," which I will explain later on, although these are generally made with the chisel. It is always advisable to mark the pattern in with the veiner before beginning the pockets, as the pencil very soon gets rubbed off. The student will find the veiner difficult to use at first, especially along the curved lines; it must be held firmly in the right hand, and pushed gently along, whilst the fingers of the left hand are kept on the blade very near the point, guiding it in the desired direction. Do not let the tool slip through these fingers, but move them with the tool; keep your eye not on the tool but on the line you are about to cut, a little in front of the tool, as you will find your hands will follow the eye. Always use both hands, as shown in Fig. 16, or you will not have any control over the tool, and grasp it firmly without pressing too heavily; do not hold it in a very upright position: let it first just "bite" the wood, and then draw it up until you have it at about an angle of 20° to the surface on which you are cutting.

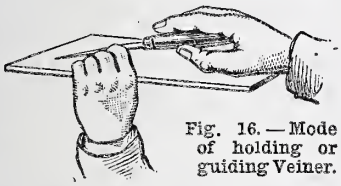


Fig. 16.—Mode of holding or guiding Veiner.

The veiner, as I said before, has another and very simple use, best shown by a diagram (Fig. 17). This is composed of four scalene triangles cut with the chisel; the square in the centre is left solid and the nicks cut with the veiner.

Fig. 17.—Simple Diagram exemplifying use of Tools.

I will now explain how the spade tool is used. It has two kinds of cuts—firstly, when it is held vertically, in cutting the triangular pockets, as they have to be deeper in the centre, you must press harder on one side than the other; thus in Fig. 18 I show a pocket veined round, then with the chisel cut lines 1, 2, and 3, pressing more heavily on the side which is near the centre of the triangle. After making these vertical cuts, we come to the use of the tool in its second position (Fig. 19). Begin at point, Y, then push the tool in a slanting direction from Y to W, until the corner of the tool at X reaches point 2, where the cut will be stopped by the vertical cut which was made from W to Z; repeat this process from all the corners, and the result will be three clear triangular chips in the shape of a wedge (Fig. 20), that is to say, thick at one corner and thin on the opposite side. Great care must be taken to slant the tool sufficiently, or else the three wedges (Z W Y, Z W V, and V W Y) will not meet perfectly in their centre point, W, and the chips will not come out. The student must also be very careful to keep the tool on the boundary lines of the pocket (Y Z, Z V, and V Y), and not allow it to cut beyond them; veining them first greatly assists in guiding the spade along the edge of the triangle and keeping it in place.

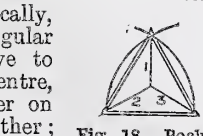


Fig. 18.—Pocket Veined round.

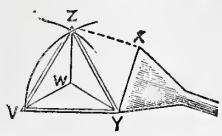


Fig. 19.—Mode of cutting Spade or Fish-tail.

Fig. 20.—Triangular Incision in Surface.

I have now completed all I have to say about the tools, and hope in my next paper to give some designs for the decoration of small objects, with a short description of them.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

INTERNAL FITTINGS FOR HIVES—FRAMES—FRAME BLOCK—DISTANCE RACK—DISTANCE PINS—METAL ENDS—REVERSIBLE FRAMES—SECTION FRAMES—QUEEN EXCLUDER.

OF the internal fittings for our hives, the first in order and in importance are the frames. For a long time after the introduction of movable comb hives there was no standard size of frame. Every beemaster did what was right in his own eyes, and, as a consequence, there were almost as many sizes of frames and hives as there were manufacturers of such articles. Now, however, the British Bee Keepers' Association has fixed the standard frame as I gave it before—viz., external dimensions, 14 in. by $8\frac{1}{2}$ in., with top bar 17 in. long.

As we shall require a considerable number of frames which we must have exactly of the proper dimensions, and perfectly square, it would repay us well to make a block upon which they can be nailed together; in fact, I may say that such a block is a necessity. I give a drawing of mine in Fig. 1. It is not very difficult to make, although it appears rather complicated in the figure.

For the back, take a piece of pine about 20 in. long and exactly $8\frac{1}{2}$ in. wide, being parallel, and the edges planed square and true. The thickness is immaterial, but three quarters of an inch would suit admirably. Find the centre of one of the long sides and measure from that seven inches in both directions. Thus we shall have two points fourteen inches apart and equidistant from the ends of the board. With a square and sharp chisel scribe two lines across the board from these points, and two other lines an inch and a half nearer the ends. Be careful that the inner lines are not farther apart than fourteen inches; if anything, let them be a shade less. If the wood is not very hard, the chisel, when held nearly vertical, and pressed down hard while being drawn along, will sink a little distance into it. The space between the cuts at the ends should be chiselled out to the depth of an eighth of an inch.

Two pieces of wood, each $7\frac{3}{8}$ in. long, $1\frac{1}{2}$ in. wide, and a little more than 1 in. thick, should now be prepared and fitted into the spaces thus cut out. They occupy a position just in the middle of the width of the board, being nine-sixteenths of an inch from either edge.

If all has been well done, these pieces will be 14 in. apart inside, 17 in. outside, and stand $\frac{7}{8}$ in. from the board. They should be screwed and glued in that position. If a piece of $\frac{3}{4}$ in. stuff, 3 in. wide, be nailed to one edge of the board, it will act as a foot, upon which the whole apparatus will stand firmly. Frames could be nailed together by the help of this block in its present condition, but we would require a couple of hands to hold the sides of the frames against the inner surfaces of the stand-out pieces while the top bar is being nailed on. This is not always convenient, and so we must devise a more convenient method. This is not difficult. Two pieces of wood, each $7\frac{3}{8}$ in. by 6 in. by $\frac{7}{8}$ in., are planed flat and smooth, and three mortises are cut through each. These may be $\frac{1}{2}$ in. long, $\frac{1}{4}$ in. wide, and in approximately the positions shown. These pieces, which we may call the jambing blocks, are fastened to the back by means of six round-headed screws with washers, as shown. In the diagram I leave out one of the screws to show the nature of the mortise in which they work. The best way to fix the positions of the screws is to put a couple of frame ends in position as if for nailing together, push the jambing blocks against them, and insert the screws nearly in the centres of their mortises. A hole should be made in the middle of the back so that a wedge can be pushed through to force the blocks apart and against the frame ends. I put a couple of loops of elastic between them, so as to pull them together and release the frame when the wedge is withdrawn. The elastic loops are upon little screws placed near the inner edges of the blocks. A strip of wood nailed against the outer surface of one of the fixed pieces acts as a stop, against which the top bars of the frames can be pushed when nailing them together.

It is scarcely necessary for me to explain how this is used. One of the lower bars of the frames is laid on the foot and pressed into the back, then a couple of ends are laid in position standing on the lower bar, the wedge is inserted, and holds the ends tightly. A top bar is laid on the tops of the end bars, which will be found to project slightly, and its position regulated by the stop at one end, glue is applied, and two 1 in. or $1\frac{1}{4}$ in. sprigs, or joiners' brads, are driven down through the top bar into each end, the wedge is withdrawn, the jambing blocks come together owing to the elastic bands, and the frame is loose. The same is done to the next, until all are finished to that extent. The bar, which has all this time been resting on the foot, is then removed, and, the frame being again inserted reversed, the lower bars are nailed on in a similar manner. The peculiar construction of the block will draw our attention to any defect in the various parts of the frames. If perfect, the sides and top bars will be on a level with the jambing blocks of the apparatus, and the top bar will be just flush with the upper edge of the back.

In length it will reach from the stop at one end to the outer surface of the fixed piece at the other. It would be good policy to attach the wedge to the block with a bit of twine, or it would probably be lost.

It is wonderful how quickly and accurately frames can be nailed together by means of this simple affair. Without it, I would very much fear to attack a gross of frames and guarantee their interchangeability.

But I will return to the preparation of the wood for the frames. Here a circular saw may be considered an absolute necessity, and I will take for granted that one is provided.

I have an excellent one for this work, which I hope to describe before these papers are concluded, and thus give my readers an opportunity of following my example in making one.

Yellow pine is the wood usually recommended for making frames. My procedure is to get inch stuff and plane it smooth on both sides, when it will usually turn out to be seven-eighths. Then I cut off 17 in. lengths for the top bars, and twice as many $7\frac{3}{4}$ in. lengths for the sides. The lower bars are of $\frac{1}{2}$ in. stuff, and 14 in. long. When sawn, I touch up the ends with the trying-plane and shooting-board to reduce them exactly to gauge. I set the saw then to cut $\frac{1}{2}$ in. exactly, and run the 17 in. pieces through, taking off as many as I can, and running the last one through to reduce it to the proper thickness. For the sides the saw is set to three-eighths, and for the lower bars to a quarter. I do not plane after the saw, because it makes them very smooth. I simply remove any ragged edges which may remain. It is important in sawing to hold the wood firmly against the guide, else the cut may be crooked. If this happens, shoot the edge of what remains, or turn it over and saw from the true edge.

If the foundation is to be fixed in a saw-cut, this must be made before the frames are put together. It is about 13 in. long, and can easily be made with the circular saw. A gauge which shows where to begin and cease cutting can be easily attached to the saw-table. Of course, the saw-cut will be in the centre of the bar.

One other thing remains, and that is to make the ends of the top bars V-shaped, to prevent propolising. A little gauge can easily be made for this purpose, like Fig. 2, and a sharp, thinly ground chisel will do the rest.

Sundry and divers methods have been used for keeping the frames the correct distance apart. Some bee-masters employ the ever ready rule of thumb, but, although it acts well with an experienced hand to guide it, I would not recommend it to a beginner. A rack (Fig. 3) is sometimes used, but is not recommended. The spaces are $\frac{7}{8}$ in. wide and the dividers $\frac{5}{8}$ in. slack, both together amounting to $1\frac{9}{20}$ in. Some people simply drive a wire nail into each end of the frame, others a bell staple or screw, but I prefer the little screwed eyes which are sometimes used to hang pictures with. I show one in Fig. 4. A gauge wherewith to judge the proper depth to put in the screw can be easily made like Fig. 5. A piece of wood is nailed upright on another, and a nail driven in at the correct height. Lay the frame on its side, and if the staple passes under the nail, just grazing it, it is right; if not, it must be driven in further, or drawn out until perfect.

When the frame hangs in its natural position, I always put the eye or staple in the right-hand edge at the near end, the far end having it at the left-hand side. This, I believe, is the usual plan, but some of Mr. Abbott's broad-shouldered frames are fashioned like Fig. 6, and so could not well be used with frames of the staple type, unless four staples were used in the latter, which would be waste.

I ought not to neglect mentioning metal ends for frames, although I never use them myself. Fig. 7 shows Dr. Pine's metal ends,

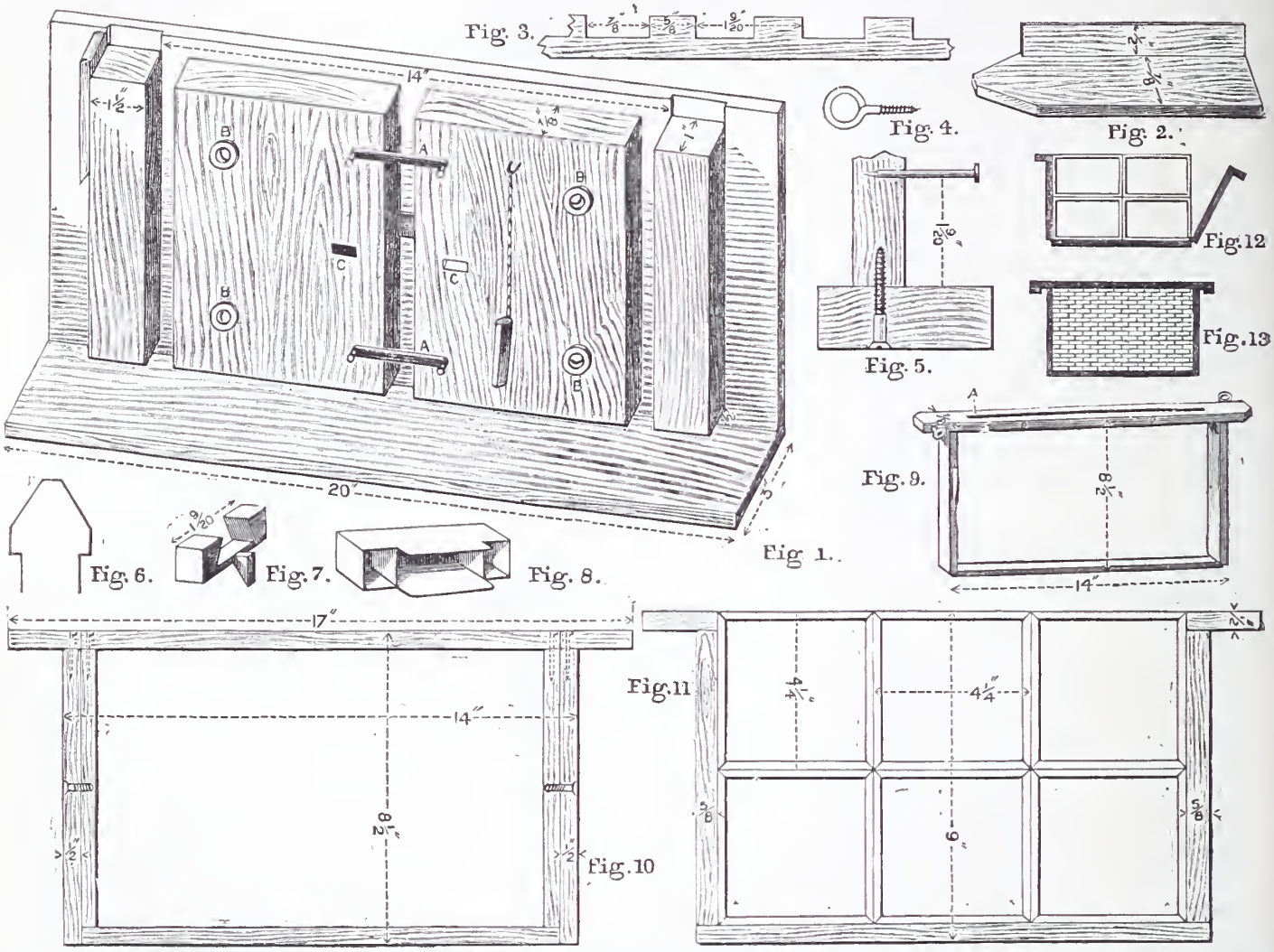


Fig. 1.—Block as Appliance for nailing Frames together. Fig. 2.—Gauge for Ends of Top Bars. Fig. 3.—Distance Rack. Fig. 4.—Screwed Eye. Fig. 5.—Gauge to measure Width of Frame End and Eye. Fig. 6.—End of Abbott's Broad-shouldered Frame. Fig. 7.—Dr. Pine's Metal End. Fig. 8.—Carr's Metal End. Fig. 9.—Frame complete. Fig. 10.—Reversible Frame. Fig. 11.—Section Frame for $4\frac{1}{4}$ in. by $4\frac{1}{4}$ in. Sections. Fig. 12.—Section Frame with Hinged Sides. Fig. 13.—Queen Excluder.

and Fig. 8, Carr's. Both fit on the projecting end of the top bar, which must be cut to fit them. I give in Fig. 9 a view of frame complete and ready for the foundation. This is inserted in the saw-cut made in the top bar by thinning it slightly at the upper edge, opening the slit with a wedge, and inserting the foundation, which is held in place with a couple of screws. Some people run a little saw-cut from one side of the bar to the slit in the middle of the frame top, but I manage to put the foundation into place without doing this, which must weaken the frame. A good deal depends, however, upon the width of the saw kerf. If it is narrow, the frame must almost of necessity be opened at one end, but mine is wide enough to embrace the foundation with very little trouble.

If any of my readers wish to experiment with reversible frames, they can easily be made as shown in Fig. 10. The inner, which holds the comb, is 8½ in. by 13 in. Then two L-shaped pieces are made of ½ in. stuff and fastened to the centre of the frame with a couple of wood screws, which act as pivots. The frame then takes the place of the ordinary kind, but it can be reversed by turning the end pieces half a turn on the pivot. The line of juncture should be very close, or the bees will propolise the two together in such a way as to make it practically a fixture.

I may here mention that propolis is a glutinous material with which the bees fill up every crevice in the hive. If any space is much less than a quarter of an inch, they will fill it up with this gluten, and if it is much greater, they will build combs in it, hence the necessity of having all hives and their belongings made accurately. If, for instance, a frame is not square, it may touch the brood-nest at one corner and be half an inch from it at the opposite one. The bees will stick them together at one corner and build the comb at the other side, so that the frame will be practically fixed to the hive. If they can be separated, it will be only with the greatest difficulty, perhaps at the sacrifice of the frame, certainly with the loss of a good deal of bee life and human temper. Therefore, in everything be accurate and square.

As there is a block upon which to build the frames, so also one can be made easily to gauge the inside of the hive with. It may be a piece of pine, 14½ in. long, 8½ in. wide, and, say, 1 in. thick. It should be made as true as plane and square can accomplish, as it will be the standard by which to judge of the truth of our work. To test a hive, slip this into the brood-nest, standing it on the floor board on one of its long edges. The strips upon which the frames rest should then be flush with its upper surface, and the hive should be exactly as wide as the gauge is long. If the hive will not stand this test, smash it up, or use it to hold old combs, but don't put bees to work in it.

It is sometimes desirable to start sections in the brood-nest, and for this purpose a section frame is necessary. This is simply a frame consisting of three sides made of 2 in. stuff (Fig. 11). The sections being 4¼ in. square, three of them will be 12¾ in. long. The sides of the section frame must, therefore, be of ⅝ in. stuff to have the external length 14 in. The top pieces for supporting it will be ½ in. thick, to bring it to a level with the other frames. The lower bar must be ½ in. thick, and will touch the floor board. The entire structure should be nailed and glued very firmly together, as it will be subjected to considerable strain.

Fig. 12 shows a section frame slightly different. It holds four sections of a larger size, and the sides are hinged to the bottom bar to make the removal of the sections easier. Any of these section frames would be placed at the back of the brood-nest, and the queen is sometimes prevented from laying in them by putting a sheet of excluder zinc between them and the brood frames. Fig. 13 shows such an excluder. The zinc must be bought, as the holes have to be punched very accurately. As the object is to allow the workers as free access as possible while excluding her majesty, the zinc should not be covered with an unnecessarily wide frame of wood. Sometimes I put merely a bead of tin round it, to give it rigidity, slipping it into an ordinary top bar at one edge; but, when I use wood, it is of the very lightest description, merely a half-inch strip with a saw-cut run half through it, in which the zinc fits. We must remember that the queen might creep round the end of the top bar, and so we attach a little block to it to stop her passage, as shown in Fig. 13.

I have now described most of the requirements for the brood-nest, and I will postpone the section racks to the next paper.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

MODELLING IN RELIEF.

WORKING FROM THE ANTIQUE — PREPARING GROUNDS—COPYING IN RELIEF ON A LARGE SCALE — MODELLED ORNAMENT ON CURVED SURFACES — REDUCED RELIEFS OF STATUES AND GROUPS—MODELLING FROM THE FLAT.

SCULPTORS are accustomed to speak of their works as belonging to two great classes—those in the "Round" and those in "Relief." The Round includes all sculpture which is not attached to a background—such as busts, etc.; whilst whatever is attached to a background, however slightly, is included under the head of Relief. Again, they speak of Reliefs as of three kinds—Low-Relief (sometimes called Bas-Relief), in which the work lies flatly upon the background, and has no under-cutting; Middle-Relief, in which the work is somewhat more raised, and in which an amount of under-cutting occurs; and High-Relief, in which the figures, etc., stand out so boldly from the background as to be frequently almost detached from it.

Works in the round demand most skill and care, and for this reason—they are intended to be looked at from every side, and ought therefore to appear satisfactory from whatever point of view the spectator may choose to take; whereas a work in relief is supposed to be looked at from one point of view only—namely, from the front. The merely mechanical difficulties of making a figure in the round are also much greater than those of making a work in relief. Hence those who are learning modelling usually work far more in relief than in the round. It will be well, therefore, that we should now see how the modeller sets about a study in relief.

We will presume that he has procured a cast of the bust of that well-known statue the Apollo Belvedere. This will afford excellent practice, as the modelling in it is large and grand, and it has so much beauty and expression as cannot fail to make it interesting. It is, of course, in the round, but we are going to see how a study in relief can be made from it. Ours will be a profile view, of the size of the original, but in somewhat low relief.

This head is about 12 in. high and 10 in. across, so that, allowing for a portion of the bust which it will be desirable to show, our background must not be less than 24 in. by 18 in. The best background is a slab of clay, which must be formed either on board or slate. Slate has its advantages, inasmuch that it does not warp; but it is heavy, and, besides, the clay model is less easily secured to it, and, should it get too dry, may be liable to slip off. A modelling board is, therefore, more commonly used. It will need cross-clamping or ledgers to keep it from warping, and a projection along the bottom in front, to support the clay. Fig. 13 shows a modelling board in section. Such a board stands better if the screws which fasten on the ledgers are driven through slots rather than round holes, so as to allow of free swelling and shrinking of the wood.

Fig. 13.—Modelling Board for Reliefs.

Such a board may be used on a modelling stool like Fig. 2 (p. 122, Vol. II.), or on an ordinary easel of moderate strength. For the present purpose a slab of clay about an inch thick will be desirable. Before spreading it, the board should be damped with a sponge, otherwise the clay will not stick well. Even in so simple a business as making a slab the clay should be laid on properly, and no air-holes left, otherwise the surface will by-and-by become uneven. This will also be the case if the clay forming it is not well tempered but is softer in some parts than others. When enough clay has been laid on, it is smoothed with a modeller's straightedge. One made of boxwood, about 12 in. long by 2 in. broad, and toothed in the same manner as the roughing-out tools, would be useful for this and similar purposes. A slab to be pleasant to work upon should always have a toothed face. The slab is then left uncovered for some twenty-four hours, that it may set, when it will need again working over with the straightedge, and making perfectly level and true.

The modeller can now draw in the outline of his relief. For doing this he will probably use such a tool as the rounded end of Fig. 8, (p. 124, Vol. II.). With this he can draw upon his clay slab as he would with a stick of charcoal on paper, any false stroke being obliterated by finger or tool; and he should take care to make his outline correct in all essentials, as this will save much future labour.

Within the outline he now begins to lay on his clay in larger or smaller pieces, according to the bulk required in any particular part, and works it down with his thumbs as he goes on. He will have determined somewhere about how far his relief is to project. In this case it might be about two inches, and, in building up, he will take care to keep his highest parts somewhat lower than this, for they are sure to grow higher as the work goes on. All forms are to be represented as much more flat than they are in the cast, and some attention will be necessary to give to each its proper relative amount of projection. An

unpractised eye is often deceived on this point, and it will be found necessary frequently to look at the cast at right angles to the point of sight, and to use a plummet. In roughing-out, the desirability already alluded to—of sketching mainly in right lines and angles—will be borne in mind. The different slightly-rounded surfaces will be represented by planes, and much attention will be given to making all these planes "move" at such inclinations as are relatively correct.

By looking well to these matters in the earlier stages, much future labour, and many after alterations and corrections which involve the destruction of elaborate work, may be avoided.

Everything at present is kept large and broad, and no attempt made to represent details which detract from breadth—such, for instance, as eyelids; but by judiciously indicating the main features in their correct positions, much general resemblance to the cast may be attained. It is this sketching out of a model which chiefly demands the worker's energies, his powers of perception, his judgment, and his dextrous handling of the plastic material. The after-work of finishing he may take far more easily.

An important matter in this, and indeed in all modelling, is the light in which the work is done. It should fall from the same direction upon both cast and model. Some sculptors' studios have sky-lights. Under the light so thrown forms are strongly brought out, but the work done in it does not look so well when taken, as it generally must be, into a less forcing light. Perhaps the best light is one which falls obliquely from above at an angle of about 45°, and the most approved arrangement for studios is the high window above the level of the head and looking towards the north. The north aspect is desirable as admitting no sunshine. A strong gas-light is even better than daylight for modelling from the cast, since it throws more decided shadows.

As the relief advances, the worker will find that his clay background has various advantages over one of plaster or bare slate. Reliefs of moderate size like the present are best laid flat when work is over and they have to be damped for the night, and with the slab most of the skewers which support the wet cloths can be stuck into it rather than into the work; besides, by adding considerably to the bulk of clay, it allows the figure to be kept in a more regular state of moisture than would otherwise be possible. These are merely practical advantages, but there are others which are purely artistic, though these are less apparent in a tolerably bold relief like the present than in one of greater delicacy. One of these is the more tender outline of which this ground admits. A hard continuous outline has a crude effect in low relief, and a clay background allows it to be softened and almost blended with the slab in parts, which could not be done were the ground of another and a hard material.

Again, much labour may be saved at times, when the ground is of clay, by sinking it a little so as to bring in some receding form. Moreover, in very delicate work the parts are less likely to be brought into proper harmony when the eye is disturbed by difference of colour in figures and background.

Other conditions regulate the modelling of mere ornament in low relief. It is in perhaps the majority of cases necessary that this should be upon a curved ground; and to keep such a ground true through the operations of modelling may be a difficult matter if it is in so yielding a material as clay. Often therefore in ornamental work it is better to model the ground roughly in clay, to cast it in plaster, and in that material to bring it to its proper form and level. In the case of a curved surface this is more readily done in the firmer material than in the clay. Then to model the ornament on it in clay; and for ornament the outline will rarely be too firm or decided. But it must be remembered that the adhesion between clay and plaster is not strong, and that the former is likely to peel from the latter if care is not taken to keep the work regularly damped.

But to return to our Apollo. The broad flesh surfaces which this figure offers will give admirable practice for finishing with the thumb, though, of course, the outline and more intricate parts of the features will need tools. The hair will be all tool-work. In working from nature, hair is a difficult thing to treat; but here, as in the antique generally, it is conventional and simple. A little drapery is thrown across the bust; and in finishing this, a flat wire tool, such as Fig. 12 (page 124, Vol. II.), will be found most serviceable.

For further practice in relief, whole antique figures or groups of figures, modelled to perhaps a third of their original size, are usual subjects. Of these, single figures in high relief are the most easy, and groups in quite low relief demand the most skill. In choosing a view of any statue or group for this purpose, some judgment is needed; it should be one in which the lines compose gracefully; and if they can be to a great extent in one plane, so much the better. It is not well to have a leg or arm sticking straight out towards the spectator; it is difficult to foreshorten such limbs, and they always look awkward.

After all care taken in sketching, it will sometimes be found, as a work of this kind progresses, that an arm, a leg, or a head is not just in the right place. It is far easier to correct such an error in modelling than in drawing. All that has to be done is to cut the part from the background with a wire or string, and move it to its proper position. Or the part may have been modelled in a relief relatively too high or too low; if the latter, it is easy to detach it from the ground with the wire, and by putting clay under it to raise it to its proper height; if the former, a slice can be cut from under it, and the relief thus lowered as required. These are some of the many facilities which clay gives for alterations and experiments, and which tend to render it the most delightful of all materials in which to work.

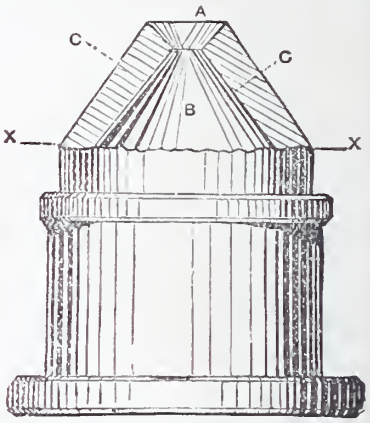
Another variety of work in relief, but one which it is better not to attempt till some experience of actual form has been gained by working from the round, is what is known as modelling from the flat. This means working from drawings, engravings, etc.—and highly interesting work it is. Designs appearing in a new form of art and a new material have something of the value of original works, and may be capable of application to various purposes.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

24.—EADE'S PATENT CONVERGING WATER JETS.

IN sprinkling water over plants, it is always desirable to break the water into as fine a spray as possible, and to throw it as far as may be practicable; and to obtain a really good and efficient water jet by which a fine spray can be sent to a greater distance than can be covered by water issuing from an ordinary rose-jet has always been a desideratum among nursery-men, gardeners, hop-growers, and all others who at times find it necessary to syringe, and thereby diffuse a spray over trees, plants, vines, flowers, etc., whether housed under glass or in the open air. To do this thoroughly and effectively, it is necessary to break up the water before it leaves the nozzle of the jet, and this has been managed by Mr. A. J. Eade, Bridge Iron Works, Edenbridge, Kent, by means of his new Patent Converging Water Jet, a section of which is given in the accompanying illustration on a somewhat larger scale than even the largest size in which the jets are made. From this it will be seen that the nozzle of the jet beyond the line, X X, although it appears to be a single cone, is, in reality, a double cone—namely, the internal cone, B, and the external cone, A, which meet in a small orifice that forms the outlet for the water as it is forced through the jet. In the surface of the internal



Eade's Patent Converging Water Jet.

cone, B, at the points indicated in the illustration by the dotted lines, C C, two deep grooves are cut on each side, which meet at the orifice in the form of two V's placed front to front, thus > <. As the water passes through the nozzle, it is split up by the grooves into separate jets, which converge towards the outlet, where they meet, the impact of the particles breaking up the water and causing it to be diffused in a soft divergent spray as it passes outwards through the smaller external cylinder, A. The jets, which are of brass, are in no way liable to be choked by any small particles of rubbish, weeds, etc., which may find their way to the orifice; and the construction, as will have been understood from the description given, is so simple, being without any loose parts in the shape of separate striking plates or guides, that it is utterly impossible for them to get out of order. The jets are screwed to fit three sizes of pipes—namely, ¼ in., ⅜ in., and ½ in., and they may be also had with tap complete for binding in hose. Jets of two different degrees of power are manufactured, distinguished as No. 1 and No. 2. Of these, the first throws the spray to a distance of 10 ft., and the second to a distance of 20 ft., and even more. Jets screwed to fit ¼ in. pipe are supplied at 1s. 3d. each; the larger sizes, which are admirably adapted for the purpose of hop-washing, screwed to fit ⅜ in. and ½ in. pipes, are supplied respectively at 1s. 6d. and 1s. 9d. each. Taps for binding to hose to fit jets screwed for ¼ in. pipe are supplied, suitable for ½ in. hose, at 2s. 9d.; for ⅝ in. hose at 3s.; and for ¾ in. hose at 3s. 3d. A single trial of a jet will be sufficient to show that they only require to be known to be appreciated. THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Band Saw Brazing.—A. R. (*Scorrier*) writes:—"On page 19, Vol. II., of Work, an article is written on the above, and as I have written more than once on the subject, the remarks by one who has done it incite me to pen the following. I often file and bevel the length of two teeth as described on page 19, Fig. 2, but the better way is to file the ends of saw as in the annexed sketch, Fig. 1, as it will make a stronger joint than if the end of braze is at the gullet of teeth. Again, when I commenced some years ago to braze band saws, I used to do as the writer of the article on page 19, that is, make the borax to a paste, and put it between and on top and underneath the joint, but have done away with that way of working long since, as I found the better way is to beat the borax to a powder and mix the spelter with it, damping only the ends of the saw; then take a

Fig. 1.

Fig. 2.

Band Saw Brazing. Fig. 1.—Ends of Broken Saw filed for Brazing. Fig. 2.—The Saw when Ends have been Brazed.

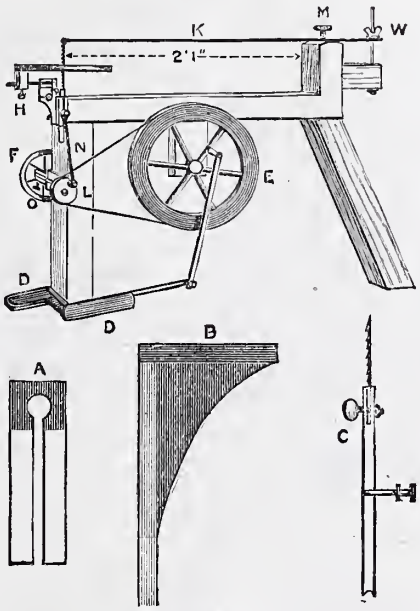
little of the same and put between the ends where they lap; there will be none needed on top or underneath the joint. I will give my reasons for this. A practical man may get on all right, but a beginner is likely to get trouble. The hot tongs being closed on the joint the spelter begins to run, and the young hand, to make sure that the spelter has well run, keeps the tongs on a little longer than is necessary. When he tries to slip it off he finds it fast to the saw, and is liable to spoil his joint. Not only so, the spelter gets on the tongs, which should be kept as clean as possible, which is essential in making a good joint. I always keep an old file near by when brazing to clean off the jaws of tongs before applying to the saw. Again, if only a pair of tongs were used, it would not only take longer to make the joint, but if spelter was put on the top and underneath the saw, and the tongs kept on until the spelter gets solid, I am of an opinion that it would be quite a job to separate the saw from the tongs. Fig. 2 is braze completed. I think the above remarks, with those I have given in former numbers, have made band saw brazing quite clear."

Tempering Brass Wire and Case-Hardening.—J. C. K. (*London, N.W.*) writes:—"It is very kind of some of your correspondents to reply to queries, and shows the good heart and honest impulse, but respondents should reflect that if they answer vaguely where exact information is needed, they waste their own time and the time of perhaps fifty tyros, who take advantage of replies to try them. I have noticed this in too many instances, that I feel constrained to point out one, as an illustration of carelessness in answering a simple question or two, in No. 57. To say 'Tempering brass wire is imparted by drawing' is misleading; perhaps brass wire has to be tempered without drawing. Where is the value of such an answer? The whole view of the matter must be taken. If not to be drawn, the wire must be made red hot and plunged into cold water, which makes brittle wire soft, and unless soft it cannot be properly drawn, which really makes it denser. J. says, 'To case-harden iron, put it in a pot enclosed and covered over with a quantity of nitrogenous matter.' This reads as if the pot was covered over with it. Again, 'The deeper the case-hardening the more liable is the forging to become warped,' as if the case-hardening warped the iron, whereas that results from prolonged heat altering the molecular structure of the iron. Again he says, 'For mere surface case-hardening, heat the iron and roll it in powdered yellow prussiate of potash.' No mention is made of chilling in water."

Jointing Boards.—A. G. (*Newcastle-on-Tyne*) writes:—"In jointing boards with a plain square joint for gluing, after the boards have been dressed and tried up, put a mark on—what is termed a face mark—so that when you shoot your joint you keep one mark next to you and the other from you; for this reason it is impossible to hold the plane at right angles, so by reversing the board your joint comes truer and even and much quicker, because you don't want to put a square to it."

Chords for Organette.—G. A. D. (*Stratford New Town*) writes:—"There is no rule that is of use in this matter. If correspondents refer to the rules in any book on harmony and counterpoint, it will be found that making the instrument is much easier than 'dropping in chords,' or 'enriching the subject;' my advice is learn music, which would enable correspondents to arrange their organette music from the composer's own copy, something better than a mere 'hum-strum' accompaniment. If, however, applicants have a knowledge of music, and wish to condense it to suit the organette, I am willing to assist them if they care to send me a few bars of music together with the compass of their instrument. One applicant had a list of chords in C; if he sends it (through Work) I will set them to a melody and explain to the best of my ability."

A Simple Fret Saw.—Artist in Wood sends the following description of a simple fret saw useful for light frets and marquetry work:—E, heavy driving wheel about forty-five lb.; F, small fly; E wheel twenty inch; F wheel nine inch; L, 2 in. pulley on ⅜ spindle, working in single bearing



A Simple Fret Saw.

4 in. long; O, set-screw to fix the wheel, F; A, slide; C, slide spindle; B, seat for workman; K, straight steel spring; M, fixing screw; W, straining screw; N, rod from crank pin to slide; the stroke of the saw is 1½ in.; H, tilting for inlaying; D D, treadle to work with both feet. The machine stands on three legs, two at the back and one in front. E wheel is loose, and works on a fixed pin. The crank pin on E wheel should be made large or small according to the length of treadle."

Fretwork Frame Designs.—A Novice writes:—"I have purchased the fretwork picture-frame design recommended by W. B. (*Wigan*) to Amateur (*Belfast*) (see page 621, Vol. I.), but I cannot understand what the small numbered patterns are for. If W. B. will kindly explain, I should feel glad."

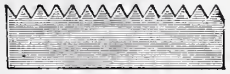
Saw Hammering.—J. R. G. (*Ennis*) writes:—"I see on page 715, Vol. I., that J. N. (*Sheffield*) promises to give any information on saw hammering. I am a circular sawyer; my employer has given me the job of saw-sharpening, but the difficulty is how to hammer the saws when they are not true. Will J. N. kindly help me?"

Sheet Metal Work Book.—Tinker writes:—"I notice in Work (see page 94, Vol. II.) that Aliquando says that Warne's book is practically useless, and contains numerous errors. As I am in possession of one, and have found it of immense benefit in my work, perhaps Aliquando would kindly point out a few of the numerous errors, and some of the problems that are practically impossible for large work."

Rubbing Down Oilstones.—A. G. (*Newcastle-on-Tyne*) writes in reply to Brum (*Keighley*) (see page 798, Vol. I.):—"In the first place you do not say whether you tried what I recommended or not. In this you are entirely wrong. 1st, you must have a grindstone; 2nd, you must either have it turned by steam or by a second person, which is not only a tedious job but expensive, and in the end not such good results. When I sent my communication I was thinking of the amateurs and 'prentices who had not the use of a grindstone. I have tried both ways myself, and for the last fifteen years I have never used anything else."

Cigarette Maker.—C. W. B. (*Plymouth*) writes in reply to Thomaso (see page 94, Vol. II.):—"My opinion is that the knuckles of hinges prevent their being practically soldered close, or, even if they were let in, the tube still has the objectionable joint when open, to fill which more than ordinary care and time would be required to prevent some of the fine shreds of tobacco overlapping, which would then get fixed on shutting. Thomaso can test this with his ordinary room door: leave it open, place his finger in the crevice, and shut to; this, no doubt, would give a good idea of the tree that he is thinking upon."

P. R. P. Glass.—A. G. (*Newcastle-on-Tyne*) writes:—"I hope I have not exhausted the patience of E. P. (*Great Yarmouth*), who wants me to explain what P. R. P. glass is (see page 795, Vol. I.). It is P. R. P. and not P. K. P. It is glass full $\frac{5}{16}$ in. thick, with one side smooth and the other small V's like the rough sketch."



II.—Questions Answered by Editor and Staff.

Dowel Making.—O. G. H. (*Sheffield*).—I do not think there is any machine for making dowels except the lathe. I suppose you mean such as are used by pattern makers for uniting halves of core-boxes. We used to turn ours when large enough to be worth while. You can, of course, saw them out with a little circular saw, take the corners off with a chisel, and then drive them through a hole in a piece of iron; this is well enough for small sizes.—F. A. M.

Timber Purchasing.—E. N. A. (*Newcastle-on-Tyne*).—Yes; you read the article right, as the prices vary according to quality; thus, if the ¼ in. by 11 in. were cut from 3rd pine at 4d. per ft. in plank, *i.e.*, 3 in. by 11 in., the price per board would be 9d., and if from 2nds, 10d. and 1s.; while from 1st quality, *i.e.*, planks at 10½d. per ft., they would be 1s. 4d. each or more. As you do not state size of cutter yacht I cannot give exact thickness of timber required, but either ¼ in. or ⅜ in. would, no doubt, suit your requirements. I suppose you will make it out of pitch pine or mahogany, as they are the best for your purpose. The price for ¼ in. by 12 in. pitch pine is about 1½d. per ft.; and ⅜ in., 2d.; mahogany, ¼ in. by 12 in., 4d. ft.; ⅜ in. by 12 in., 4½d. You need to get either wood quite dry and free from sap and knots.—A. J. H.

Stresses of Metals.—J. A. (*Liverpool*).—The breaking torsional stresses of the metals for a diameter of rod of one inch and leverage of one foot are as follows:—Cast iron, 995 lbs.; English wrought iron and mild steel, 1,005 lbs.; Swedish wrought iron, 950 lbs.; blister steel, 1,668 lbs.; shear steel, 1,709 lbs.; cast steel, 1,759 lbs.; yellow brass, 462 lbs.; cast copper, 402 lbs.; tin, 141 lbs.; lead, 100 lbs. Gun-metal metal varies with its composition, but both that and Muntz metal will fall between brass and copper. For other sizes the resistance will vary as the cube of the diameter, and inversely as the leverage.—F. C.

Stereo Casts.—Amy Chure (*Finsbury Park*) asks me to tell him where to get stereos cast and mounted from copy without providing type, forme, etc., but does not say whether the "copy" is manuscript or letterpress, which makes all the difference. There is no means of stereotyping from manuscript without first setting it up; there is a means of making stereo plates from good clean letterpress, albeit it is far inferior when done to the copy. It is by means of photo-zincography, but it is only resorted to when an absolute facsimile is required of some rare specimen of printing, such as some book by one of the early printers, such as Caxton or Guttenberg. It is expensive, and the casts are very shallow and quite unfit for modern bookwork, except as an illustration. I advise Amy Chure to dismiss from his mind the idea of dispensing with the compositor, and if he cannot himself set the matter up, if he will write to Mr. Hawkins, 72, Mildmay Grove, N., giving full particulars as to size, number of pages, size and style of type, etc., when no doubt he will receive a reply, giving estimates for composition and for mounted stereos, which I know will cost less, by far, than, as he implies by the above question, he expects to have to pay.—J. W. H.

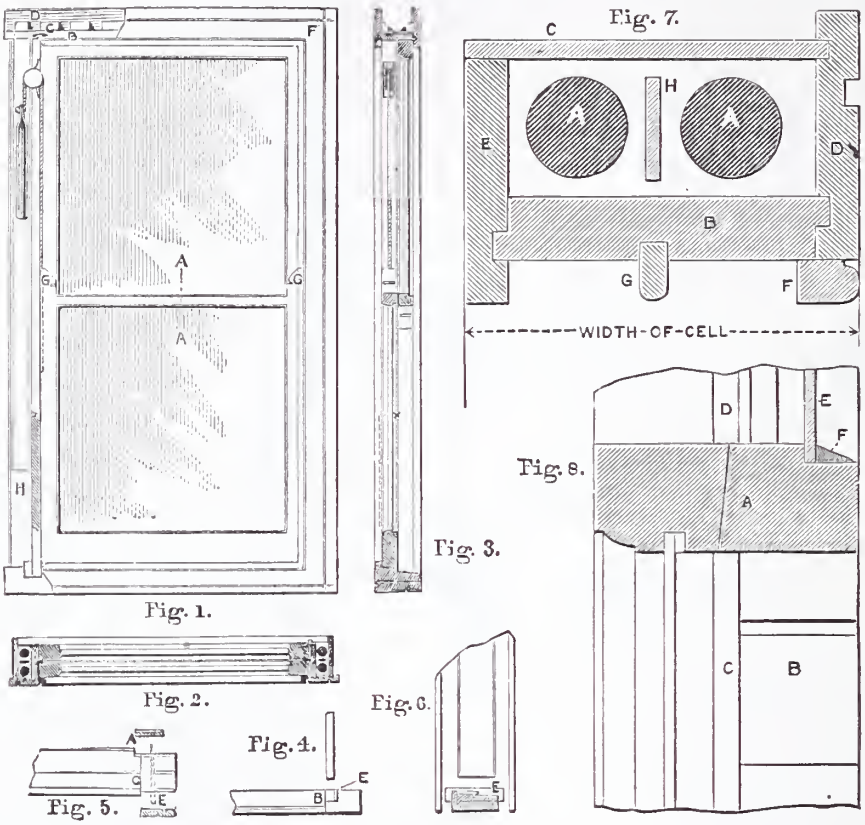
Electric Lighting.—J. R. (*Wapping*).—A six-volt 5 c.p. incandescent lamp could be worked at short intervals through two yards of No. 18 copper wire by current from five Fuller cells arranged in series. For further information on this subject please refer to my article, "Model Electric Lights," which will appear shortly.—G. E. B.

Pocket Lamp.—W. G. H. (*St. German's*) wishes to know where he can obtain a small pocket lamp in which a spring strikes a percussion cap and lights the burner of the lamp. The caps are rolled in a coil of paper held in the head of the lamp. I am sorry not to be able to oblige you. Perhaps some one of our readers may be able to help you.—G. E. B.

Sashes.—T. F. (*Brixton*).—I must confess that I am surprised that after serving your time where you have, you should find any difficulty in making sashes and frames, for, although they may not as a rule make them as they are made at a builder's, still they must go through the same routine from time to time. But I suppose you have not been fortunate enough to get a job in which this particular sort of work was required. I take it for granted that you can make the sashes, and it is the frames only which give you trouble, so I will endeavour to give you a few hints as far as the limited space at my command will allow. First set out the height and width sections, as at Figs. 2 and 3, on a rod to the full size, which we will suppose are for a pair of 2 in. sashes and frames as Fig. 1. As this is the first job of this class we have done, we must feel our way as it were. To do this we must determine the exact width of sill, pulley, stiles, etc.; this is, of course, fixed by the thickness of sashes (which are to be 2 in., that is to say, about 1¾ in. finished), outside lining, parting bead, and width of sash bead, allowing the sashes to be a little thicker than they will finish for play in sliding, say 1⅛.

Thickness of 2 sashes, each 1⅛ in. thick ..	3¼
Thickness of outside lining	⅝
Thickness of parting bead	⅝
Width of sash bead ..	1⅞
Width of sill ..	5⅛

When you have once determined this, the rest of the setting out is plain enough, as will be seen by examining the detail as Fig. 7. A very simple way of making yourself familiar with these different sections would be to obtain samples of sill, pulley, stile, inside and outside linings, sash and parting bead, parting slip, and sash stuff, etc., at any importers of Swedish goods. You would find them very cheap, especially as you only want very short lengths. The only difference between them and the ones you would prepare yourself would be that you would have to do the setting out after the stuff was worked, instead of when it was all suitably planed straight and square. (I hope you will not infer from these remarks that I am in favour of using this class of goods.) We will consider that you have prepared all the pieces you require. Now set off the distance between the pulley stiles on the inside face of sill, as at B, Fig. 4, and along top, as at C, Fig. 5, and the distance between outside linings, as at A, Fig. 5. Next mark the thickness of pulley stiles, allowing for wedge behind, as E, Figs. 4, 5, 6. Now gauge for the depth of this housing, which should be about half the thickness of sill. If you are setting out a sill already sunk and weathered, you will have to gauge from the bottom, taking care that it is out of winding, etc., before you do so. If you now gauge the thickness of the inside and outside linings on top and bottom of sill, all you require to do is to cut the various pieces out and it will be ready for putting together. Next mark off on the head the same distance between pulley stiles, and cut the groove to receive the tongues of same. The pulley stiles may next be set out, squaring the ends where they enter the housing in sill, and marking the position of pocket piece and pulleys. In your case I should advise fitting these four pieces together. The method is this:—Lay the sill on the bench, and stand the right-hand pulley stile up in its place, taking care that it stands square with sill, and fair with the sinkings for inside and outside linings, and gently drive in the wedge, E. Now serve the other side the same, and try and fit on the head. You might now fit on your inside and outside linings. These are very often framed together at F, Fig. 1, and likewise very often not. But you must be sure that your frame is perfectly square before fitting these on. Now knock it apart and cut your pocket pieces, the positions of which are shown by the dotted lines in Fig. 3. This is done by boring a small hole—indicated by star in same figure—and with a pad or keyhole saw making a fine cut down the centre of the groove for parting bead. If you now cut with a fine tenon saw both back and front, as shown in the sectional part of Fig. 1, cutting from the front edge of stile, a slight tap will release the piece, and the same piece will do. This requires a little care to cut it in such a manner that the piece itself forms the so-called "pocket piece," and renders it unnecessary to get out others, which very often has to be done. There are several other means of cutting and joining these pieces, but the way I have explained is the one most in vogue for ordinary purposes. A very thin chisel, about 1½ in. wide and sharpened on both faces, is sometimes used for cutting pocket pieces by men who make sashes and frames for a price. The pulleys should now be let in, and if you make a thick saw cut at each end of head to hold the parting slip, the frame can be put together for good, driving the wedge at bottom of stiles home tight this time, and nailing the stiles to sill as well. After fixing on the linings, the top linings should be blocked to the head, and you will be surprised at the rigidity of the frame. Next put your parting slips in the slots in head, letting them project up about 1½ in., and about 3 in. clear of sill. These are simply secured with a couple of small nails driven through them into the head. I hardly need caution you to be sure that your frame is square and out of winding before fixing on the linings, etc. The back lining may now be nailed on; this is very often simply pieces of thin outside stuff laid horizontally. About the sashes, I think there is very little I can say but what you must already know, except that you must plough the outside of stiles sufficiently long to allow for the pulleys when the sashes are up. The brackets I show at G G, Fig. 1, are not always used, but they make a stronger job, because the meeting bars can be mortised and tenoned instead of dovetailed. The above remarks are very sketchy and brief, because to thoroughly explain everything connected with making sashes and frames would take up a whole number of WORK. I have to condense it accordingly, but I think you will gather from these hints all you as a practical man would want to know.—E. D.



Sash Making.

String Hammocks. — G. F. K. (*Belper*).—An article on how to make string hammocks will be published in an early number of WORK. This will fully meet your requirements.—G. E. B.

Book on Accumulators.—B. F. E. (*Carlisle*).—Sir D. Salomon's book on the management of accumulators is published by Whittaker & Co., Paternoster Square, London, E.C. The price is 3s.—G. E. B.

Printing Hatters' Labels.—G. McA. (*Liverpool*). — (1) "Hat tips," as they are technically termed, are printed by means of heat—like tickets for goods—in metal or leaf. Firstly, a brass block must be cut similar to an engraved woodcut—*i.e.*, the portions not intended to be gold or metal cut away, and the rest left level with the surface. The block being heated, usually over a gas jet, the gold leaf or metal leaf is laid upon it, and next the silk, which is not always sized; pressure is then applied. When cool, the superfluous metal is brushed off. It can be done in any ordinary letterpress, but there is a delay consequent upon removing the brass block to heat it every five or six pulls, and therefore hat tip printers have special presses, giving heavier pressure, and with a hole through the table, which comes exactly over a gas jet when the table is out, so that when the necessary heat is once attained, it is easily kept up by being renovated whilst the leaf or metal is being laid to register upon the block. It is very seldom that gold leaf is used, as this class of work is badly paid. Dutch metal is usually quite good enough. (2) The tips are usually printed, not upon separate labels, but upon the circular crown linings of hats, and often upon the "head-leathers," also especially for the felt hat trade; it is but seldom that the necessity arises for "cutting round," as G. McA. phrases it. When required, a cutter of the exact shape is made of steel, square inside and tapering outwards, with chisel edges, and several sheets of paper, silk, or leather, as the case may be, are knocked up in register, laid upon a block of lead, and the cutter forced through them, either in a ball press or, more primitively, with a mallet. (3) As to the use of size, isinglass is the best; if too expensive, use "Gloy" (12s. per cwt.; "Gloy" Co., St. Mary's Chambers, St. Mary Axe, E.C.), one of the best sizes ever made, as it never can decompose. If the latter, let it down with two-thirds water for either paper or silk, and one-third for leather or American cloth. I think you had almost better put this kind of work out to be done, unless you have a prospect of having a long run of consecutive orders for it, as in the neighbourhood of Denton, Failsworth, and Stockport there are plenty of tip printers, who will print in metal or gold (supplied) for 10s. to 15s. per thousand, on your own unsized stuff; and there used to be some years ago a colony of them round and about Rylands' warehouses, Manchester. Finally, I have never heard of the use of gutta-percha in this connection, and fail to see how it could come in, as in the tympan no blanket is used, only shalloon boards, so as to keep the edges of the leaf or metal as sharp as possible.—J. W. H.

Coppering Blotting-Paper.—A. J. (*Manchester*).—This can be done by polishing the paper with blacklead on both sides, then mount it on a wood frame, with the edges of the paper clipped by strips of paper. Connect these strips to the wires of a battery, and immerse in a copper depositing solution until the required thickness has been obtained. Calico or linen would be better than blotting-paper because stronger. But I am working quite in the dark, because you do not choose to enlighten me with the purpose for which you require the coppered paper. If you could trust me with your secret, I could help you with sound advice. Had you enclosed a stamped directed envelope, I might have replied by post, but it is obvious I could not do so when you omitted to give your address. I do not keep letters after I have answered them, nor register the addresses of correspondents.—G. E. B.

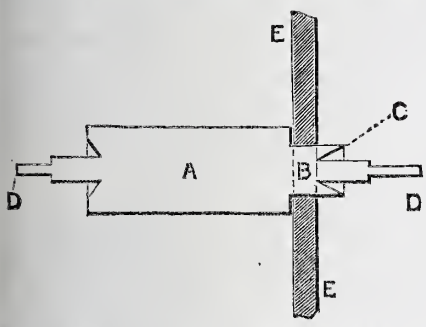
Light Forgings.—J. F. (*Wandsworth*).—Bayliss, Jones, & Bayliss, Wolverhampton, supply these.—J.

Crucibles.—J. C. H.—The Morgan Crucible Co., Battersea, sell these.—J.

Child's Cot.—F. G. (*Stamford Hill*).—I have carefully examined the rough sketch and specification of your child's cot, and I certainly cannot advise you to take out a patent for it, for the simple reason that the improvements claimed for it have been forestalled in a way that I think is superior to yours. However, this latter is merely an opinion, and you may prefer yours, but I am afraid in any case you could not substantiate your claim for originality, as the falling side of yours seems to be practically the same as the prior patent, though the details may vary slightly. Your suggestions for folding up the cot do not appear to possess so many good features as another patent which I think is an improvement on yours. I am very sorry I cannot give you more encouragement to proceed with the cot, and having given my opinion, it is, of course, optional with you to do as you think best. The advantage of having a side which can be altered in height is at least a doubtful one, so far as safety is concerned, and it is chiefly a convenience when the cot is close alongside an ordinary bedstead. In answer to your inquiry about the number of children who are injured by falling out of low railed cots, I can only say that I have never known of an instance, and

my experience has been considerable. The number certainly cannot be large, and the risk is very inconsiderable. Personally I think that the risk is greater with a cot of which the sides are high (unless they are so high that a child cannot climb over them) just because the height of the fall is greater. Most of us, at least those who are family men, know that even the best of children, *i.e.*, our own, soon acquire mischievous habits, one of which is a tendency to climb. I hope the other idea to which you allude as having been derived from WORK may be a successful one, and you may quite rely, whenever you choose to send us particulars of any improvements you contemplate patenting, that your communications will be regarded as confidential.—D. A.

Watch Repairs.—W. W. R. (*Poplar, E.*).—If you have the pieces of old cylinder for the size, perhaps, though, it would be best to see that the old one is the correct size by trying a tooth of 'scape wheel in the body, and see that it has a little shake, then hold the cylinder between two teeth of 'scape wheel and see that there is a little shake or freedom equal to what the tooth had inside; then select a new cylinder, exact size, and proceed as follows:—To put a new pinion, select a new one, same size as old one, or, if lost, send wheel to tool shop for one, or, if you have a stock by you, select one to suit the wheel it is to be driven by. Mount a ferrule on it and truly centre it—that is, run true centres or points on each end of it; now with your graver turn a part of it, slightly longer than the thickness of the wheel, down, till the wheel fits tightly on. See that you make the shoulder or seat quite flat for the wheel to pass on; now undercut the part you have just turned, so that you can rivet the wheel on. Gauge or measure the height for your wheel from the plate or cock, and turn your pivot shoulder

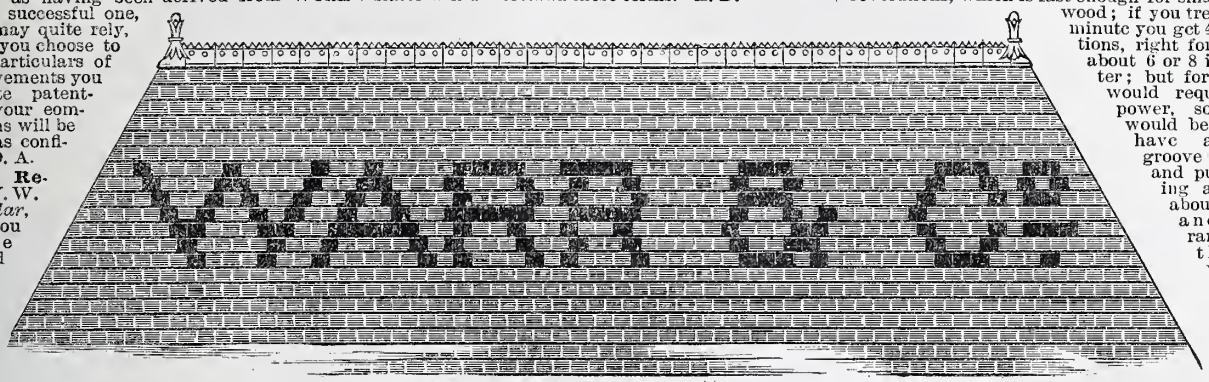


Watch Repairs—A, Body of Pinion; B, Seat for Wheel; C, Undercut for Rivet when finished—that is, punched down on the Wheel and holds it; D D, Pivots; E, Wheel.

back to that mark; turn your pivot straight and true till it will just go in the hole; then a rub with a burnisher, and slightly rub a round broach through the hole and that end is done. Now take a peg and cut it flat; cut a notch in it and let the end rest on the plate, and cut away the notch or bottom of the peg till it will just fit under the top plate or cock. You have now the measure for the other pivot shoulder; turn it back to that mark and fit it as the other. Now try it in its place; if no endshake, turn one or other of the shoulders back till it has a little shake up and down. Shorten pivots till they just come through the plate, and nicely round off. You did not say what pinion it is, so that these hints may require a little altering to suit the particular pinion; for instance, the centre pinion of a Geneva watch is hollow, and must be fitted in on an arbor, and the 'scape wheel pinion is so short there is no room for a screw ferrule, and must be fixed to wax ferrule; then a fourth pinion, with a seconds pivot, should have the long pivot finished last, or you may bend or break it. But should you not be able to get on, write again. There was a description and illustration on "How to Pivot a Cylinder" in WORK, No. 19, page 302. Refer to that.—A. B. C.

Incubator.—D. F. A. (*Winona, near Hamilton, Ontario*).—Messrs. Hearson & Co's. incubator is patented, and to describe it in full would be injurious to them, as it would enable others to make that which is manufactured and sold by them to their profit in virtue of their patent rights. A notice of the incubator was given on page 153, Vol II.

Slating.—J. K. (*Bolton*). — I append a sketch showing how the name mentioned can be worked in two different coloured slates. If you had given the size of the slates, and length and width of roof, etc., it would have been much more satisfactory; for, although the sketch answers your query, it may not be exactly what you require. But I hope this may not be so. The slates shown are 20 in. by 10 in., or countess slates, laid to a 3 in. lap, and consequently 8½ in. gauge. You being a practical slater will understand these terms.—E. D.



Example in Slating.

Xylophone.—INSTRUMENTALIST (*Saltaire*).—In reply to your questions respecting this instrument, (1) The straw ropes are similar to what are used in some parts by farmers to fix the thatch on stack tops. If you were at a farm, you could get as much as you require for a few pence; if you have no opportunity of getting any in this way, you might make them in the following manner: fix a wooden axle about 2 ft. long in bearings, putting a pin in at each end to prevent its working out; fix a handle at one end, and a small iron hook at the other end, then draw some straw straight with your hands, bend it in the centre over the hook, get some one to turn the handle, and draw your hand back over the straw, when it will be twisted into a rope; before the end is reached, insert another length of drawn straw between the ends of the first piece, and so on, till you get the requisite length; you must try to keep it of one size, about ¾ or 1 in. diameter; when finished, tie the end and keep it stretched till wanted, as if let go, it has a tendency to untwist. If you cannot manage this, I believe a piece of dry white hemp rope the same size would do; fix it on the wood with wire staples, keeping them clear of the notes. (2) I don't think knots will affect the tone if hard wood is used; if pine, it would be better clear of knots; the wood must be dry and well seasoned. Rosewood is supposed to be best, but oak, pitch pine, or yellow pine may be used; make the notes about 1 in. wide and 1½ in. deep. (3) Set the notes 1 in. or 1¼ in. apart, remembering that the wider apart they are, the longer the instrument will be; they are made with from twenty-eight to thirty-six notes, naturals; if you want to have flats and sharps, you could fix a third bar with rope on it, and fix the sharps and flats in groups of two and three, same as the keyboard of a piano. I did not notice what note the highest or lowest was, and cannot see the instrument at present. If I have an opportunity of seeing it again, I will get all particulars and dimensions, and with the Editor's permission will send a description to WORK.—E.

Micro Lens.—If J. L. (*Shields*) will send to Messrs. Lancaster & Son, Colemore Row, Birmingham, for a set of lens for the microscope at 4s. or thereabout, he will have what he requires. It will be understood that the object glass will only be a common one, but quite good enough for a beginner. I would also advise J. L. at the same time to get Messrs. Lancaster & Son's catalogue; he will find it a great help, as he will then see what is to be had and at what cost. I have placed an article on eye-pieces in the hands of the Editor, which I think will help those who are working in optics. If it will be any convenience to J. L., I would procure the lens suitable for the microscope. Shall be glad to help any amateur in the same way.—O. B.

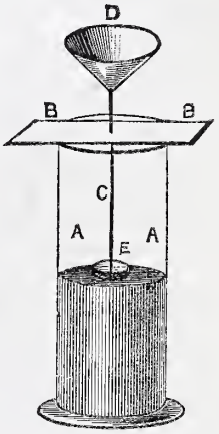
Oval Chuck.—W. B. G. (*Manchester*).—Descriptions of an oval chuck, with sketches, are in hand, and have been written in answer to a similar question by A. S. H. L. (*Walworth*), another subscriber. Probably these will be sufficient for W. B. G., but the explanation is short, as befits "Shop" columns.

Battery for Lamp.—A. C. F. (*London, W.*).—The lamp you have is, probably, a Fairy Star lamp, requiring a current of ·75 ampères at a pressure of four volts to light it. This you could obtain from a two-cell pocket accumulator, or a three-cell chloride of silver battery. To make the accumulator, you will require closely-fitting, well-made ebonite cells of the desired size. The lead plates will have to be cut to fit the cells. You will probably know respecting their preparation. A six-cell bichromate battery is scarcely suitable for charging an accumulator, even when charged with chromic acid solution, as this battery so soon polarises when a large current is demanded from it. Three cells of a Bunsen (quart size) will be more suitable to use in charging a four-volt pocket accumulator.—G. E. B.

Speed for Lathe.—D. C. D. (*Bowis in Ossory*).—As the speed of your mandrel will vary with the rate of treading, it may be best to reckon the speed of your 4-in. lathe by the ratio of the wheel to the pulley; in other words, the number of times the diameter of the wheel is greater than the diameter of the pulley. Now in a 4-in. lathe a good proportion will be 8 to 1—say, the wheel 24 in., and the pulley on mandrel 3 in. diameter. If you tread very fast, say, 120 per minute, you will get 120 by 8=960 revolutions, which is fast enough for small work in wood; if you tread 60 per minute you get 480 revolutions, right for wood of about 6 or 8 in. diameter; but for this you would require more power, so that it would be better to have a second groove on wheel and pulley having a ratio of about 5 to 1, and so arranged that the band will fit equally well on either place.—F. A. M.

Transfer Process Pictures.—G. W. E. (*Leeds*).—Messrs. J. Barnard & Son, 19, Berners St., London, supply transfer process pictures.—F. B.

Quality of Glue Test.—F. R. (*London*).—Good glue should be nearly transparent, without taste or smell, free from spots or cloudiness, and of a deep brown colour. A rough method of testing its adhesive power is to soak it in a large quantity of water for some time, which causes it to swell considerably, absorbing 5 to 16 times its own weight of water. The more consistent and elastic the glue in this state is found to be, the greater will be its adhesive power; and the larger the quantity of water absorbed, the more economical will the glue be in use. But as this test is only applicable to bone glues—for those from animal offal do not behave similarly — Lippowitz's method is often used, which is as follows:—Five parts of glue are soaked in cold water for some time, and then dissolved in sufficient hot water to make the weight of the solution equal to fifty parts, when it is kept at about 64° F. for twelve hours to gelatinise. To determine its consistency the jelly is placed in a cylindrical glass vessel, A, across the top of which is a piece of tin, B, perforated in the centre. The hole in the tin should be large enough to allow the free passage of a stout iron wire, C, having a funnel, D, soldered to the upper end, while the lower is provided with a saucer-shaped piece of tin, E, with its convex side turned downwards and touching the surface of the jelly into which it is forced by loading the funnel, D, with weights. The greater the consistency of the glue, the greater the weight which will have to be used. But the most accurate method consists of ascertaining the weight of force required to break a given bar of the material as compared with that used to break a specimen of known quality employed as a standard. Sticks of pure gypsum or plaster of Paris are cast of precisely the same dimensions, and then saturated with solutions of the different glues and thoroughly dried. These are placed one by one in a metallic ring, having notches which receive them, and a lever having the centre of the stick as the resistance and a graduated mercury cup upon the long arm as the counterpoise. Mercury is poured into the cup until the standard stick commences to break; the level of the mercury is taken as the absolute standard, and marked 0, and the scale can then be numbered at equal distances above and below. Glue, which is less tenacious, will require less mercury, and will be so many degrees *below* zero; whilst a stronger glue will require more mercury, and be so many degrees *above* zero. The chemical method of estimating the gluten by precipitating it with tannic acid is not a criterion of the quality of glue, as a glue rich in gluten may have poor adhesive qualities.—F. B. C.



Glue Test Machine.

Inlaying.—J. G. (*Falmouth*).—The subject is too vast to be treated fully in "Shop," but you may be sure it will have due attention in the body of the magazine. A series of papers is projected, but they must wait their turn, as there are many which are considered more important waiting publication. In

the meantime, without giving you all the information I should like, the following hints may help you. I daresay you are aware that inlaying is generally done with veneers or very thin wood. In the simplest form two pieces are cut at the same time—that is, the saw cuts through two thicknesses. It follows that the piece cut out of one must fit in the other, so that if, say, a piece of white veneer is cut at the same time as a piece of black, two inlays can be formed. The piece cut out of the black will go in the opening of the white, and that from the white will fit within the black. The pieces will, however, not fit closely to each other, for the saw in cutting removes a perceptible amount of material. To do away with this looseness is the intention of the tilting table. It is tilted to such an angle that the saw cuts through the wood on the bevel instead of perpendicularly to the surface of the wood. The piece cut from the upper veneer is therefore slightly larger than the hole in the lower piece. I think the purpose of the tilting table will now be plain to you, though I have done little more than indicate how it is to be used. The elaborate inlays so much used in furniture just now are produced by an entirely different method, requiring great exactness in cutting. Each piece is cut separately, or rather each colour, for four inlays are usually prepared at the same time. This marquetry or inlaid work is not done with a machine, but with a hand frame almost exactly the same as those used for fret cutting, the principal difference being that the marquetry cutter uses one made of wood. The veneers while being sawn are held in a peculiar appliance called a "donkey." After veneers are cut, the best way to lay them is to glue the pieces down on a sheet of paper. When dry, the upper or uncovered surface must be levelled, and should be roughened with a toothed plane or other means. It is then ready for laying on the solid wood like any other piece of veneer. If you try the work, read the articles which have already appeared on veneering. After the veneer has been properly laid (with a caul) the paper may be removed. The surface is then cleaned up and finished in any way desired. If you still want to know anything, write again and state clearly on what point you want information.—D. A.

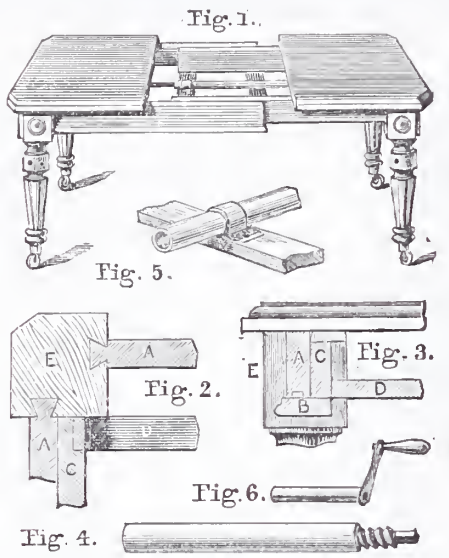
Cover for Book.—AMATEUR (*Holloway*).—It is impossible to oblige you with the probable price of covers for a book about the size of WORK, and also where you could buy them about Islington. You should name the work for which the cloth cover is wanted. It would then be possible to find out if such a cover is supplied for the book in question.—ED.

Taxidermy.—G. G. H. (*Oswestry*).—It would take up too much time and space of "Shop" to give a complete description as you require for preserving and stuffing birds. The cases you speak of you will be able to make yourself, or a joiner could make them for you. They cannot be bought ready-made, as they vary so much in size—in fact, they are made to fit the birds; for instance, what will fit a wren will not fit a crow. You can get the eyes either from myself or Messrs. Pache & Sons, Birmingham. The work that is likely to suit you is published by West, Newman, & Co., 54, Hatton Garden, London, price 1s. With respect to the last part of your note, I intend, if the Editor will allow me, to treat of the art of taxidermy in all its branches.—J. A. W.

Mortising. — H. N. (*Airdrie*) appears to believe that it makes some considerable difference which edge of a stile is mortised first. I have not found much difference, and certainly never spoilt a job through "it being all one which edge was uppermost." He appears to use a machine; my directions were for mortising with mallet and chisel, not for machine. Certainly, if by "blazing" he means driving out the core, the inner edge should be uppermost. If this surmise is correct, H. N. is, of course, quite right. Whenever a mortise is smaller one edge than the other, the core should be driven from the smaller mortise to the larger, or the accumulated core is likely to do damage, especially under the pressure of a mortising machine core-driver. Machines need experience, and H. N. is wise to find out the reason of his failure.—B. A. B.

Spirit Graining.—EXILE.—By the time this appears, it is probable that the subject of graining will have made some progress in the pages of WORK. We will not, however, deny you herein the information you ask for, briefly. I assume you refer to the imitation of oak in "spirit," or turps, colour, and which is a quick-drying process, useful for such places like Cheapside, where ordinary oil graining on the outsides of the shops, etc., would be spoiled before it could dry. The graining colour is made in this way:—Rub up a few ounces of gilders' whiting, which must be quite dry, in turpentine to a thick paste; stain—that is, colour—this with either raw or burnt sienna, burnt umber, and ivory black (ground in oil), according to the colour desired—light, medium, or antique oak. Add to this a little quick-drying bath varnish, and then thin with turps to working consistency. About two ounces of varnish to one pint of turps will usually bind the colour; too much varnish will dry it too quickly for working, and will not let it be spread evenly. Spread as with oil graining, but "hurry up!" and don't cover too much at once. Use a dusting brush to give variety of depth after spreading the colour, and then comb at once, not attempting too much variety with the latter. To put in the figure of oak, procure a flat hog-hair veining fitch, and with a solution of common soda-water, stained with a little Vandyke in water, or such-like pigment, mark in the figure. Care must be taken to avoid the soda-water running down or spreading, only sufficient being in the brush to make a clean, sharp marking. With practice, it will be found that the flat but thin formation of the brush can be made to execute the desired shapes quite as well as the ordinary bone or thumb-nail in oil graining. The soda-water, of course, bites out the spirit colour, and should be all right and clean after the work has been well sponged off with clean water. In working stiles and cross-rails, a little turps is used on a rag for "cutting up" the joints cleanly, just as a wash-leather would be in overgraining in water. Turps can also be used for the biting out, but this is done by veining, and then drawing a pad of old flannel down it at once. This process allows work being grained, overgrained in water, and varnished on same day. Respecting your other question, I would advise getting a printer to put them in the cutting machine for you, or get a bookbinder to finish them off.—F. P.

A Screw (Telescope) Dining Table.—T. H. and E. C. (*Blackburn*).—As there are two of you who have signed the query creating this reply, I hope these particulars will satisfy both. You want a table 5 ft. by 4 ft. 6 in. to extend to 10 ft. This one will extend to nearly the distance—9 ft.; it will give you much more trouble to have it to extend the extra 12 in. The height of it will be either 28 in., 29 in., or 30 in., as considered best. Do



A Screw (Telescope) Dining Table. A, C, D, E, in Figs. 2 and 3, show correspondence of parts. Fig. 1—Table partly extended. Fig. 2.—Plan of one Corner. Fig. 3.—Section of one Corner. Fig. 4.—The Tube and Screw. Fig. 5.—Method of screwing down Tube. Fig. 6.—The Handle or Key.

not condemn me if the following dimensions do not suit you, but alter them accordingly, as there is no decided rule to work to. Thickness of top, 1½ in; thickness of leg blocks, 4½ in.; thickness of inner framing, 1½ in.; thickness of outer framing, 1 in.; width of side framing, 4½ in.; width of inner framing, 3 in. The top must, of course, be divided in the middle. To one pair of leg blocks are joined the *outer* side frames; to the opposite pair the *inner* frames. These must work freely along each other. In Fig. 2, A is the outer framing, C the inner framing, D the rail joining together the two inner frames at the end. A similar rail to this latter connects the two outer frames together at the end at B in Fig. 3. Underneath all the outer framing is a moulded rail, B, in Fig. 3, between which and the top rail shown above, C in Fig. 3, the inner frames, C, run. I have not shown the rail above C in Fig. 1, as it would then partly conceal the working of the table. The iron tube, Fig. 4, is screwed down, as in Fig. 5, to the back connection of the inner frames, the other end of it being inserted in a block fixed to the framing at the end. In this tube works a screw which should protrude partly through a hole bored in the end framing. The table, as perhaps you know, is opened or closed by turning the screw with the key or handle in Fig. 6. Extra flaps are required to fit into the top. Read previous articles for polishing, finishing, etc.—J. S.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. W. C (*Tottenham*); W. S. (*Glasgow*); C. C. H. (*Northallerton*); BREVITY; W. J. B. (*Chesterfield*); NEW SUBSCRIBER; J. C. S. (*Cardiff*); J. S. B. (*Oldham*); M. (*York*); F. P. (*Brighouse*); DIDYMUS; T. B. (*Blackburn*); X. W. I. (*Portsmouth*); CLOCK JOBBER; F. W. R. (*Harling*); A. G. (*Newcastle-on-Tyne*); W. L. (*Durham*); HYDROSTATIC; SELF-HELP; H. S. (*Stratford, E.*); J. A. M. (*Stamford Hill*); SOLUTION; P. P. (*London*); H. W. (*Nottingham*); J. R. (*Dewsbury*); T. H. (*Glossop*); B. J. T. (*Southsea*); SHEET IRON; G. R. R. (*West Calder*).

Trade Notes and Memoranda.

EXHIBITION OF HOME INDUSTRIES.—The third exhibition of home industries organised by the Co-operative Union, Limited, will be held in the Crystal Palace on August the 16th, 1890. Prizes will be given for the best specimens of amateur work in any of the following classes: Engineering, marine and miscellaneous models, art metal work, general metal work, cabinet making, joinery, house decorating, wood carving, wood turning, fretwork, toy making, painting on glass, china, and pottery, oil painting, water-colour drawing, pen or pencil drawing, bookbinding, modelling in clay or plaster, musical instruments, confectionery, inventions, and miscellaneous collections. "All work entered for competition must be executed by amateurs, and must be the *bonâ-fide* individual work of the exhibitors." Intending exhibitors must be members of some co-operative society. There will also be held at the same time an exhibition of specimens of work showing the skill of workmen and apprentices in their own trades. Full particulars may be obtained from Mr. Wm. Broomhall, general secretary, 49, Bedford Street, Strand, W.C.

A MANCHESTER EXHIBITION OF ARTS AND CRAFTS.—The Art Gallery Committee of the Manchester Corporation have issued regulations for the proposed Exhibition of Arts and Crafts in the City Art Gallery, which will open on February 9th, 1891. The articles to be exhibited must be produced during 1890, and be the work of residents within a radius of twenty miles from the Town Hall. Prizes are offered, and firms at a distance may exhibit, but not for competition. Forms of application for space will be supplied by the Curator to intending exhibitors, and the forms must be returned before November 1st, 1890. All work must be delivered in January, 1891.

The exhibition will consist of contemporary work in design and handicraft, and will include the following:—

Designs and cartoons for decoration of all kinds.
Decorative painting, more particularly in association with architectural or cabinet work.
Textiles: tapestry, needlework, woven and printed fabrics, lace.
Painted glass, lead light-work.
Pottery: tiles, majolica, painted china.
Table glass: blown, cut, and engraved.
Metal work: wrought iron, brass and copper repoussé, gold and silversmiths' work, chasing, enamels, and clockwork.
Models, architectural and mechanical.
Wood-carving } carving in ivory, cameo, and
Stone-carving } other materials.
Cabinet work: inlaid and painted and carved furniture.
Decorative sculpture and modelled work: friezes, architectural enrichments, reliefs, plaster and gesso work.
Printing: book decoration, printers' ornaments, illuminations and decorative manuscripts, wood and metal engraving.
Bookbinding and cloth cases.
Wall Papers.
Stencilling.
Leather work, stamped, tooled, cuirboulli.
Fishing tackle and the arts of the taxidermist.

And such other kinds of decorative art not above enumerated as may be approved by the Selection Committee.

WORK
is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [24 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Machinery and Tools.—Largest Stock in London. BRITANNIA CO., 100, Houndsditch. Cash or Hire Purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks and Dies, Forges, etc. Catalogue of new, 6d.; second-hand, 2d.—BRITANNIA CO., Colchester.

Best Book on Lathe, Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [21 R

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured.—ETHELBERT HENRY, Alvaston, Derby. [22 R

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 sheets, 2s. 6d. All post free. Lists free.—F. COULTHARD, 113, Old Christchurch Road, Bournemouth. Note change of Address. [1 S

Amateur Printers.—Several small Founts of Type and Commercial Electro Blocks cheap. Send for Specimens. Also small Printing Press.—E. POUTEAU, 18, Ailcroft Road, Haverstock Hill, London. [1 S

A1 Water Motor.—¼ to ½ h.p., according to pressure, price 10s.—WALTON, 9, Queen Anne St., Stoke, Staffs. [2 S

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET

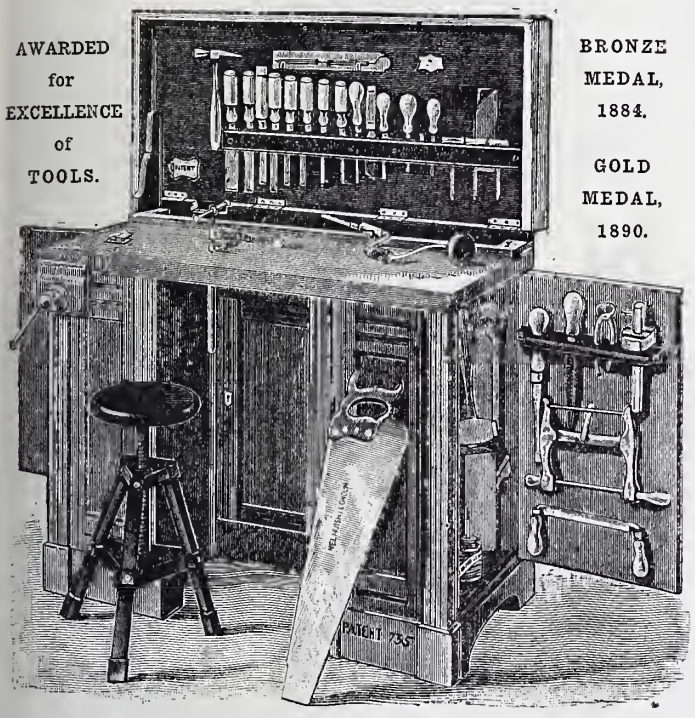
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

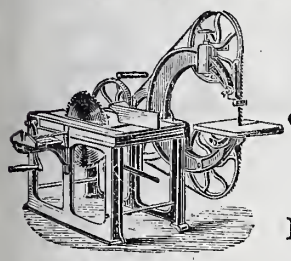
Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

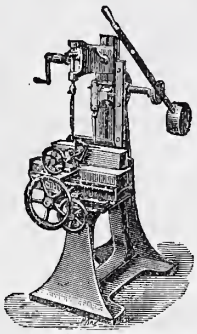
LEWIS & LEWIS,



ENGINEERS,

CAMBRIDGE HEATH,

LONDON, N.E.

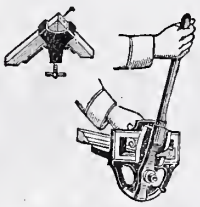


THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,

For Hand or Power, will take in 22 in. Circular Saw, and will cut by hand-power up to 5 in. deep.

THE "HACKNEY" MORTISING & BORING MACHINE,

With 8 Chisels, 1 Coredriver, Key, 3 Augers, and 3 Drills.



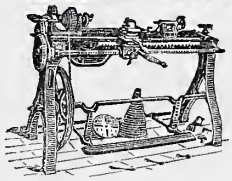
PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine,** any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,

TOOL MAKERS, DUBLIN.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.

37, CHANCERY LANE, LONDON, E.C.

MONTHLY, *4d.*

CASSELL'S TIME TABLES.

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

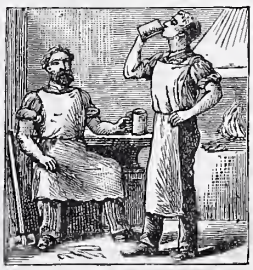
NOTICE.

"CALAMITY JANE," a New and Original **Story of Adventure,** will be commenced in **No. 350** of CASSELL'S SATURDAY JOURNAL (ready June 11). 24 Pages Illustrated, Weekly, 1d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

Post free on application.

CASSELL'S CLASSIFIED CATALOGUE.

ASPINALL'S

INCOMPARABLE,

COLOURS

BEWILDERING,

BEAUTIFUL.

PRINCESS.

TO AMATEURS.

The roughest proscenium, or fittings, knocked up for the occasion in Hall, School, or Country House, may be made not only beautiful, but very like the real thing by a pot or two of ASPINALL'S ENAMEL at the cost of a few shillings, and the success of a show is frequently enhanced by bright surroundings. *Verb.sap.*

SOLD EVERYWHERE,

In Tins, or post free, 7d., 1s. 6d., and 3s.;
For Baths, 9d., 1s. 9d., and 3s. 6d.,
FROM
WORKS, LONDON, S.E.

ASPINALL'S EBONICA,

A JET BRILLIANT BLACK, FOR
Cycles, Basket Carriages, Bedsteads, &c.
Sample Tin, 9d., post free.
COLOUR CARDS POST FREE.

ENAMEL.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6d. OR FOR 7 STAMPS.
BIRMINGHAM.

[33

GRATEFUL—COMFORTING.

EPPS'S COCOA

BOILING WATER OR MILK.

Bovril

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril

WILL KEEP ANY LENGTH OF TIME.
SOLD EVERYWHERE.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

Vol. II.—No. 65.] SATURDAY, JUNE 14, 1890. [Price One Penny.

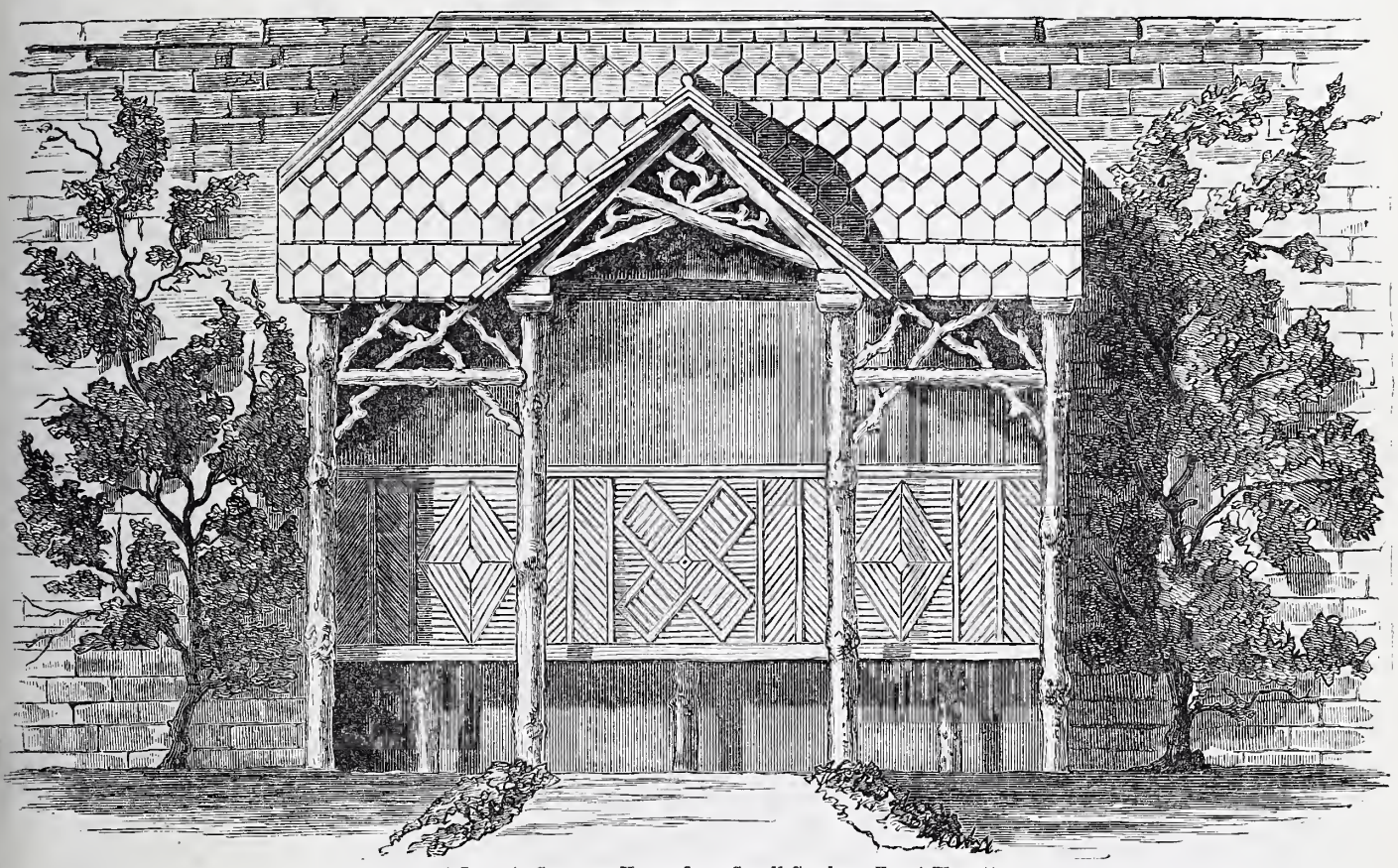


Fig. 1.—A Lean-to Summer-House for a Small Garden: Front Elevation.

A LEAN-TO SUMMER-HOUSE FOR A SMALL GARDEN.

BY ARTHUR YORKE.

Advantages of a Lean-to for a Small Garden—Arrangement of Ground Plan—Construction—Elevation of Front—Decoration of Interior—Roof—Shingles: what to Make them of and how to Use them—Various Methods for Lining Roof.

It has been aptly observed that to nine men out of every ten life is but a series of makeshifts. This certainly holds true of those who love gardens, for few there are who have not to content themselves with something far short of the ample and charming paradise which forms their ideal. The summer-house which is the subject of the present paper is intended less for the happy tenth man than for his nine less fortunate brethren, and it will be found that the makeshift element enters largely into its composition.

In many, and especially in suburban, localities the gardener has to make shift with a narrow strip of ground. He has more walls or fences of some kind than horizontal space, and he may grudge room for a summer-house that would take up much of his open ground. This one has, therefore, so been planned that it shall get in the way as little as possible. It is intended to be stuck against a wall, from which—its eaves apart—it will project little more than a yard.

Perhaps in no better way can a dead wall or the back of some unsightly outhouse, such as is pretty sure to present itself in such a garden as we are contemplating, be better utilised than as the background for such a building. By availing ourselves of it we may save about one-half of the materials and labour necessary to provide the same amount of accommodation in a summer-house built in the open.

In Fig. 1 we have a front elevation of the very modest structure proposed. Perhaps some will rather incline to call it a covered seat than a summer-house. It will, nevertheless, afford sitting room, with comfortable shade and shelter, for half a dozen or more persons. Its dimensions are: length, 8 ft.; breadth, 3 ft. 3 in.; height, 8 ft.

Its general arrangement is seen in the ground plan (Fig. 2). Four pillars, A, B, B, A, occupy the front. These are poles 3½ in. or 4 in. in diameter. Any rough and tolerably straight wood will do, but larch is to be preferred. These rise 5 ft. above ground, and should not have less than 2 ft. below the surface. The dwarf pillars supporting the seat are marked C, C, C. These should be of similar stuff, but rather smaller. They show 14 in. above, and should be buried about 9 in. below ground. The pilasters—if the term may so be applied—which appear at D, D are of rather larger stuff sawn in half. These are only 5 ft. long, as they need not enter into the ground, being fixed only by strong nails to the wall.

The ends of the summer-house (the space from A to D) are of smaller half-stuff, ranged side by side (as seen at E, E), and nailed to the cross-pieces, F and G, which appear in Fig. 3.

In this last-named figure also appears one of the wall-plates, resting on and nailed to

the tops of the pillars (H, Fig. 3), and at I is seen where one of the front wall-plates meets it. There are two of these front wall-plates, each resting on the two pillars to right and left of the entrance, and their inner ends appear in Fig. 1, where the ends of the purlins which form the small gable rest upon them. The wall-plates are of large half-stuff, with the flat side above. In Fig. 3 will be seen how the short cross-piece which carries the sloping end of the roof is supported; and Fig. 4, which is a section through the centre of the building, explains how the ridge-piece of the small gable, E, rests at its inner end on a cross-piece from rafter to rafter, seen in section only, and marked M, whilst N shows the point at which the purlins meet and support the ridge-piece towards its outer end. The intersection of the diagonal braces in the gable is indicated at O, and P shows the course of one of the rafters, and how its upper end rests against the wall, and upon a ridge-piece of half-stuff, Q, strongly nailed to the masonry.

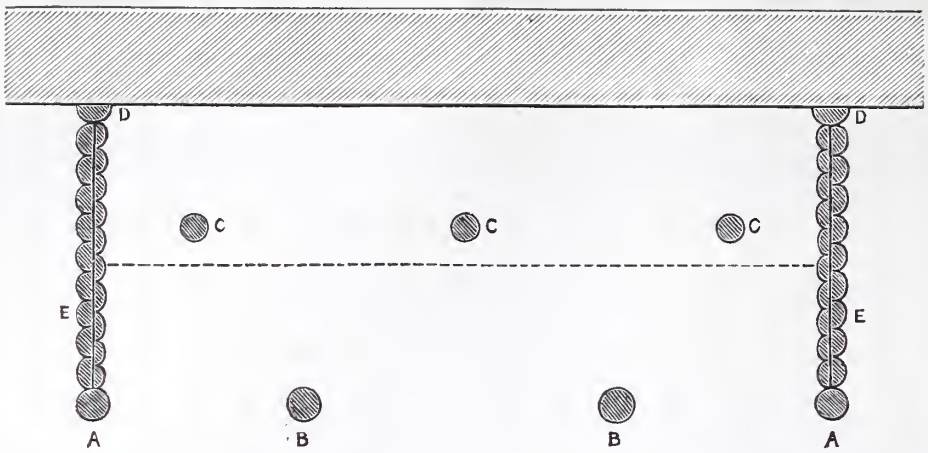


Fig. 2.—Ground Plan of Lean-to Summer-House.

The elevation (Fig. 1) explains pretty clearly the ornamental details of the front. They are not elaborate. It will be seen that the top of each pillar has a small cap, formed of four pieces of quartered stuff, mitred at the corners, and that across the opening on each side of the entrance, near the top, is a "transom" of straight wood, with a little arrangement of crooked bangles round it. Over the entrance are diagonal braces crossing, and also a little filling-in with bangles. The entrance is 5 ft. 10 in. high, and will, therefore, admit any person of moderate stature without stooping.

In order that an ornamental and appropriate lining may be given to the back of our summer-house, it is recommended to plug the wall, and nail over it a level covering of thin boards—say, of ½ in. match-boarding, or, as in a still less costly makeshift, of packing-cases from the grocer's, which will cost a mere trifle. Upon this the decorative work can be bradded. The back of the seat is shown in Fig. 1 to be of rustic mosaic, a kind of work fully described in the former article on summer-houses. Above this, as well as under the seats, a covering of bark has been introduced. Our home-grown bark, such as elm, can be made to lie more flatly, and, therefore, makes better work; but as in any but rural districts this may be hard to be got, virgin cork may be made to take its place.

Fig. 3 gives an inside view of one of the ends, and from this it will be seen that the ornamentation of those parts varies little from that of the back. The lower band, however, answering to the strip under the seats, is not bark, which, in this place, would be liable to be kicked and destroyed by the feet, but of smaller half-stuff, so arranged as to break joint with the outside pieces. This will be seen by referring to the ground plan. Any chinks in the ends should be neatly tucked with moss, so as to make them wind-proof.

In a former article thatch was emphatically spoken of as by far the most appropriate and pleasing of all coverings for buildings of this class. I have no wish to retract anything said in that place, yet it will be observed that the roof shown on the structure before us is not a thatched one. But this summer-house, as before stated, was intended partially to show what could be done with makeshifts. There is no reason why, in situations where the thatcher and his materials come readily to hand, it should not be thatched, though on so narrow a building the thatch will neither look so well nor stand so well as on one where the stetches could be longer. But in those especial situations in which this design is intended to be of chief use, thatcher-man and stubble can probably not be had. In place of the best possible roof, we must then use the best available one.

The makeshift suggested is one of wooden shingles — things which any rough hand at carpentry can prepare and put on for himself. As will be seen from Fig. 1, it is easy to give an ornamental character to these. They will have a rustic look, which will go well with other parts of the structure, and, if clumsily made, the effect will be none the worse. What I would recommend for the purpose, as at the same time cheap and well adapted, are the staves of paraffin casks. Such casks may be bought in any town at firewood price (indeed, the greater number of them are split up for fire-lighters when emptied), and they may easily be sawn to the required length and shape, and so trimmed with a hatchet as to make them lie fairly even. Being of oak, and thoroughly saturated with oil, it may be inferred that they will be durable, but on this point I cannot speak definitely, as my experience in connection with them for garden purposes goes back about eight years only; but in any case they will not, like thatch, need renewing every tenth year. The disagreeable smell of the paraffin soon goes off in the open air. For our present purpose, we suppose our shingles to be 12 in. by 4 in. The lower ends may be sawn to a variety of ornamental shapes.

If this covering is used, instead of nailing laths across the rafters, it is proposed to cover the whole roof with similar boarding to the back, and upon this it is a simple thing to nail the shingles, placing them just

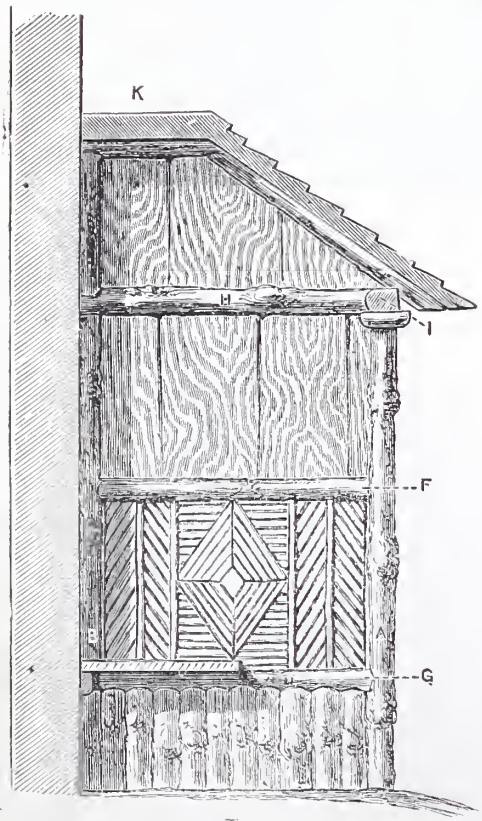


Fig. 3.—Inside of End of Lean-to Summer-House: Elevation.

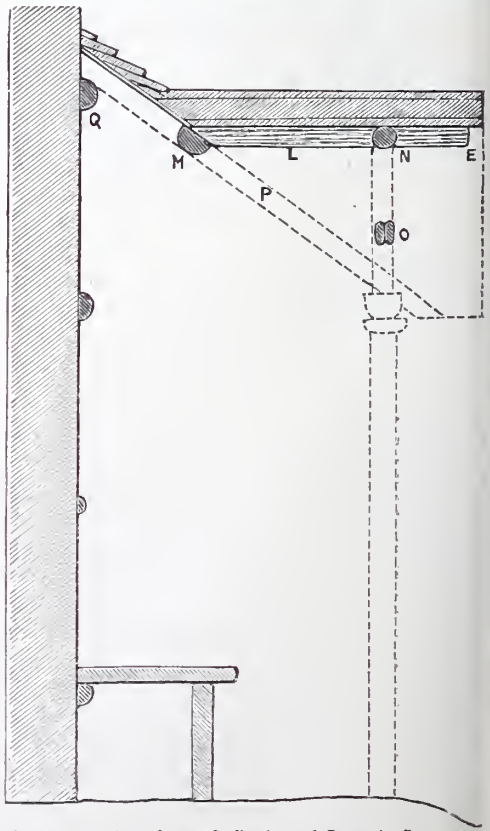


Fig. 4.—Section through Centre of Lean-to Summer-House.

as tiles might be placed. Whilst nailing them on, it will be necessary to have some person within to hold a heavy hammer against the place, otherwise the vibration will jar off the shingles as fast as they are fixed. A ¾ in. board, rather wider than half the length of the shingles, should first be nailed along the eaves, to make up the required thickness. It will be noticed that the ends of the rafters are made to project so as to give a good breadth of eaves—a desirable feature in so narrow a building, alike for shade, shelter, and the appearance of cosiness. If, however, the roof should be thatched, the projecting rafters will be unnecessary, as the thatch alone will form sufficient eaves.

But to return to our shingles. Down the "valleys" at the juncture of the main roof and the entrance gable a strip of zinc will, of course, be nailed before the shingles are put on, whilst along the ridges a strip of zinc will be nailed upon the shingles; and this latter will need painting to match the colour of the wood.

As regards painting the shingles themselves, the question is chiefly one of taste; and I imagine that the best taste would suggest that they should be left unpainted. Nature will soon tint them with her delicate green mosses, and give a far more pleasing colour than the brush can give. This, and the natural colour of the wood, will go well with the rustic work, and I presume that, saturated as they will be with oil, paint will not be needed to keep water out of them. If, however, paint should be used, it is recommended that a brown colour, in harmony with the natural bark of the rustic work, should be chosen.

Various suggestions may be given for finishing the inside of the roof. Supposing that round or half-round larch stuff has been used for the rafters (the latter is to be preferred for shingles, as giving a level surface to board upon), the space between the rafters may be covered with bark—virgin cork or otherwise—the chinks being stuffed with moss. But if this is done it will be well to fix the bark with screws, as the vibration caused by driving nails would displace or loosen the shingles.

A second plan under the like circumstances would be before nailing the boards upon the rafters to stretch matting across the latter — either ordinary garden bast matting or, better, the more substantial rush matting, both of which are very inexpensive. These have a pleasant natural colour (the last-named especially, of a greenish hue), and are so unartificial in their structure as to appear in no way out of place among rustic work.

Or it may so happen that suitable larch stuff is not to hand, and that ordinary sawn scantling has to be used for the rafters. If so, the whole roof may be hung with ling, as directed in a former article; or the rush matting may be stretched across the lower side of the rafters and tacked there, being afterwards more completely secured and finished by nailing a split hazel or other rod down the middle of each rafter. This last plan makes a neat and pleasing roof.

It scarcely needs to be said that to make such a summer-house look its best the wall on each side ought to be covered with ivy or other creepers; and it will also be obvious that, if the height of the wall permits the floor of the summer-house to be raised a step or two above the surrounding level, the structure will gain thereby both in effectiveness of appearance and in pleasantness as a place in which to sit.

THE ART OF GRAINING.

BY A LONDON DECORATOR

Grounds and Graining Colours for all Varieties of Oak.

The justly deserved popularity of oak graining for woodwork in situations which are very much exposed to either the variable influences of our English climate, or to hard usage and wear, is a fact patent to most of us. A passing glance at the houses in a street of middle or working-class build will usually discover that nine out of ten of the front, or entrance, doors are so treated; and although we find that amongst the aristocratic quarters of the metropolis and other large centres, very dark shades of bronze green, maroon, "leather," or cinnamon colours are much in vogue, with here and there an occasional entrance door of enamelled ivory white, oak graining of some shade and colour is still well patronised even in these high places. Notwithstanding the "monetary aspect" is, without doubt, the main reason of this partiality to oak for front doors—since woodwork finished in plain, varnished colours requires double the amount of preparatory work that suffices for work to be grained on—the patrons of the imitative art are sufficiently numerous among the wealthier residents of most towns to foster amongst grainers the study and introduction of distinct varieties of colour, instead of the monotonous repetition of ordinary polished oak. To this cause, far more than to any considerations of their suitability for *interior* work, the present use of "light oak," "medium," "dark," "antique," and other similarly termed graining effects, is undoubtedly due. In the papers upon oak graining already published in Work, I have confined my efforts to instructing the learner how to proceed in the imitation of ordinary figured oak of one colour only—viz., light, or wainscot, oak. My object in so doing—that the energies and attention of both writer and student might the better be concentrated upon the imitation of grain and figure—being now, I trust, satisfactorily fulfilled, it is here desirable, in order to obtain some measure of completeness, that the learner should extend his knowledge and practical study to those other varieties of figured oak, the demand for, and advantages of, which have been already briefly indicated.

The basis of all oil paints which are prepared as grounding colours for oak graining is, invariably—or should be—the ordinary white lead, ground in linseed oil. Although when mixing the ground for a very dark, or "antique," oak, the amount of such is, naturally, much less in proportion to that required for light or medium grounds, it is preferable to consider the coloured pigments as purely staining factors — called "stainers"—than as "body" or base pigments. Beyond the main consideration of tint or shade—a question materially affected by the lead—it may be pointed out, with advantage, that none of the ordinary coloured pigments furnish the opacity or solidity, nor the desired amount of durability, that white lead is noted for. Whilst in respect to the colours of oak, the grainer who always uses white lead is seldom guilty of those unnaturally bright and garish grounds which are wrong from every point of view. Sufficient white lead for one's purpose, therefore, with the addition of about one-tenth of patent driers, having been well broken up in linseed oil, the stainers are added, and well mixed, until the required colour is obtained. The paint should then be strained through a piece of old stocking, or such like mesh, and, finally, thinned to working consistency with about two-thirds of linseed oil to one of turpentine; or, if required with less gloss and to be quickly grained upon, the proportions may be reversed.

The pigments used for oak in all its varieties, whether for grounds or graining paints, may be briefly classified as either *opaque* or *transparent*. Under the first heading are the chromes, Oxford and yellow ochres, and Venetian red; and these should only be used as stainers in making "grounds." Although the degree of transparency possessed by the colours in the other division varies considerably, not only one from the other, but with different qualities of one pigment, they are sufficiently translucent to give due effect to any coloured ground they are superimposed upon. Raw and burnt sienna—or *Terra di Sienna*—raw and burnt Turkey umber and Vandyke brown, are the most useful of this class; whilst for the purposes of glazing and overgraining, ivory and blue blacks, with Prussian and indigo blue, may be added to the list—the blues being, however, seldom required or advisable.

A detailed description of the above, and all other house-painters' pigments, having been given in the elementary papers in Vol. I. of Work, it will only be necessary here to briefly reconsider the former in their relation to graining purposes.

Chrome, of either the "middle" or "orange" colour, may be useful, *to a slight extent*, in staining ground colours when very bright and rich imitations are desired. If used with other more sombre stainers to lower its tone somewhat, and providing the graining colour and overgraining are used to still more modify its native brightness, the effect may justify the means; but, generally considered, chrome is neither conducive to good colouring or a natural, woody effect. Although one may sometimes see a door grounded with a bright chrome-yellow tint for light oak, or a decided orange-red colour for medium oak, such will certainly not be the work of one who has studied and worked from the real woods, much less a good grainer.

Yellow ochre, *Oxford ochre*, *Italian ochre*, and so forth, are all of one similar nature and colour, their main difference being that of quality and price, and the degree of warmth or redness noticeable—the so-termed "Oxford" being the richest. Their proper function in graining is purely that of staining the white lead paint for ground colours. It is no uncommon matter to see an incompetent person prepare graining colour with this pigment, a use which it is totally unsuited for, since, being decidedly opaque by nature, the due effect of the ground it is spread upon is very much marred. If very rich and light oak is required, raw sienna is the yellow pigment which ought to be used, but even this is seldom required, as decided yellow and bright tones are not true characteristics of real oak colours. The ordinary commercial yellow ochre is, moreover, the only one of this class of pigment we need use, since the addition of a little Venetian red will make any warm tint desired. This latter pigment, a species of *burnt* ochre—whereby the redness is acquired—is the only one commendable for obtaining warmth in grounds, not only for oak, but also for the red imitations of mahogany, etc. Turning to the transparent and semi-transparent pigments, raw and burnt umbers are the two most useful amongst them, and, as such, demand a little more notice in these graining papers than they have heretofore received.

Umber is a natural pigment, consisting of a mixture of clays and brown hematite, originally obtained from Umbra, whence its name. The best is now obtained from Cyprus, and is usually known as *Turkey umber*. Besides the usual washing and grinding, which all such native pigments have to undergo before being fit for commercial use, the umber is subjected to a moderate amount of heat to obtain the tone we know as *raw* umber—an almost neutral brown. When strongly heated, the pigment attains to more warmth and richness, and we then have the *burnt* umber of commerce. This pigment is also largely produced from other artificial sources, the bulk of cheap umbers being of this kind. Besides being valuable on account of their transparency, the umbers are also particularly noted for their good drying qualities in oil, so much so, that under certain circumstances they may be employed as drying factors. For graining purposes in oil colour this is a very commendable property, and one which the competent worker will practically bear in mind when using large proportions of the pigments. If the grainer was possessed of only the raw and burnt umbers for staining his oil graining paint, the imitation of varieties of oak colour would rather gain than lose in natural colour status; for the former is not to be bettered, generally, for very light imitations, whilst burnt umber may be used from light to the darkest of "antique" oaks. They are, further, invaluable for mixing grounds.

Raw and burnt sienna, which were described fully in the elementary papers, are useful for oak colours when a forced richness is required. Similar in nature and preparation to the umbers, they appear rather more transparent than the latter, but lack the natural drying qualities of umber when used in oil. Their chief province in graining is for those imitations of woods which are obtained with pigments ground in water, and for mahogany, maple, walnut, etc., they are almost indispensable.

Vandyke brown is also an earth pigment, which owes both its name and, I believe, its popularity to the celebrated Dutch painter, by whom it was largely used. Our modern Vandyke differs but slightly in nature and preparation from the original pigment. It is a very dark and rich brown, neither inclining to yellow or red, but yet so rich and deep as to make ivory black look poor against it. Since in its nature it partakes largely of bituminous substances, it is a remarkably *slow drier*, and if used alone in oil will require to be diluted with little else than terebine or a similar drying liquid. "Japan gold size," it may here be mentioned, is not a suitable drier to use with linseed oil paints; terebine is far preferable, although with turpentine mixtures the gold size is an admirable drier. Like the *siennas*, Vandyke brown is mostly used for graining when ground in water. In overgraining oak, it is the principal pigment used, its colour, in water, being usually warmer and richer than when used in oil.

The few remaining pigments mentioned with the transparent colours for oak graining are all of the "cold" type—viz., neutral blacks and blues. Of the former, blue black is the most useful for oak and that principally for overgraining in combination with Vandyke. Black is also useful in mixing the dark, "drabby" *grounds* necessary for obtaining very "ancient" oaks. To some of my readers who have worked, perhaps, in a professional way at graining, the use of the transparent blues of Prussian and indigo may seem a questionable, or, to say the least, a curious, innovation. To those whose minds are open to the results of experiments and practical experience, I commend the study of such natural oak colour effects as are to be obtained by using occasional touches of "bluish" washes made from the above transparent pigments. It must be remembered that richness of colour in woods, as in polychromatic effects, is but a matter of comparison and contrast, and therefore, if, instead of forcing their colour values by bright grounds, bright graining colour, and richer overgraining, some contrasting cool tones are introduced, it is possible to obtain more *natural* colour variety and yet retain the native modesty of the real oak contrasts. One of the most successful pieces of interior oak graining that I remember to have come across was such an example, which had been worked upon a ground slightly "cooled" with blue, and with a graining colour anything but rich in tone. Again, Prussian and indigo when ground in water are vastly different to the same prepared in oil; whilst the mellowness given by ordinary copal or oak varnish is, generally speaking, very much in excess of that which either French or wax polishing will give to real oak. It is by far the better plan to work the first stages of a good piece of oak in sober tones, leaving to the glazing and overgraining to enrich, if necessary, the work, than to start with a false brightness, and, in the final phase, struggle to modify the fault.

The binding of distemper graining pigments may here be touched upon ere concluding this paper with a few definite recipes for oak colours. The principle which underlays the use of a gum with water-colour painting, and with which the pigments are fixed to the paper, is the same when the water colours are connected with graining. Beer for the latter purpose is, however, the usually accepted binding medium. Although it was once a recognised imposition for the grainer to represent beer—and that in no very minute quantity—as absolutely necessary to his work, a more honest and educated knowledge is now current. Vandyke brown requires no binder for overgraining in water, and the siennas but very little, and that in exceptional cases. When using black or the cool tones—either alone or in combination with warmer colours—a little beer is necessary, since black has no binding power of itself. Although if mixed with Vandyke in equal proportions, the latter will bind the black also, it is always best to be sure that the overgraining will not work up when varnishing our work. For black alone, when finishing "antique" oak, the wash must be strong in beer; and for mixed washes, the half beer is a safe proportion. For the student's future use and reference I now append a short list as a guide in mixing grounds and graining colours of the varieties I have indicated, at the same time commending him to work ultimately more by knowledge and understanding than by recipe.

For very light oak the ground colour is made from white lead paint, tinted to a decided cream with yellow ochre. The graining colour may be stained with raw sienna and raw umber, or the latter alone; and the work overgrained in water with Vandyke brown and blue black or indigo, used very weak in colour.

Ordinary light oak requires a clean buff ground, stained by ochre, and occasionally a touch of Venetian red or umber, according to required warmth or coolness. Raw umber is sufficient for the graining colour, or burnt umber, if desired of a richer cast; Vandyke and blue black for overgraining.

Medium oak is best upon a warm buff, the red and ochre therein being slightly toned down with umber. Burnt umber alone makes a splendid graining colour, and Vandyke is usually sufficient for shading.

For dark oak the grounds are best made with three pigments—ochre, burnt sienna and burnt umber. The best grounds for this variety, although showing a decided yellow cast, require more umber than the preceding one. The presence of red should be very apparent in the mixture, but both that and the yellowness should be sobered by umber. The graining colour may be burnt umber, or burnt sienna and black, overgrained with black and Vandyke washes, either used separately or as a mixture.

Very dark or antique oak graining has been of late years in comparatively strong demand—a treatment doubtless introduced by the use of so much ammonia-fumigated real oak. A neutral, "drabby" ground is most suited for this, both the red and yellow being very subservient to the umber or black tones. The graining colour for this may be either Vandyke, ground in oil, or ivory black and burnt umber; whilst the overgraining will give very deep and transparent effects if blue black or even ivory black is used. A little Vandyke touing—here and there—will improve the work in its entirety. Vandyke alone for the overgraining will make it very rich, but transparent black tones are more characteristic of the real "antique" colour.

Mechanical and patent aids and imitations will be considered in the following paper of the series.

PRACTICAL DETAILS OF BOOKBINDING.

BY GILBERT CLARKSON.

Covering Pamphlets—Gathering and Collating—Rolling and Pressing.

After pamphlets have been stitched whether with wire or thread, the next operation is that of covering, provided they are to be covered. This is a very easy matter, but as I see that operators in different places go about this process in a many different ways, it will not be out of place to say which method I like best, and which, to my mind, is the most economical of time—a very important item in a long job.

We will suppose the pamphlet to contain 16 or 20 pp. Proceed thus:—Lay the cover out on the table with the inside uppermost and the head at the right hand, knock up a parcel of, say, twenty or fifty pamphlets and paste or glue the backs. Use paste by all means, if there is time to let them dry. Set them down at the right hand, and lift one and place it down in the centre of the cover and draw the front over it. Repeat the operation throughout the job. The operator will thus be able to watch whether the covers are being drawn on straight. The front of the cover has generally more printing on it, and if there are any lines they can be kept even, and the pamphlets will have a decent appearance when they are cut. A good workman should be able to cover close on a thousand per hour. If the pamphlets contain a number of pages

ıd have been sewn, it will be best to knock ıem well down with the hammer before ıvering them, or they will cause no end of ouble in the cutting. They should be well ıbbed in the back with the folder, to make ıe covers stick properly. People do not ınt pencil-cases in the back of a pamphlet a shilling novel.

Pamphlets of many sections may be ıtched with thread through the side, but will be necessary to make holes for the ıedle to pass through. This may be done ıth the hammer and bradawl, or a stabbing achine may be had for the purpose. ake the first hole in the centre of the ıck, about midway between the printed atter and the outside margin, the other ·o at equal distances from the first and the ·ad and tail of the book. I had almost rgotten to mention this operation as the ıre machines have thrown this old fashion the background.

After the ımphlets ıve been ›vered ıd proper- dried, it ill only be ecessary cut the lges of em be- re send- g them ıt to the ›ading ıblic.

After the eets of a ›ok or an ition of ›oks have en fold- , they are ıd out in aps in al- ıa betical der and ıthered. ıe usual ıy is to ›egin at e bottom ıd rise to ıe top," as e song ›es, *i.e.*, gin at the d or last eet of the ›ok and ılk up the floor lifting one sheet at a time ›m every heap until the first or title page reached. This is a long, tiresome job if e edition is a large one, and many a mile ıs to be walked before all the sheets are thered. A large revolving table is now ›ing introduced into the shops, and the therers sit, and as the sheets come round ey pick them off one by one.

While the sheets are being gathered by ıe set of workers another set are engaged collating them at the same time. This is e right method of procedure, for if there ıve been any mistakes made in gathering ıey can be rectified at once. There e sure to be mistakes made; two or more ıeets may be lifted from one heap, or some ıe may be missed altogether. There might › two or three such mistakes in one book.

Collating is done by taking the book in e right hand by the upper corner of the re-edge, and with the left hand opening the sheets at the back and letting them fall successively one after the other in alphabetical order, as A, B, C, etc., to the end. Sometimes books in folio or quarto are collated with the needle by raising the sheets one by one from the table, and it is amazing to see how quick some girls can do it. This practice, however, should not be encouraged, for it is apt to tear the sheets, and besides, it is better to take a little extra time for collating, as it is an awkward thing for a reader when he is enjoying his book to find a few sheets mixed up in some queer mystical fashion.

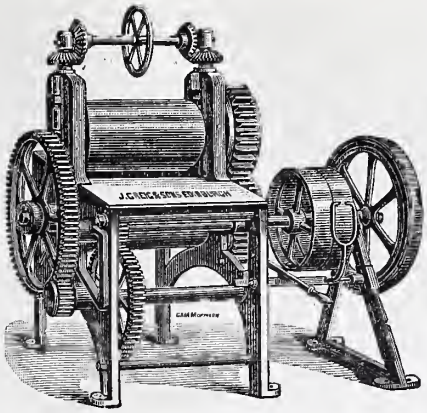


Fig. 9.—Greig's Bookbinders' Rolling Machine.

After gathering and collating, the books will be ready for pressing or rolling. Cloth books, *i.e.*, books bound in cloth, are seldom rolled; a nip in the press is all they get. If the books are not very thick, knock them up nicely at the back and head, and build them into the press between smooth wooden boards, taking care to have them built evenly, and on the top of each other, so that they will press flat all over.

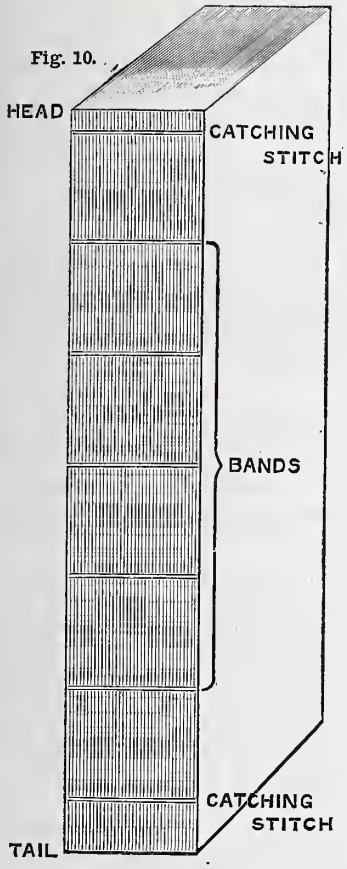
The better class of books are always rolled or "machined," as this operation is termed. The mode of operation is as follows:—Divide the book into parts or sections, and place a section between two smooth sheets of zinc or tin, and pass it through between the rollers of the machine while in motion. It requires very little skill for this part of the work, a little care only being needed in setting the rollers to give the desired pressure. If too much pressure is given the books are liable to wrinkle or to get nipped at the corners, which would be rather a serious matter if the book was a valuable one.

The machine is just like an ordinary domestic mangle, only it is made much heavier, and the rollers are of steel instead of wood, as in the mangle. The rollers are adjustable to any thickness.

Messrs. John Greig and Sons, Fountain House Works, Edinburgh, supply thoroughly well-made machines of this class (Fig. 9). They can be fitted for steam or hand-power.

The amateur bookbinder will not have a rolling machine, nor is he likely to have an hydraulic press, so he will not be able to roll his books or press them sufficiently to give them a feeling of solidity. But he need not despair, for there remains for him the old process of "beating." For this a large flat hammer and a stone will be required. The books are divided into sections as for rolling. A section is taken and placed

Fig. 10.



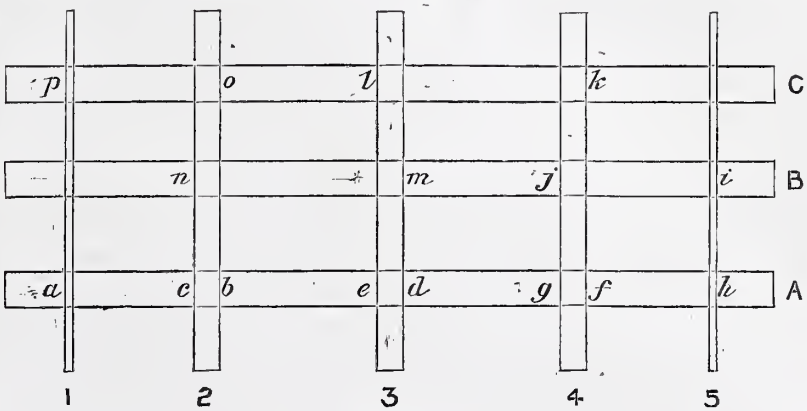


Fig. 14.

Fig. 13.

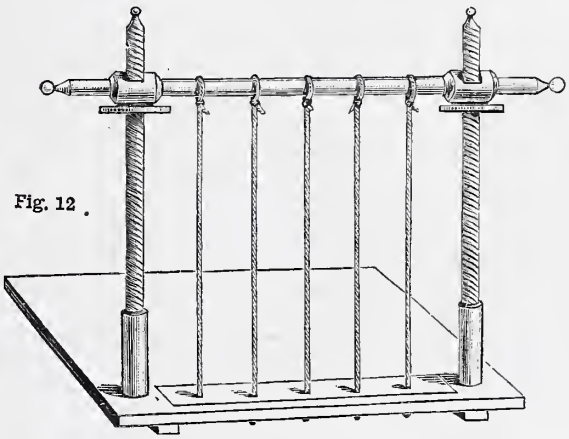


Fig. 12.

Fig. 10.—Back of Book, showing position of Saw Marks.

Fig. 12.—Sewing Bench set for Five Bands.

Fig. 13.—Key for fastening Cords to Bottom of Bench.

Fig. 14.—Diagram showing Method of Sewing "Two Sheet on."

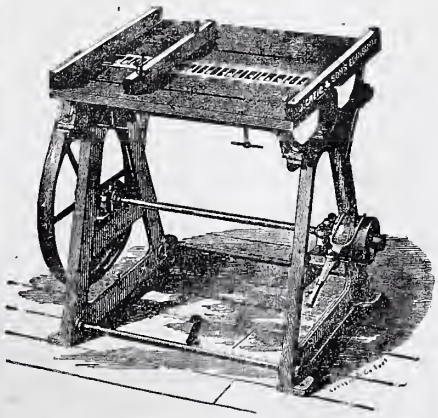


Fig. 11.—Greig's Circular Sawing Machine.

upon the stone and well beaten over with the hammer, drawing it with the left hand towards the body, so as to bring the various parts successively under the hammer, and care should be taken not to give more blows in the one part than the other. The section is then turned and the beating repeated, and so on until the whole book has received the same treatment. It will be necessary during this process to keep the book knocked up even at the head and back.

If there are any plates in the book it will be well to put them in now. Care should be taken to make the margins correspond with the text of the book. They should be placed to face the page where reference to them is made; plates that are folded in the centre should be pasted out from the back or mounted upon a strip of paper called a guard, so that when the book is open the entire plate will be seen. Sometimes a book will contain a large number of plates, and the directions given will necessitate them being placed at the end; in this case, they will have to be overcasted and sewn on the bands—a process which I will describe further on.

Before commencing to sew, it will be necessary to saw a number of grooves in the back of the book to take the bands upon which the book is to be sewn. The number of bands is determined by the size and the style in which it has to be bound. Besides the bands, a groove is made at the head and tail of the book for the catching stitch. This prevents any unevenness showing on the back. (See Fig. 10.)

Sawing is done by first knocking the book up and placing it between two cutting boards, allowing it to project over the edge of the board, and afterwards screwing it up in the lying press, the whole being sufficiently elevated to prevent the sawing damaging the cheeks of the press; care should be taken not to saw too deep, as the book would not look very nice when it would be opened.

When there are a great number of books to be sawn, the operation becomes very laborious, and a great deal of time is taken up: matters of no small importance in these days of cheap binding. To effect a saving in both of these items, Messrs. John Greig and Sons make a circular sawing machine (Fig. 11) which does the work better than it can be done by hand, and a very great deal quicker.

The operation of sewing a book is one which requires extreme care, as a book unless it is well sewn will not be a success when bound, no matter how much care is taken with the after processes.

Fig. 12 shows a "sewing bench," set for five bands. The bench is formed of hard wood throughout. The bed has an opening extending to within a few inches from each end. Uprights are fixed at each end, and these are screwed or threaded almost the entire length, and are provided with nuts on which the cross-bar rests.

The bands are fastened to the cross-bar, which rises or falls as the nuts are raised or lowered. It can be easily made for a few shillings. The handy amateur can construct his own, or he may use the back of an ordinary kitchen chair in lieu thereof. Fig. 13 shows a key for fastening the cords to the bottom of the bench.

A good three-ply cord should be used for the bands, one that will scrape nicely. The reason of this will appear by-and-by. The thread also should be well selected: a good linen thread as free as possible from knots and burrs. The most useful sizes are 3-cord 25 and 3-cord 18.

Books can be, and are, sewn in a variety of methods, according to the size or thickness of the sheets. If the sheets are thick, or if they contain a plate or a map, they should be sewn all the way up, or to use a technicality—"one sheet on." There are very few books sewn one sheet on, unless there is something special about them. The most common methods are two sheet on and three sheet on. Sometimes, indeed, they are sewn four, five, and six sheet on. But what is meant by this "sheet on" business? asks some amateur. I will try and make it plain, although it will be somewhat difficult. Five minutes in a binding shop watching a sewer would do more towards giving the requisite knowledge than pages of writing.

When a book is to be sewn two sheets on, set up three bands on the bench. Take a sheet, turn it face down, and place it with the saw-marks close up to the bands. Insert the needle in the mark made for the catching stitch at the tail of the book, bring it out at the far side of the first band, bring it round the band, put it in again at the near side of the same band, carry it to the second and third, sewing in the same manner as at the first band, and bring it out at the head. Take the second sheet, insert the needle in the mark at the head, bring it out at the bottom side of the third band; take the third sheet, insert the needle at the top side of the same band, bring it out at the bottom side of the second band, put it into the second sheet at the top side of the second band, bring it out at the bottom side of the first band, put it into the third sheet at the top side of the first band, bring it out at the tail, and fasten up. Go on in the same way throughout the entire book, always working with two sheets until the last sheet is reached; sew it all the way up as the first was done. The first and last sheets are more liable to break away than the others. Perhaps the diagram, Fig. 14, will help us to understand this better; A, B, and C, represent the first three sheets; 1, 2, 3, 4, and 5, the saw-marks, and the position of the bands. The small letters, if taken in alphabetical order, will show the outs and ins of the needle. Thus in at *a*, A, out at *b*, in at *c*, out at *d*, and so on until *h* is reached; the needle will be at the outside of the first sheet or A, which will have been sewn all the way up. Now in at *i*, in the second sheet or B; out at *j*, B; in at *k*, C; out at *l*, C; in at *m*, B; out at *n*, B; in at *o*, C; out at *p*, C: and fasten.

The diagram has little of the appearance of a book on the bench; it was drawn as you see it, for the purpose of showing this intricate matter plainly and simply, which I think it does.

Care should be taken not to draw the thread too tight at the head and tail, and it is better to allow the book to swell a little, as this will help in the rounding process. Much of this, however, will depend upon the taste of the binder. Some men like to work with books that have been sewn tight, and kept well down on the bench while sewing. Others again prefer the opposite; *i.e.*, books that have been sewn slackly and allowed to swell. In the case of tight sewn books, the backs will always be flat, no matter how much they may be hammered; and in the other case the backs will be very easily rounded—in fact, too easy sometimes. I have seen many a little bit of unpleasantness arising between the sewer and the binder over this matter. It will be best then for the general sewer, unless special instructions are given, to take the middle of the two extremes.

When a book contains a large number of plates, or when the back is so far gone that they will not hold the thread, as in the case of music, it is usual to overcast it. This is done by first knocking the book up at the head and back, and taking a small cutting off the back to make the sheets even. It is then glued and allowed to dry. When dry it is sawn in the usual way. Three or four sheets, according to the thickness, are then taken, and commencing at the catching stitch, they are whipped over and over, allowing a sufficient number of stitches between the bands to give the necessary strength, ending at the other catching stitch. The whole book is treated in the same manner. This forms it into sections, and the sewing is proceeded with as in an ordinary book.

There is another method of sewing which is now resorted to for high class books. It is that of sewing on raised bands, known in the shop by the term "flexible." In sewing in this manner, it is only necessary to make a saw-mark at the head and tail for the catching stitches, and for the sake of keeping the sheets and bands straight, it is better to mark with pencil where the bands are to be. This *is* essential in good books. Bring the thread backwards over the cords, for if brought out at the near side it will be sure to tear the sheets.

Silk thread is generally used for this class of work. The effects of this style of sewing can be seen in the fine Bibles and Prayer Books emanating from Oxford and Cambridge, and Mr. Samuel Bagster and firms of like report.

CIRCULAR SAWS: THEIR ADJUSTMENT AND MANAGEMENT.

BY M. POWIS BALE, M.I.M.E., A.M.I.C.E.
Author of "Wood-working Machinery," "Stone-working Machinery," "Saw-mills," etc.

I MENTIONED in page 138 of WORK, Vol. II., the first seven causes for circular saws sometimes running out of truth, and I showed how these various defects in working might be remedied. I said there were fourteen other causes yet to be brought under the reader's notice, and I will now proceed to enumerate and deal with as many of these as the space at my command will allow.

Stated in proper order of sequence they are:—

(8) Saw becoming "buckled" through overheating from the friction of the wood or heat from bearings, etc.

(9) Collar or steady pin of saw spindle out of truth.

(10) Saw plate of too mild a temper or untruly ground.

(11) Saw not compensated, hammered, or distorted enough when cold—by the maker—to run true when warm and at its full speed.

(12) Too much "lead" or rake on the saw teeth.

(13) Saw teeth allowed to get out of space or shape.

(14) Too long a saw guide or fence, causing binding of the wood.

(15) Improper packing of the saw.

(16) Binding of the timber through not being "opened out" as it leaves the saw or other causes.

(17) Chips getting between saw and packing pieces.

(18) Through end play on the spindle.

I will now consider these eleven causes

and the means for counteracting them, leaving the remaining three to be dealt with in another brief paper.

(8) A very common cause for saws running untrue is the heat conveyed from the bearings through the saw spindle to the eye of the saw, and many plans to get rid of this have been tried. It arises, of course, in the first place from the bearings being out of order, screwed up too tight, or from driving with too narrow a belt, which has to be strained too tight, or from running at too short centres, which also necessitates a tight belt; thus undue strain and friction are put on the bearings and heat engendered. These defects can usually be remedied without much trouble. Many schemes for keeping the saw spindle cool have been tried, including one in which it is made hollow, and a stream of water allowed to pass through it and escape at the collar on both sides of the saw, the centrifugal force distributing it over the surface of the plate. To this spindle is fitted a contrivance for relieving the saw and allowing a little end play when necessary, and when the saw is through the cut the end play is taken up automatically by means of a weighted lever and knuckle-joint arrangement. For sawing pitch pine and gummy woods which clog the saw plate, this plan of lubricating with water should be decidedly useful, as it keeps the saw clean and cool, and it may consequently be run with less set. With the same object in view the author has recently constructed a new form of ventilating bearing, through which a steady current of air passes; this has been tried, with very satisfactory results. A saw spindle has also been patented, in which the collars are arranged with a circular groove, and several rows of curved grooves extending to the periphery; when the spindle is in motion a current of air enters into the circular grooves and escapes at the holes at the sides of each collar, thus acting somewhat after the fashion of a fan, and keeping the saw spindle cool. It is needless to say especial care should be given to the matter of lubrication. Get an oil with plenty of *grease* in it, and add one part of finely powdered plumbago to three parts of oil, and, with properly constructed bearings, little trouble should be experienced in keeping them from heating.

(9) Bear in mind if the collar of a saw spindle is only slightly out of truth, this is multiplied considerably in a saw of large diameter. Again, a seamy saw spindle with a bit of metal torn up is enough to throw a saw out, or if packing is used between the collars, and it is rucked up or uneven, it will have the same result. Saws are often blamed for cutting untrue, when the fault lies with the collars or pins. The side of the saw nearest the wood should be constantly tried with a straightedge, and should it be found to bulge in the centre, it will probably arise from the saw collars being out of truth, or improperly concaved. The collars should be carefully tried with a straightedge, and any inequalities or lumps removed. If the collar attached to the saw spindle—that is, the one nearest the wood—is perfectly flat, have it removed and slightly concaved, when the bulge in the saw plate will probably disappear. Inequalities in the saw collars may be temporarily remedied by introducing one or more paper or thin leather washers between them and the saw plate. If a saw should permanently buckle or bulge even slightly, from any cause, it should be at once hammered, as by use the trouble will be increased, and be more difficult to remedy. A skilful sawyer can tell by trying a saw with his fingers when running whether it is buckled or out of truth, even if it be only slight.

(10) This rests with the saw-maker. All circular saws should be made of the finest quality of steel, combining, as far as possible, toughness with hardness, be uniform in temper and gauge, and be ground on a face plate. It is important also that the saw be scientifically hammered, so that the tension or strain is properly distributed. "Cheap" (?) common saws—in fact, all kinds of wood-cutting tools—are dear at any price. No professional workman will be troubled with them, and no opportunity should be lost of warning the amateur against purchasing inferior articles, which will only be a source of trouble and vexation to him as long as he continues to use them.

(11) No. 11 also rests with the saw-maker to a considerable extent, but not entirely, as the speed at which the saw is run should determine the amount of distortion necessary. Thus a saw may be hammered to run perfectly true at a slow rate of speed, say, 6,000 ft. per minute, but if this is quickened up to the standard speed, say, 9,000 ft. or 10,000 ft. per minute, it may become wavy and pliant, and run out of truth. It therefore follows that, if saws are to be run at any unusual speed, the saw-maker should be so informed, that they may be distorted or hammered to a suitable tension, and the tension uniformly distributed. If a saw is distorted too much, either at the teeth or centre, it will, when subject to improper usage and the friction of sawing, become "rim-bound" or "dished;" hence the importance of a perfectly adjusted saw to commence with, and the absurdity of expecting fine work from a cheap saw. It is, of course, apparent that the rim of a circular saw runs faster than the eye, and consequently heats and expands faster. To overcome this unequal expansion, and allow the saw to expand equally and run true when in work, additional heat is created in the centre by means of "packing" in this country, whilst in America the same end is attained by distorting the saw to a greater extent when hammered by the maker.

(12) In sharpening saw teeth with a hook to them, such as is found in the different forms of gullet and briar teeth, care must be taken that too much "rake" is not given to the teeth, or they will be found to tremble in work, dig into and draw the wood, and run from the line; of course, some woods will stand more rake on the saw than others.

(13) Allowing teeth to get out of space will, in some cases, make a saw run untrue; say, alternate spaces set wider than the others; the teeth following those spaces have more work put upon them, and being set all one way—say, to the right—they naturally pull hardest into the wood in that direction, consequently the saw runs to the right. Hence the necessity of keeping all the teeth uniform in space. This can readily be done by using an adjustable sheet steel template shaped to the teeth in sharpening.

(14) The author is of the opinion that a not by any means unusual cause of a saw jamming and buckling is the use of too long a saw guide or fence, so that the timber becomes crowded against it and has not room to open out. A fence for rip saw should not, as a rule, project above three or four inches beyond the roots of the saw teeth unless very thin stuff is being sawn. For sawing deals, etc., some makers now fit friction rollers in the fences, arranged to project slightly beyond the face of the plate.

(15) The proper "packing" of a saw, unless of very thick gauge, is a matter of paramount importance in its effective working. The object of packing, in addition to supporting and lubricating the saw, is to allow it to expand equally from the friction or heat created by the packing rubbing against it. To ensure this it is very necessary that the saw is packed evenly and equally. The plan generally pursued in this country is to screw pieces of wood to the finger-plate, and below the saw table on either side of the saw, the wood being rebated to allow the hemp gasket, or other fibrous material, charged with grease, to be packed in tightly on either side. There are a right way and a wrong way of doing even this simple operation, and care should be taken that the packing is put in evenly, and bears uniformly and without undue pressure on both sides of the front half of the saw. However, in preference to the above, we can strongly recommend the following simple plan:—Take either two pieces of hoop iron or strips of hard wood of the length of the saw from the teeth to the eye, and of a width that will reach not quite flush with the top of the table; then take some flax or rope yarn and lap it evenly round the strips from end to end till they are made thick enough to fill the packing space and bear evenly and not tightly against the whole front half of the saw plate up to the spindle.

Instead of packing the back half of the saw as some do, take two small discs of leather and attach them to the wooden packing pieces which are fitted to the frame of the bench, so that they bear on either side of the saw at the back and near the rim or roots of the teeth, and so steady and guide it. It is a mistake to use much oil in the packing, as this is wasteful and unnecessary. The above will, I think, be found a decided improvement over the plan generally pursued—of ramming down packing on either side of the saw, as this is, at the best, uncertain, as should the packing be tighter at one point than another, or should it be lumpy, the friction on the saw plate is uneven, and it will often cause it to run "wavy" and out of truth.

(16) In sawing woolly-fibred and difficult timber special means should be taken to open them out as they leave the saw. This is usually done by the sawyer with wedges driven into the kerf by hand: this is often neglected, thereby causing many a saw to jamb and buckle. To obviate this, the use of a revolving opening wedge can be recommended; this should be fixed immediately behind and in the same line as the saw. The wedge should be made preferably of steel, circular in form, and say half an inch thick at its centre, tapered down to a blunt edge at its circumference, its diameter being regulated by the size of the saw. It can either be arranged to project through the face of the bench, or be mounted on centres at the end of a lever, and suspended behind the saw. The wedge as it enters the cut is revolved by the friction of the wood, and thus relieves the saw from a considerable amount of side friction. Instead of a revolving wedge a fixed steel spreading-knife or wedge can be employed; in any case something of the kind is certainly to be recommended, as it tends to relieve the saw considerably, and is always there when wanted.

(18) End play on the saw spindle should be prevented; this can be done by means of an adjustable lock-nut.

NOTES ON GLASS PAINTING.

BY FRED MILLER.

Tracing.

It would be a great improvement to our window blinds if we painted each square with some simple pattern, and I will now tell my readers how to set about accomplishing this. You want some glass tracing brown, and you could purchase some where you get your glass and leads.

Buy a couple of fine black sable writers and mull up the colour on a glass slab, putting as much loaf sugar with it as will bind the colour firmly to the glass when it is dry. The proportion of sugar would be somewhere about one to ten of colour, but the best test is to put a small portion of sugar, and, when mulled up, paint a few strokes on a piece of glass and dry before a fire. If it comes off easily, add more sugar. Should the colour dry shiny and sticky, this tells you you have too much sugar in it, so you must add more colour. Colour improves by being kept, for though it will dry hard you have only to add water and mull it up again to make it fit for work. You must have your patterns drawn out the proper size on paper, and you then place your glass over the design and follow it with the brush. At first you will find that your brush touches the glass before you seem aware of it, and you will have some difficulty in following the design. Then possibly your hand will be shaky, and your strokes, instead of being firm and regular, will be uncertain. You must not expect to trace a square with feeling and precision until you have tried your 'prentice han' on many a failure, but it does not matter how often you rub out, as the glass is in no way injured. Keep your brush full of liquid colour (constantly add water) so that it flows freely on to the glass. Never work with a dry brush, for unless the colour flows freely on to the glass, a thin, scratchy line is the result, and lines on glass must have a certain solidity, as they have to look well *when held up to the light*, an important consideration.

Fig. 1.—Design for Circle of Glass for Centre of Window. Subject—Medlars, Tit, and Small Butterfly.

The secret of good tracing is to get a crisp, firm line without doing it in a laborious, mechanical way. The freer, and consequently easier, the tracing is done the more artistic the result. The outline need not be equally solid everywhere. I like to get a certain variety in it by allowing the colour to run on in a more diluted state in some places than others.

In making a line semi-transparent, effect

this by putting thin colour, *i.e.*, colour largely diluted with water, on freely rather than solid colour on thinly with a dry brush. When the outline is dry, I sometimes wash a little very thin colour on certain parts of the pattern, say where one leaf comes over another, or in the centre of a flower, or anywhere where a want of relief is felt. This washed-on shading, if done with feeling, adds to the artistic quality of the work, as it lessens the mechanical appearance. Should it be desirable to do this shading in a little more exact way, a little colour (ancient brown) finely ground up in turpentine, with as much Venice turpentine to bind it on the glass as the sugar did in the tracing colour, will accomplish this. This oil shading colour is put on with camel-hair brushes very thinly. It should be put on freely and in a liquid manner, but if you put an excess of turps in it the colour is apt to spread on the glass. You must use it thin enough to flow freely, and not too thin to run. When this shading colour is getting dry, dabbing the finger over it evenly will lighten a dark passage, and give an evenness of texture to it, after the manner of lantern-slide painting. Should it be desirable to remove this oil shading, even when quite dry, a little turps on a soft rag will effect this.

STAINING.

We now come to an interesting branch of our work, *viz.*, producing that beautiful, golden yellow colour on glass. As I have heretofore said, coloured glass is made in the "pot," and there is only one colour that can be given to glass after it is made, which enters chemically into its composition and stains it without lessening its transparency. Chloride of silver is the active agent of "yellow stain." It can be made by dissolving a piece of ordinary nitrate of silver, which can be procured of a dealer in photographic requisites, in water and precipitating it by throwing into this solution some common table salt, when the silver will fall to the bottom in the form of a white precipitate. Pour off the surplus water and wash the residue a few times in hot water. Allow this white powder to dry, and as it is sensitive to light it will darken by exposure. When dry, mix with about three or four times its weight of "yellow lake," and grind up thoroughly in turpentine, and as you use it remix a little with a small quantity of Venice turps in addition to ordinary turps. This yellow stain acts with varying strength on different makes of glass, and one way to test the strength of your stain is to paint a little on a small piece of glass and place it in the brightest part of a clear fire. When the glass gets thoroughly red hot take it out, and when cold rub off the yellow lake (this is only used as a mordant and has no effect on the glass), and see what strength of yellow you have obtained. The whiter the glass the stronger stain you can use, and the more colour the weaker. To stain some shades of greenish white it is necessary to add a good deal of yellow lake, for it does not do to merely put an ordinary stain on very thinly. The more stain you apply to glass the darker it comes out until you can get it a deep orange, but as a general rule you only want to have a suspicion of the yellow floating, as it were, over your pattern, with here and there a stronger touch to give accent to it.

This yellow stain you apply to the *back* of the glass when you have traced it, as it must never come in contact with other colours. Keep the stain well inside the pattern, and always look straight through the glass. If you look at it anglewise you are apt to get the stain beyond the outline.

Having traced and stained your glass send it to be burnt. The firm I have mentioned will burn it for you, but wherever you can get china burnt, there can you have your glass fired. Should the stain have come out too weak, or should there be any defects in the tracing, touch up and have it refired. After that the glass only requires leading. Of course, it is impossible to go very deeply into the art of glass painting in the space that can be devoted to one subject. I may perhaps make some remarks on the subject of figure painting and the use of enamels on glass in future papers, in addition to the brief hints given here on simple glass painting.

The illustrations accompanying this article are reproduced from full size designs drawn expressly for the purpose of glass tracing, and the reader ought to have no difficulty in enlarging any of them to the required size, or using them as given in the pages of WORK.

Fig. 1 is a design suitable for the centre of the window, the left-hand half of which is shown in Fig. 2. Here, as the design is *not* going to be *repeated*, a more naturalistic style can with advantage be adopted, and the introduction of birds, as the tits on the branch of medlar, give point and accent to the design.

Fig. 2, in addition to showing the left-hand side of the window, affords designs suitable for being repeated as often as necessary, until the required number of squares are painted. Windows composed of squares that are merely the repetition of three or four simple and not *too naturalistic* designs are most effective and beautiful, the yellow stain giving a great variety of colour. The quarry A may be alternated with the floral ones.

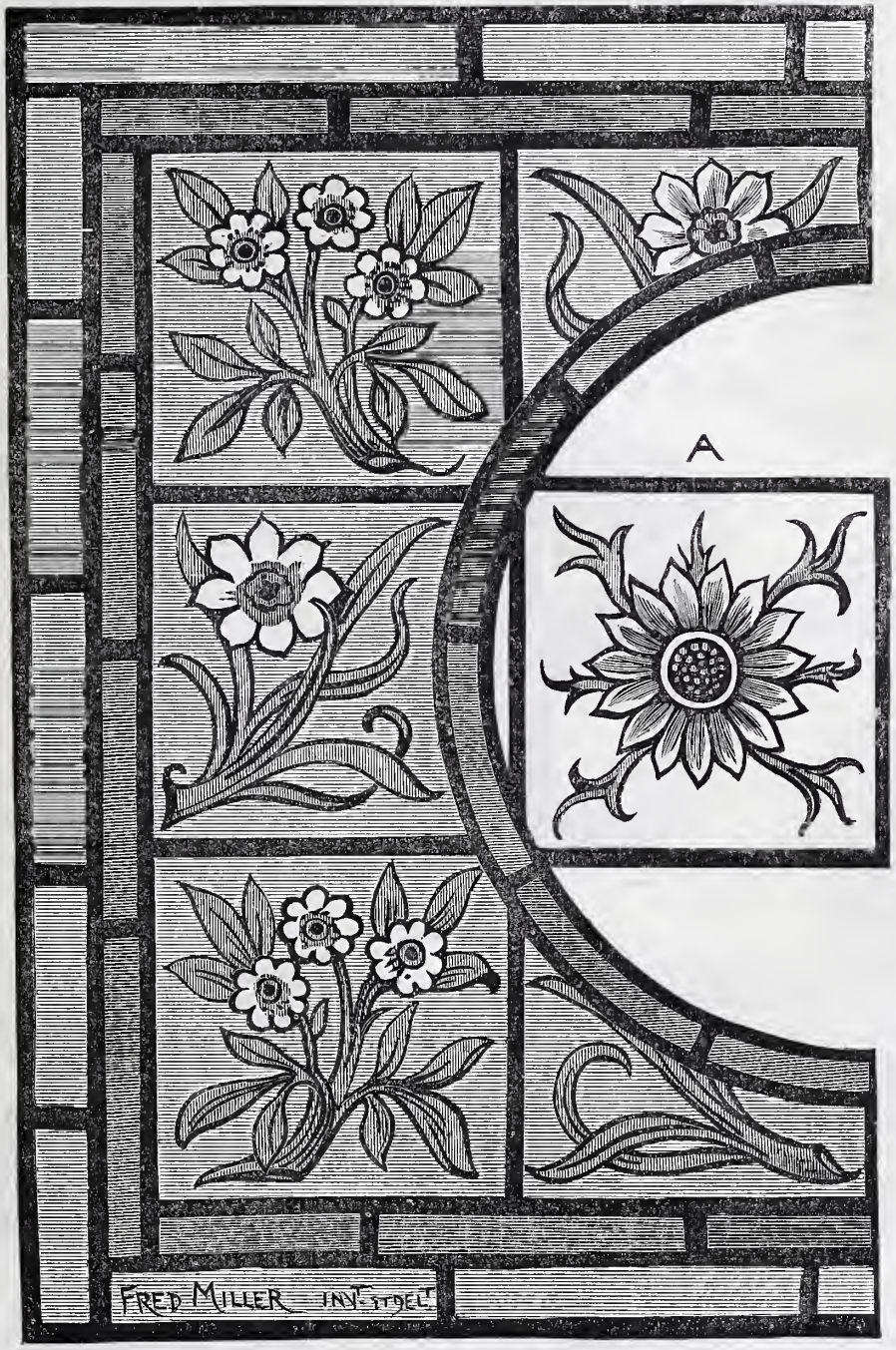


Fig. 2.—Design for Window, showing Treatment of Floral Quarries round Centre Panel.

OUR GUIDE TO GOOD THINGS.

25.—Britannia Company's Capstan or Turret Compound Slide Rest. 26.—New Patent Screwing Machine. 27.—Dividing Appliance for Engineers. 28.—Appliance for Sharpening Cutters for Milling Machines. 29.—Small Circular Saw Bench.

Capstan or Turret Compound Slide Rest.—So energetic is the Manager of the Britannia Company, Colchester, and so rapid is the rate of production of new machine after new machine at the Company's works, that it is difficult to manage the supply of space devoted to notices in Work in such a manner as to keep pace with the demand, and I am compelled to deal briefly and *en masse* with a number of the Company's specialities, each of which ought to have at least a column to itself. In Fig. 1 is shown an excellent Compound Slide Rest for brass finishers and electricians, to which—from the form of its revolving head, or tool-holder, which is rotated by hand—the appropriate name of "Capstan" or "Turret" has been assigned. This head is constructed to hold five tools of any desired form for sliding, surfacing, pointing, paving, etc., enabling all such operations to be done at one setting of the work; and, if used in conjunction with a headstock having a hollow spindle to take rods of brass or iron, studs, joints, pins, etc., may be quickly produced and cut off from the rod. The rests may be bolted to any ordinary plain lathe, or made to fit the saddle of a screw-cutting lathe. Prices range from £6 to £12 15s.

New Patent Screwing Machine.—This machine is shown in Fig. 2, and an enlarged view of the screwing head at A, in Fig. 2, is shown in Fig. 2A. The principle of the machine is extremely simple, and it is economical and time-saving in its use. The headstock is fitted with a hollow spindle to take rods or tubes of any length, and a self-centreing die chuck. The screwing head is carried on a saddle fitted to the bed, actuated by racks and pinions and hand-wheel. A clutch arrangement enables the machine to be stopped instantly in case of accident or necessity. The important feature of the screwing head is the simplicity of the dies, which are merely pieces of steel cut off the bar, put into the tool-holder, and secured by set screws. In this machine they can then be cut up by the master tap, and hardened, and are finished ready for use. Its bed is 4 ft. long, 10 in. on face, and 6 in. deep; cone pulley, three speeds, 3 in. wide, the largest being 12 in. in diameter; gearing, $\frac{3}{4}$ in.; pitch, 2 in. face; spur-wheel, $12\frac{1}{2}$ in. diameter; pinion, $4\frac{1}{2}$ in.; spindle bored with $1\frac{3}{4}$ in. hole; approximate weight, 8 cwt. Price, complete, with master taps and dies for $\frac{1}{2}$ in., $\frac{5}{8}$ in., $\frac{3}{4}$ in., $\frac{7}{8}$ in., and 1 in., and reversing overhead motion, £35.

Dividing Appliance for Engineers.—This is a machine of a strong pattern well adapted for use with milling, shaping, or other similar machines (Fig. 3). It has a cast iron planed bed to bolt on to the machine table, and quadrant slots to adjust to any angle for cutting worm-wheels, angled tooth-cutters, etc. The fast head is constructed for the spindle to be elevated and locked at any angle. The spindle is moved for dividing by a steel worm and wheel, and the worm-shaft carries a division plate with five rows of holes capable of dividing, with the worm gearing, up to 3·600 to an inch. The appliance is of the best materials and workmanship, and very accurately fitted. Height of centres, 4 in.; length of bed, 24 in.; between centres 11 in. Price £14 10s.

Appliance for Sharpening Cutters for Milling Machines.—This appliance is illustrated in Fig. 4 as in use on a milling machine, and fits on its table. It is driven from the countershaft of the machine and adjusted to correct position for grinding by the slides of the machine, the cutter to be sharpened being meantime held in its usual position as for cutting in the mandrel of the headstock, the driving belt of the latter being thrown off for the time. It has a firm base to bolt to machine table, and a swivelling head, carrying a steel spindle with driving pulley fitted and arranged to hold an emery wheel at its end. When in operation, the emery wheel is brought into contact with the cutter, and the latter is turned by moving the cone pulley by hand, bringing each successive tooth in contact with the emery wheel. This, being fitted to swivel, can be arranged to suit cutters having teeth cut square across or obliquely, and can also be used with a square-edged emery wheel to run in a vertical direction and sharpen the cutter by grinding the tops of the teeth, which is sometimes preferable. Price £4 10s., or with overhead for driving it independently, £6 10s.

Amateur's Circular Saw Bench.—This handy little bench, which is illustrated in Fig. 5, is suitable for cutting wood or metal, has a rising table, and can be driven by any ordinary foot power. Length at base, 10 in.; width, $6\frac{3}{4}$ in.; table, $9\frac{1}{4}$ in. by $6\frac{1}{4}$ in.; height of bench, $4\frac{3}{8}$ in.; fast and loose pulleys, 1 in. wide and $1\frac{5}{8}$ in. diameter. It takes a $3\frac{3}{4}$ in. saw, and costs 35s.—The Editor.

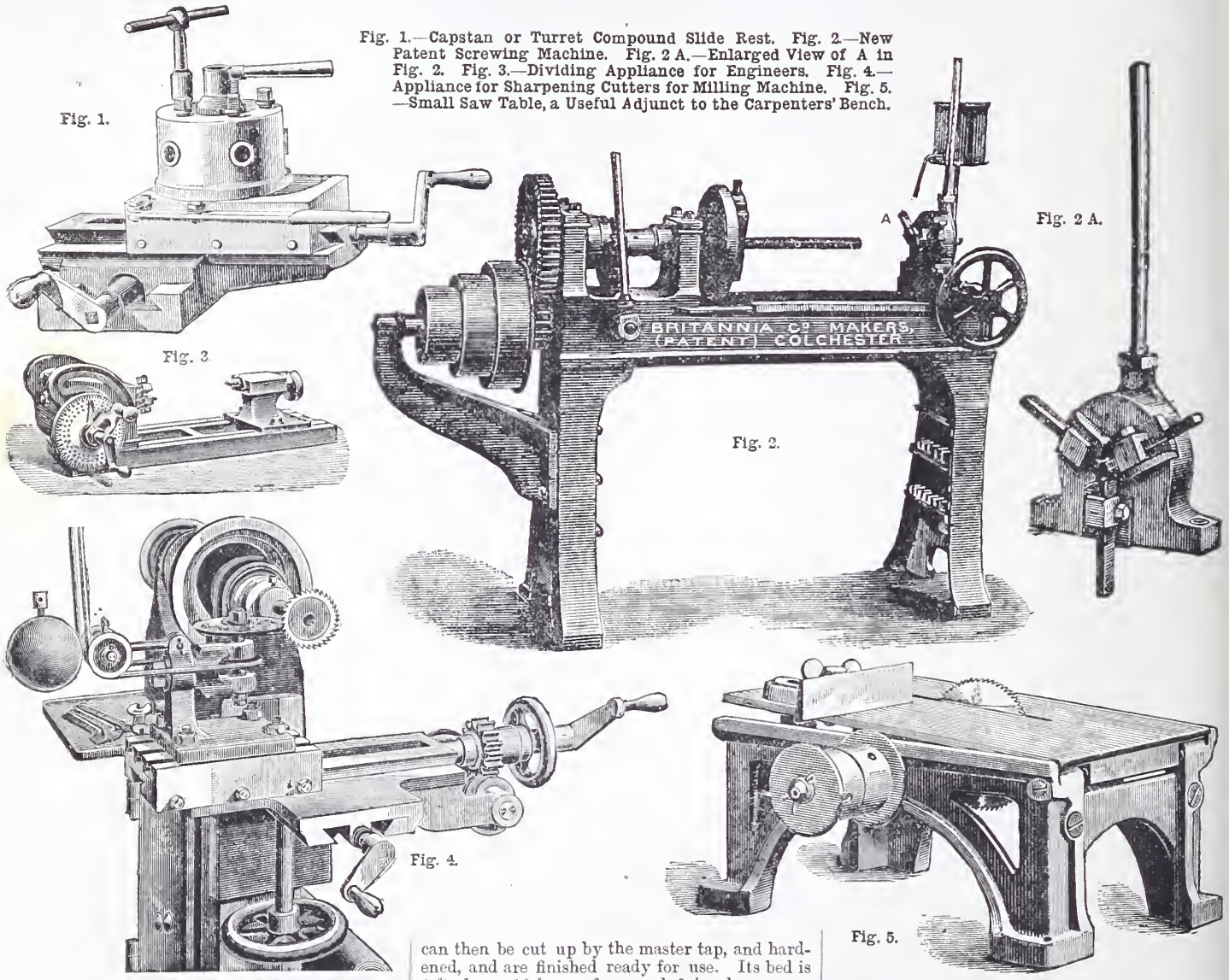


Fig. 1.—Capstan or Turret Compound Slide Rest. Fig. 2.—New Patent Screwing Machine. Fig. 2 A.—Enlarged View of A in Fig. 2. Fig. 3.—Dividing Appliance for Engineers. Fig. 4.—Appliance for Sharpening Cutters for Milling Machine. Fig. 5.—Small Saw Table, a Useful Adjunct to the Carpenters' Bench.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

D Dulcimer Errata.—R. F. (*Norwich*) writes: "In my reply to H. M. L. (*Coatbridge*) (page 159, Vol. II.) *re* D Dulcimer, the natural sign (♮) is confounded with the flat sign (♭). Wherever the word *flat* occurs in the paragraph in question it should read *natural*."

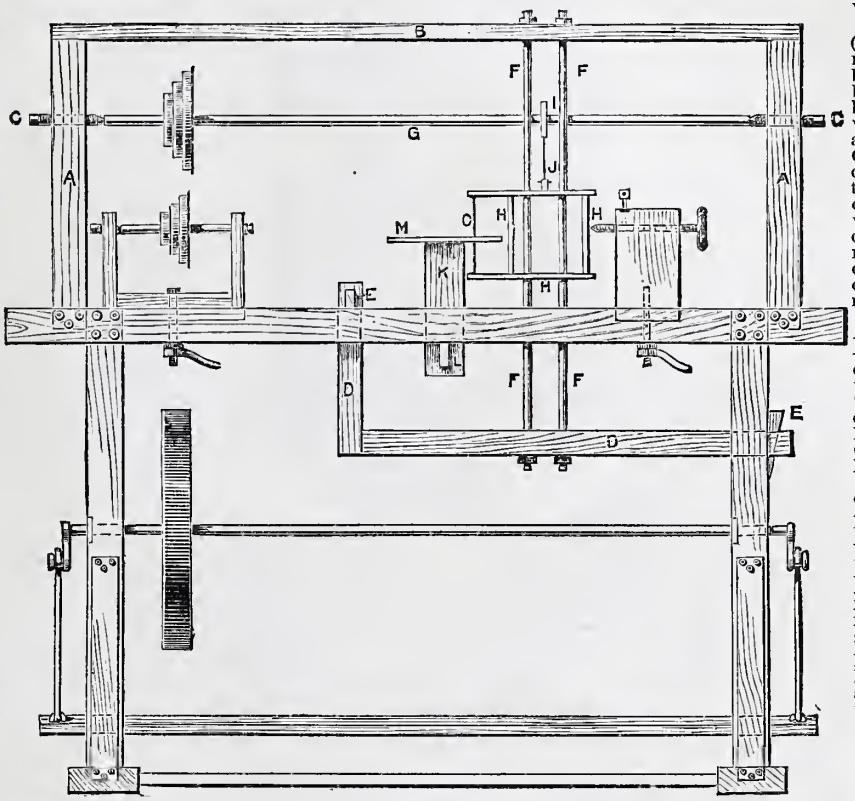
Case - Hardening. — A Smith writes: — "J. H. is under a mistake in saying (page 144, Vol. II.) that 'only wrought iron is treated thus.' Nearly all patent axle-boxes are cast iron—of all qualities, too; they are all case-hardened in the same way as steel and wrought or malleable iron.'

Lockmaker's Address. — Brass writes:—"I think in the reply of T. W. to E. M. (*Glasgow*) (see page 143, Vol. II.), the reference to Messrs. B. Walters & Co., lock manufacturers, etc., Willenhall, is wrong, and should be North Street, Wolverhampton. I do not know of a firm in Willenhall of the above name."

Trade Usages. — B. A. B. (*Hampstead*) writes to H. B. (*Jarrow-on-Tyne*) (see page 127, Vol. II.): —"I am not able to justify the terms used in workshops, and would hail with pleasure any effort by H. B. or any one else to make workshop language easily and readily understood by the youngest beginner. I know well how much better it would be for all learners and all teachers. But the fact remains that the operations of the workshop are named not by the material of which the work is composed, but, usually, after the tool by which the work is done, and the name is not always consistent. Sometimes the name tells its own tale, and is suitable, such as a plane, a joiner's tool to make flat surfaces. Work on which a plane is used is said to be planed, even if the work is far from the ideal plane. We have such contradictions as a compass-plane. I could give plenty of instances of confusion arising from careless nomenclature, still I must hold to my position that it does not matter if the material to be perforated is metal or wood, the terms remain. A steam-engine cylinder is metal, yet it is said to be bored; a gun or rifle is also said to be bored, H. B. notwithstanding. Only small holes bored with a drill can be said to be drilled, which, of course, throws us back to 'What is a drill?' which H. B. knows as well as any reader of Work."

Opalistic Topaz.—Olrac writes:—"I notice in the reply of H. S. G. to L. J. P. (*Wellingborough*) (see page 129, Vol. II.) that he states 'almost positively that it belongs to the same class as sapphirines, that is, it is a production of the chemist's, not of Nature's.' I beg to call H. S. G.'s attention to the fact that there is a stone, the work of Nature, called sapphirine, which is the name given to a blue variety of spinel which comes from Aker, in Sweden, imbedded in limestone; also in Forland and Straskan, in Moravia. My authority is H. Emanuel's book on diamonds and precious stones."

A Fret Saw Hint.—J. H. N. (*Malvern Wells*) writes:—"Seeing a fret saw in Work, page 636, Vol. I., described by A. A. (*Coventry*), I thought it a pity for any one to go to the trouble of making it with such a bed without adding lathe headstocks. I have sent a rough sketch of a machine on same principle, which I think will be an improvement. Besides, it is not every one who has a beam to fasten fret frame guides to. As A. A. does not show beam fastened to bed of machine, I presume it is a separate affair. I was also wondering if the weight of the crankshaft is sufficient to drive saw, as I see no fly-wheel in sketch. I now describe parts of machine sent: A are standards of overhead gear; B, beam along top; C, pins to hold overhead shaft; D, frame fixed to bed and right-hand standard of machine by wedges; E, F, guide rods fastened through B and D by nuts at each end, rods coming down between slot in lathe bed and in front of overhead shaft, G, so as not to rub; H, fret frame sliding on guide rods, F, and worked with an eccentric; I, an overhead shaft of lathe; J is a pin through rod and box, to allow for play of eccentric and give motion to frame, H. Of course, it is a well-known fact that whenever an eccentric is pitched out of centre it will give double that throw, so that if we have this one 4 in. out of centre, we shall get 8 in. throw, which is about right for a fret saw. K is a block with tenon cut to go between lathe bed, and fasten underneath with wedge; L, table on top of block at M; O is the saw, fastened with usual clamps. The table can be shifted along the bed for convenience by having a saw cut down same, for fret saw to run along. The arms of the frame could, of course, be made longer, from first stay of same to saw clamps, to allow more scope of work. I think I have explained all that is necessary, namely, the saw, as the lathe may be made from previous instructions by Self Helper, the only addition being the overhead gear, which will be found very useful for turning. All the saw parts may be removed to leave lathe clear for turning, as may be seen. The only part that may not appear clear is the removal of the eccentric, but this may be easily managed by having a set screw to clamp it to overhead shaft, so that when screw is loosened it may be pushed along to right-hand end and taken off by undoing centre pin; the pin at J may also be made so that it will slide in and out easily, to connect and disconnect eccentric rod to saw frame."



Fret Saw.

II.—Questions Answered by Editor and Staff.

Paint for Boats. — W. H. (*Nottingham*).—Special preparations of paints and varnish are made for the shipping branch. It is not necessary that such should always be used, although, if any quantity of work has to be done, I should certainly advise them; it stands to reason that materials made specially for resisting water would be preferable to such as are used for all ordinary work. Three or four qualities of copal boat varnishes are made by most firms, ranging from 10s. to 18s. per gallon, price depending chiefly upon colour (see paper on varnishes). Mander Bros., Wolverhampton, make all kinds of varnishes, or Messrs. Farmiloe, of Rochester Row, London, N., make the above at prices quoted. Messrs. Pontifex & Wood prepare special "anti-fouling compositions" (varnish paints) for ship and boat work; their London offices are in Shoe Lane, E.C. If you don't require a gallon, you may make your own paint, using plenty of boiled linseed oil for mixing and varnishing with any good outside copal varnish. Previously make watertight with putty.—F. P.

Gilding Frames.—T. N. (*Halifax*). — (1) The best to use is the gilder's oil of gold size, which you can buy of any respectable oil and colourman. (2) It requires about twelve hours to dry. The usual method adopted in the trade is to use it at night, and it is ready for gilding in the morning, and is also less liable to get dust or grit upon it. (3) The best to use is English gold leaf, sold in books at about 1s. 6d. book. When the gold size is just tacky take a few leaves upon your cushion, cut into strips the width you require, and pick up with tip in right hand, and place it at left end of moulding or parts you propose gilding; and so continue until the whole is properly covered with gold, using a cotton-wool dabber to get it well down; put aside to thoroughly dry, then wipe round with cotton-wool and clear size with vellum size. When dry it is ready for use.—G. R.

Gilding Mounts.—W. H. (*Stockport*).—You can buy best gold paper, gilded in gold leaf, not such as is used for bon-bons, ready prepared for use at about 1s. large sheet, which requires cutting into narrow strips the width required according to thickness of your bevel; cut the left hand at angle (if for square mount), moisten the prepared side with your tongue, place on the bevel neat and straight, and rub down with a linen rag until it all sticks, which you will find do very easy.—G. R.

Mitre Cutting.—J. A. C. K. (*Darwen*).—If you screw your machine to a solidly fixed bench, and have a good sharp blade in and gently push your handle over from left to right without stopping, you must get a clean cut without chipping. Of course if the machine gives, or you have it fixed to a table that jolts, you cannot avoid chips; a sharp knife is also very important. I have used one for this past two years, and make many fancy frames without the slightest chipping, except through my own carelessness.—G. R.

Books on Metal Working.—Metal Worker (*Tiverton*).—There are no separate works on subjects you mention; you will probably find them in "Spon's Workshop Receipts," of which there are 4 vols. published, price 5s. each, Spon & Co., 125, Strand, London. — F. J. C.

Chinese or Japanese Models.—Bird Cage (*Folkestone*).—In making a bird cage I fear the model of a Chinese house would hardly help you, as it is too crowded with balconies, verandahs, and so on, to give room for the wirework. I have many hundred volumes of Japanese books, and amongst them a series of drawings of houses by the famous artist Hokusai. I have just completed a sketch of a bird cage after the details given therein, which, if not a model of a Japanese house, will be a fair imitation of one. This drawing I am sending to the Editor, who will doubtless publish it in due course; but remember please that engraving takes time, and that a paper with the circulation of Work is arranged many weeks in advance, so that if time elapses before it appears, it will be from the result of circumstances, and not the fault of the Editor or of E. B. S.

Gold Leaf.—M. L. (*Clapham*).—Gold bronze for gilding is sold by Hughes & Kimber, Fetter Lane, E.C., who, if they do not also keep gold leaf, would doubtless give you information concerning it.—E. B. S.

Transferring Papers.—J. T. F. (*Sunderland*).—The transfer pictures for decoration are sold at any fancy stationer's. But I doubt whether they could be effective on a painted surface. The glacier window decoration you suggest would most certainly not be satisfactory, since it needs a transmitted light to show the pattern. If you cannot paint the decoration required, I would suggest that you buy some odd patterns of handsome cretonnes and cut the flowers out. These would be far more effective than transfer pictures, as they are bolder in design and colour; besides, the texture shows out well on a painted surface. Wall papers might serve as well if you could get access to a good pattern book and choose a few appropriate sheets.—E. B. S.

Screen Covering.—J. T. F. (*Sunderland*).—The Japanese gold leather paper, sold by Messrs. C. Hindley & Co., Oxford Street, or at Liberty's, Regent Street, or of any good decorator's, is the best screen covering I know, costs 1s. a square yard, upwards, looks well, wears splendidly, and is gorgeous in its colour and design. Failing this, there are pretty cretonnes in imitation Japanese designs at Liberty's and elsewhere. A plain covering of American cloth, with the pattern of a good

cretonne—a paper cut out and stuck on—as an all-over design is also effective.—E. B. S.

Sticks for Wooden Bird Cages.—ST. ANDREASBERG.—With regard to the sample of sticks used for making the small Hartz cages at St. Andreasberg, in the Hartz Mountains, I note that they are rather more than $\frac{1}{8}$ in. in diameter, and not very perfectly rounded off. You ask me to suggest a tool to make them with. If I wished to make any myself, I should get wood $\frac{3}{16}$ in. thick, cut it into strips of the same width with a cutting gauge, and then take off the sharp edges with a scratch in the form shown in the accompanying illustration. To prevent breakage, clamp your sticks down on a piece of board while scratching or scraping them into shape. You will find how to make a scratch complete in an article entitled, "The Scratch or Beading Router," in No. 7, on page 101 of Vol. I.

Tricycle Making.—J. T. (*Bradford*).—This subject will be taken up in due course, but it is difficult for me to say when papers will appear.

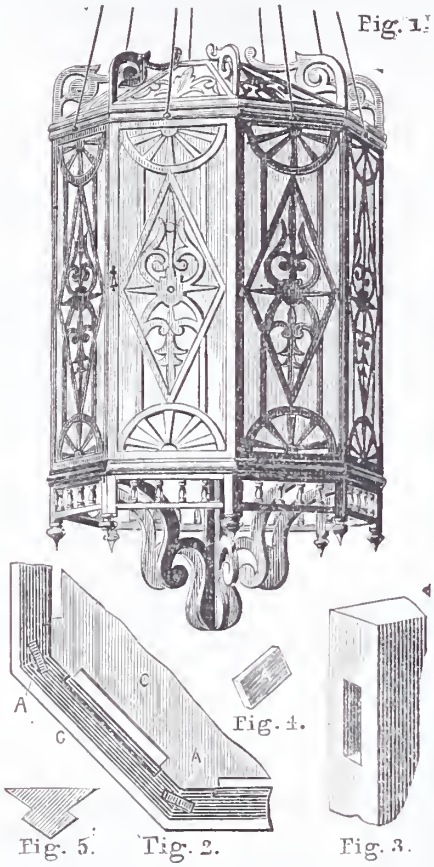
Banjo Making.—E. D. (*Clapham, S.W.*).—If you have plenty of work in your own line of business, my advice to you is to stick to it and leave banjo making as a business alone. I presume from your letter that you do not know much about making a banjo, and there is more art in making a banjo than most people credit. By this I mean to make an instrument to take round to the trade and offer it in competition against other makers. I have no wish to dishearten you; every one must have a beginning, but to satisfy yourself you might make up a decent instrument and take it round to the various music warehouses and music shops, and ask what you think would be a fair price for it, reckoning material and labour; it is ten to one if they do not show you instruments they have bought for a third or one half less in price than you ask for yours. You might stand a chance if you had capital and could fit up a workshop with machinery and employed cheap labour; even then you would have to be thoroughly practical yourself, and see all material cut and used up to the best advantage. If you could make a first-class instrument, one that would advertise you whenever it was seen and heard, and sell direct to the public, that would be the best way for you to get on. Then again you must have practice, that is, make a few instruments before you get into the style and swing. There are lots of small difficulties you will encounter and which experience alone will teach you to surmount. The best time of the year for you to commence would be the beginning of winter; this business in summer is wonderfully quiet, and after making a start, if you got enough business to keep you going all through the summer you would be fortunate indeed. You could get the fittings from the music warehouses; if you wanted your brackets good you should get them made by some brass worker. The hoops of the best banjos are made of German silver, and the edges spun over two steel wires, which you would have to get made for you by some metal spinner. It would not pay you to cut your own pearls, they would cost you much less by getting them made by a pearl cutter. It would be expecting too much from human nature to ask a banjo maker to give you addresses of firms who make articles in connection with the trade for him that he cannot make himself. Borrow a directory (if you have not got one), and look out the addresses of people in the various lines that are nearest your own home; take your designs and sizes and get them made to your own liking; if you have anything new and novel, so much the better chance you will have in making a name. You could buy your fittings from a good banjo maker until you made two or three instruments and saw how you got on with them; it would hardly be wise to lay out a lot of money to start with, until you were sure of what you could do and knew exactly what you wanted. I am afraid this reply is hardly what you expect, but what I have told you is correct and taken from my own experience.—J. G. W.

Scale Drawing.—KROW.—"Drawing to Scale," by Wilkinson, 2s., Jarrold, 3, Paternoster Buildings, London, is a book to answer your purpose.—F. J. C.

Dulcimer Making.—NOVICE HOMO.—I am afraid he would find some difficulty in boring eighty holes 1 in. deep, and all in exactly the same direction, in a hard block with such a primitive tool as a gimlet. However, if he cannot beg, borrow, or annex the necessary articles for the short time he might require them, he may try his hand with the tool he has, but I tremble for the result. The hitch-pin block is only bored about $\frac{1}{4}$ in. with a small bradawl, and the pin is driven in with a hammer to within $\frac{1}{4}$ in. of its length. The top part of the wrest pin, viz., the part that is flattened, is the part to blacken. The diagram on page 645, Vol. I., represents the finished F instrument, that which was mentioned in the first paper, but whether the instrument stands in F, E, D, or any other key, the scale is the same.—R. F.

Tins for Blacking.—STAUNCH (*Carnarvonshire*).—You will be able to get boxes of the kind you require—viz., for paste, blacking, and so forth—of the following:—A. Truelove, 11, Carver Street, Sheffield, or G. Shadling, 21, Florida Street, Bethnal Green Road, London, E.; prices I cannot give, but they will, no doubt, quote them to you on application.—R. A.

A Hall Lamp.—GLACIER (*Maidstone*).—The method you mention in your letter would be as suitable as any for making a square hall lamp, but if you construct one, I should say make one side as a door, which is easily done, instead of having a glass to slide upwards. I have designed this lamp here, which is intended to be octagonal in shape. The dimensions depend upon the size of the lamp you wish to place in it. Fret-cut eight comparatively thin boards after the pattern of Fig. 1. Secure six of these as in Fig. 2, and the remaining two by themselves; these latter will act as a door. Frame up some narrow rails and spindles to go under the bottom of the lamp, and then have eight other rails the width of the combined thickness of the bottom board, bottom of the fret frame, and top spindle rail; pass these through the spaces shown in plan, Fig. 2, in the bottom board, and nail or screw top and bottom half of them respectively to the fret frame and the spindle rail. This will prevent any weight pushing out the bottom board, which would be a serious matter if it occurred when a lighted paraffin lamp were upon it. The top board, etc., might be treated in a similar manner, although this top board must have the greatest part of its



A Hall Lamp. Fig. 1.—Lamp complete. Fig. 2.—Plan of one Corner. Fig. 3.—Edge of Frames. Fig. 4.—Corresponding Part to A in Fig. 5. Fig. 5.—Section of Uprights to secure Glass.

middle cut away (making it really an octagon frame) to allow the heat to pass through. Eight pieces of fretwork slope a little distance on the top, but not far for the reason just mentioned concerning the top board. The edges thus formed by them should be planed down, and small pieces of scroll fretwork joined along them. Small brackets are also joined under the bottom of the lamp. I think sufficient ventilation will be found in this design. For the insertion of the glass, I have represented the frames in Fig. 2 cut away to receive them, being held in position by uprights, shown in section in Fig. 5; but I think that if the uprights were fitted into each corner there would be no necessity to cut the fretwork thinner; neither do I think the heat from the lamp will injure the glue. Of course, you might have eight boards thicker at the sides than that part which will be fret-cut, and shape the sides the same as Fig. 5, but each would have to be done separately, whereas, you may make Fig. 5 in one long piece, and slice it up to the required lengths. For the glass, I think if one were red, the next yellow, the next blue, and the next yellow, and so on, so that every opposite pair would be the same colour, a pretty and effective article would be the result. Your suggestion to attach the patent glacier, to imitate stained glass, is a good one, and I mention it for the benefit of others.—J. S.

Modelling, etc.—C. E. H. (*Hull*).—After a very careful perusal of your letter, I will do my best to supply you, and, doubtless, thousands of others, who appreciate as you do the excellence of Cassell's "Technical Educator," to which WORK, as you evidently think, ought to be a practical supplement. As the one gives you the theory, so ought the latter to give you the necessary knowledge to enable you to carry out that theory into practice. Knowledge lies dormant in the mind, whilst Practice is the evidence given before the Court of Public Opinion that proves the deponent has rightly understood his lessons in theory, and has discovered for himself their utility and value to the busy world. I glean from yours that you have spaced out for yourself a rather ambitious course, and I am glad to have this opportunity of giving you advice that will be of service to you long before you can possibly attain the summit of your ambition, and may save you, if you act upon it, many a weary mile of climbing. "Let all the ends thou aim'st at," as Shakespeare says, "be," to take his latter subject, "truths." Truth, absolute truth, in words matters less than in deeds, but in WORK, truth of workmanship in action is of the highest and most paramount importance. Accuracy is its modern name, but I like the grand old Anglo-Saxon name far better. In setting out to make anything, the drawing is the truthful way of expressing your intentions. Therefore let your drawing be perfectly clear, honest, and truthful. There are three dimensions—length, breadth, and thickness, in all solid forms. Before commencing to make anything at all, make a drawing, which will show you, as in WORK, length as in "elevation," breadth as in "plan," and thickness as in "side elevation." To convince yourself that the drawing in feasible and practical, make sections, to show how you intend the interior and other hidden portions to be executed. Then if you have fallen into error, indiarubber and thought will put you right, without expense. Drawing is better practice than you think. Now, suppose you have done what was done before the Menai Suspension Bridge, the Tubular Bridge, the Manchester and Liverpool Railway, the Forth Bridge, the Eiffel Tower, and every other engineering work, every public building, every sea-going ship, were commenced, prepared a drawing, to be followed in every particular conscientiously in the construction. Go to work consulting the drawing which you must (having decided that it is correct and true) consider as an authority—in fact, as your judge—never to be departed from upon any pretence. Remember this, that if you cannot make a correct and truthful drawing of what you want to do, you cannot hope, unaided, to execute in the solid your ideas and plans. This fact, which you appear to have, to some extent, realised, will be more impressed upon you as you go on, and you will no doubt find yourself, as I and others have done before you, that you will have to abandon the labour business and go back to the drawing part of it and reconsider the drawings, correct them, re-modify them, and commence again, with the actual carrying out of the work in its material form, which you denominate "modelling." I hardly know what books or tools to recommend, your range is so wide; better begin under the foregoing advice, and write again for assistance, not before you begin, but when you meet with a real difficulty; express it as clearly as you can, and I will try and wipe away the cobwebs for you. There are within a few miles of you splendid examples of architecture: York Minster, Thornton Abbey, Selby Church, Howden Minster, endless churches, ancient and modern, Leeds Guildhall, and other examples which you can readily measure and take all particulars of; then reduce them to drawings and reproduce them. The clay used for modelling is Staffordshire pipe clay. The Hull School of Art, if it declined to supply it, would tell you where to get it. Canova used a pocket knife and a piece of a broken wooden platter; Michael Angelo a piece of broken reed, which he whittled to the required shape with the knife with which he ate his bread and cheese, and the stick he used for his macaroni, for modelling the clay with. Go thou and do likewise!—J. W. H.

Zinc Etching.—INQUIRER (*Portland, Maine, U.S.A.*).—The plant for zincography consists of a lithographic or copperplate press, half a dozen rollers for ink and varnish—some covered with flannel, some with calf leather—a trough mounted on rockers, ink and varnish slabs, a planed plate or table of iron heated by means of gas or oil, a circular saw, a fret saw, a metal shooting board and plane, and work benches, etc. INQUIRER is not very explicit, and I can scarcely determine whether he means photo-zincography or intends to make drawings in line on transfer paper, transfer them to stone, and then make zinco blocks from them. All the processes are fully described in a cheap little manual by Josef Bock (Wyman's "Technical Series"), 2s. 6d., published at 65, Chancery Lane, London, E.C. I believe, also, that the American Lithographic Publishing Co., 37, City Hall Place, New York, have published a similar book, but I have not read it. (See also my answers in "Shop" to J. W. S. (*Sheffield*) and F. J. T. (*Bristol*).—J. W. H.

Joint Making and Roof Sweating.—AMATEUR.—There ought to be no difficulty in wiping brass bosses into lead pipe to keep the metal at its proper heat. You should not begin to wipe too soon; let it all get well hot before you commence to wipe; tin the bosses first. With regard to your roof sweating, I can only put it down to exhalations from the earth; but at the same time I must say that I have seen iron roofs with earth floors under them that have been quite free from this peculiarity.

I suggest a wood floor or a good stove, or, better still, both of them.—R. A.

Violin Bass Bar.—B. F. E. (*Carlisle*). — The Editor of WORK is always willing to find means for the ventilation of new ideas, and would give proper consideration to anything you have to communicate. A consultation with a practical man might have enabled you to attain in a short time that which has, you say, cost seventeen years to investigate. Many experiments have been made with the bass bar, and I should be interested to hear the tone resulting from the working out of your theory.—B.

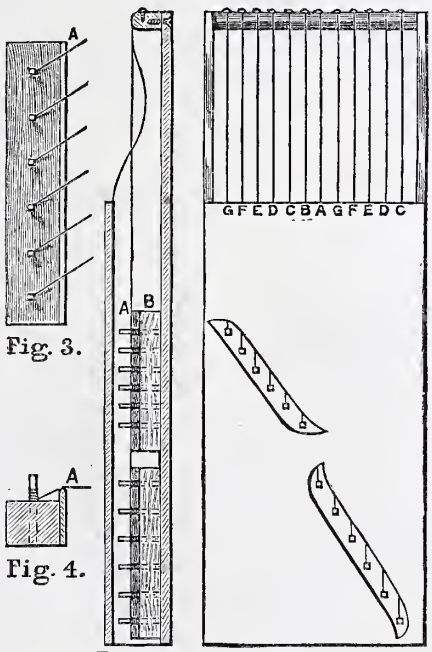
Victor Cycle Company.—P. W. (*Bowling*).—As this company has not sent any other address than the above, I am at a loss to say at what part of the east coast their place of business is situated. Perhaps they will kindly send on their full address for the benefit of our readers. In the meantime you can get your axle and a pair of rubber-tyred wheels from Mr. G. P. Lee, 60, Tib Street, Manchester. Write first for him to quote a price for the same—not forgetting to give the diameter of wheels required—including the carriage fare for sending them on to you. But I should think that you would be able to get them at your nearest town—Bradford.—W. P. [The address of this company is very properly advertised in our Sale and Exchange Column, see page 734, Vol. I.—ED.]

Future Subjects.—U. C. (*Hitchin*), B. E. C., (*Stepney*), and others.—Papers on the subject you write about may appear in the present volume of WORK.

Polishing.—W. R. H. (*Leeds*).—Are you sure you are not comparing your varnished work with French polished goods? If you do, of course you will not be satisfied with it, as the same high finish cannot be got with the brush as with the rubber. However, assuming that yours does not look so well as even varnished work may do, it seems to me that one, if not the principal, cause of your finish being inferior is the stain you use. The mixture of red ochre and glue will give a muddy appearance to work coloured with it. Try a liquid transparent stain instead, and I fancy you will find the appearance of your tables, etc., greatly improved. —D. D.

Polish Stains.—JAS. MCG. (*Salford*).—Possibly you may get the marks out by going over them with raw linseed oil and methylated spirits, applied with a soft rubber. If they do not yield to this treatment, the only thing you can do is to scrape and repolish the table top.—D. D.

Fairy Bells.—A SUBSCRIBER (*Homerton*) has asked for instruction to make the instrument known as fairy bells, and cost of same. I will, therefore, as far as possible, comply with his request. The writer does not know whether there is any standard size, but the measurements given will be large enough for a full-grown hand to play; if SUBSCRIBER is only a youth, why then he must alter the dimensions to suit himself. The wood for back, belly, and sides, must be of straight even grained pine, perfectly free from all shakes and knots; the pin and wrest blocks must be of some even grained tough wood. Beech, elm, or, indeed, any wood with a tough close fibre will be suitable. For the back plane and square up a piece of $\frac{3}{8}$ in. pine, 2 ft. by 2 in. This when finished will be $\frac{1}{4}$ in. full. For belly, same thickness and width, and 1 ft. 4 in. long. Sides, 2 ft. by 2 in., by $\frac{1}{8}$ in. full when dressed up. The top ends are hollowed out (as shown) where the hands grasp it. The pin block at the end must be 9 in. long and $1\frac{1}{2}$ in. square; the top must be rounded off as shown. The wrest blocks will be about 8 in. long by $1\frac{1}{2}$ in. wide by $1\frac{1}{2}$ in. thick. To one side of each block a thin strip of hard wood—mahogany—is glued; this should be $\frac{1}{8}$ in. thick, and projecting above the block $\frac{1}{4}$ in. Care must be taken that both surfaces are true, so that when glued together the joint shall be perfectly sound without any shake. The end must be of the same thickness and width as the sides. Glue the pin block in its place (using the best glue), and clamp it until dry. Now mark off twelve points to receive the screws to take the strings. Lay the top on the back and draw a diagonal line at such an angle that one end shall be twice as far from the pin block as the other. Draw parallel lines from the screws to this line; where the lines cut will be the position of the wrest pegs. Two (F) holes must be cut as shown; the diagonal line marked will form the front edge of left-hand hole and lower edge of right-hand hole. By placing the holes one in advance of the other, we shall not weaken the belly so much; also we shall be able to bring the two middle strings in their proper place, *i.e.*, the same distance apart as the others. Having made the wrest blocks, draw a line down the centre, and place them on the back. Put the front in its place and adjust the blocks so that the central line shall lie parallel with the centre of the F holes; firmly glue them in their position. Care must be taken that the parts glued together are perfectly level, so that no hollows exist. They must either be clamped or put under weight until perfectly dry. We shall now require one dozen screws, such as are used in pianos, and of the smallest size. If the smallest procurable at a music shop are too long, they must be cut to the proper length. Find where the strings cut through the line drawn on the centre of the blocks. At these points holes must be bored with a bit that will admit the wrest pins, but sufficiently small so that the pins will hold the strings when tuned. The sides and end must now be glued in their places, the top glued on, and all clamped firmly together, and set on one side to dry. One general remark about gluing. Care must be taken that all joints are good. There must be no hollows, else there will most certainly be an unpleasant jar in the instrument. Round-headed screws must be used in the pin block to receive the wires. Procure from a music shop a sufficient quantity of piano wire of the smallest gauge; the quantity can be ascertained by measurement by a bit too much rather than too little. Cut the strings three or four inches longer than the distance between the blocks. At one end twist a small loop, and pass it over the pin. Carry the other end under the belly, and pass it through the hole in the wrest pin, and with a wrest key twist the wire on the pin, but not tune it up to pitch. When all the strings are on, roughly tune it by a piano or other instrument, commencing at the middle C, and by it tune the lower C; then the higher G, and by it the lower G. Tune the other notes of the scale, working alternately on each side so that the strain in tuning shall be equally distributed. It will be understood that all the wood must be



Fairy Bells. Fig. 1.—Fairy Bells as seen from above. Fig. 2.—Section of the same. Fig. 3. —Wrest Block. Fig. 4.—End View of Wrest Block.

thoroughly well seasoned, else there be will be no end of warping. When finished so far, it must be varnished with fine white varnish. Some, perhaps, would like it better if the wood were stained reddish or yellowish. As to cost, I should judge it would be under 2s. 6d. The wood ought not to be more than 9d., the pins 1s., and the strings another 9d.; but I really think this sum would include glue and one dozen round-headed wood screws for the pin block. If the joints are good, no screws will be needed, except perhaps join in pin block, as there will be considerable leverage exerted on this. Fig. 1 represents the instrument complete. Fig. 2 gives a sectional view —A the bridge, and B the wrest block. Fig. 3, a wrest block, showing the bridge, A, taking the strings. Fig. 4 is the end view of the block, showing the pin, string, and bridge, A. Note.—On looking over my drawings, I think it will be an advantage if the right hand, or G F hole, is brought forward two inches with the corresponding wrest block.—O. B.

Painting Polo Cart.—VAN BUILDER (*Glasgow*). —In the first place, you have started wrong in painting it in lamp-black ground in oil, as this colour will never dry without plenty of driers; and in the second place, painting it in a shed at that time of the year (January), unless well heated with a stove or hot water pipes. In the first place, scrape all the old paint off the body with a steel scraper, or the edge of a piece of glass, sand-paper, and dust well off. Give the body a coat of lead colour composed of boiled oil, white keg-lead, and a little black to colour it, also in this case add a little driers; when mixed, give the body a coat, leave it for a week to dry, then sand-paper it down, dust off, and give it another coat of lead colour, leave for a day, then stop all the screw and nail holes up and any dints or cracks, etc., with stopping made of keg-lead, gold size, and filling, as stiff as putty. We next make a can of filling—take of keg white lead one part, and two parts of filling, mix on the stone with the palette knife into a paste with turps, place into the can, and then this filling down with equal parts of gold size, varnish, and turps to the consistency of paint. The body should receive six coats of this filling. The first two coats have a day each to dry in, the remainder being put on two coats a day. If the first coat dries shiny, too much varnish is in; to remedy this, put some powder filling in the can with a little turps; this will absorb some of the varnish. The filling when on should be dull when dry. We now mix some staining by putting in some rose-pink or Indian red in the remainder of the filling left in the can, and thinned down with turps. This will change the colour in the can. Then we give the body a coat of staining all over, and then leave it to dry for a few days. The body will now have a very rough appearance. To get the body quite smooth, we have to rub this staining colour until we get it all off by means of a piece of pumice stone sawn across the grain. Have by your side on a little table a flat piece of a flag, with a sponge and a leather, also a bucket of water. Hold the piece of pumice stone in the right hand, and rub the sawn part on to the stone, using a little brickdust to make the pumice stone bite and to help keep it clean. Hold the wet sponge in the left hand and wet the panel to assist the stone in rubbing the panel down until you get all the staining off, then you have the panel flat; water must be freely used, and the pumice stone kept clean, or else it will tear the filling up. When all the rubbing down has been accomplished, leave for a few days to dry. If you now rub your hand over the flat panels they will feel as straight and smooth as marble. We next dust the body off well, and mix some lead colour up very fine, and give the body a nice and even coat of colour; stroke the paint well down and avoid all runs, fat edges, and brush marks; when dry, in a few days any little place or scratches can be filled up with the stopping and rubbed down with the pumice stone; next day, when dry, also rub the body down with a piece of fine spent sand-paper; dust well off, and give it a coat of lead colour, with just sufficient oil in the colour to keep the paint from looking shiny when dry. When this last coat of lead colour is dry, we rub the body all over with the pumice stone and water, keeping the stone clean and frequently rubbing it on the flag, and not using brickdust this time as it would make the stone too keen, and would, instead of flatting the paint down, fetch it off instead; dust off well, and give the body a coat of dead black, made of dead black ground in turps and bound with gold size mixed; this will dry in a few hours. Afterwards give it a coat of the best black carriage japan. In a couple of days after, flat the body down with a pad and wet pumice-stone powder. When the body is flatted down, it will look like ebony. In flatting mind the edges, and be sure to wash the body off well, and only flat and wash off a panel or a couple of rails at a time, using a water tool in the corners and wiping off well with the leather, for if any grit is left on, it will get into the varnish and show. Some painters give the body two coats of japan, others can make it look well with one. After it is flatted down and dusted off, we give it a coat of carriage or undercoating body varnish, then leave for a week to dry; then flat down again with the pumice stone and the pad, wash, and dust well off, and finish by giving the body a flowing coat of the best durable body varnish. In painting and varnishing, always stroke the paint down from the top to the bottom, and take out all runs and fat edges before the paint dries or the varnish sets. In varnishing, the success and the secret lies in a good varnish brush and putting it on freely, working it all over, then stroking it down, and leaving it to flow out smooth in a warm room, the heat being kept up until dry. The inside can be painted buff, the bottom painted black; the wheels, shafts, and springs painted vermilion, picked out black, or any other colour to match the upholstery. If there is any little point in coach painting which you do not understand, I shall be pleased to explain it to you.—W. P.

Lock Pick.—J. S. (*Spilsby*).—The pick you mention may be used for any kind of solid warded locks, either rim or mortise. You could obtain excellent sets of picks from G. H. Buck, 261, Edgware Road, London, N., on enclosing trade card and stating what you required.—T. W.

Galvanic Battery.—J. S. (*Kirkcaldy*).—A galvanic battery is an apparatus for making electricity. There are some dozens of varieties now in use, and you must please say which you require, and what you want it for, before I can undertake to describe it in "Shop." At some future time I hope to write a series of articles on "How to Make Galvanic Batteries at Home," for the benefit of amateurs and youths taking an interest in electrical subjects.—G. E. B.

Small Electric Lights. — PO BAH (*Swansea*). —You will find full details in my articles on model electric lights. All the parts will be described and illustrated in them shortly.—G. E. B.

Electric Lamp, etc.—W. W. (*Dublin*).—I am pleased with the account of your success in making an electric bell, but I cannot advise you to make an accumulator to light up a 10 c.p. incandescent lamp for three hours a night, such accumulator to be charged with current from a primary battery. You know not what you ask. You have no idea of the cost in material and labour, and the poor return for the same. This you will learn by reading my articles on model electric lights. If, after reading them, you feel you need further instruction, I shall be pleased to give it. A volt is the unit of electrical pressure, and is equal to that obtainable from the current given by one cell of a Daniell battery. An ampère is the unit of electrical volume, and is represented

by the volume of current obtainable through the resistance of one ohm at a pressure of one volt.—G. E. B.

Galvanometer.—GALVANUM (*Manchester*).—An illustrated description of a galvanometer to suit your purpose will be given when space can be found for it in WORK. Soak the plaster in dilute muriatic acid.—G. E. B.

Wood Carving.—To Po (*Shepherd's Bush*).—All right. If you prefer shorter handles, by all means use them. The writer of the article gave the lengths as being best in his opinion, and in that of many authorities on the subject. There is, however, no invariable rule, and, of course, a small tool would not require so long a handle as one of a larger size. As you have apparently made some progress in the art of carving, you will naturally know what size tool suits you best, and you cannot do better than follow the dictates of experience. Of course, when mentioning the length of new tools, wear was not taken into account. As you say that you invariably cut an inch or so from your new handles, in order to make them 4½ in. long, it seems to me that you have, while finding fault with the length stated in the article, proved the correctness of the size preferred by the writer of it.—D. D.

Painters' Blouses.—GRAINER (*Manchester*).—You will get these at Charles Baker & Co.'s, at the corner of Euston and Tottenham Court Roads, London.—D. A.

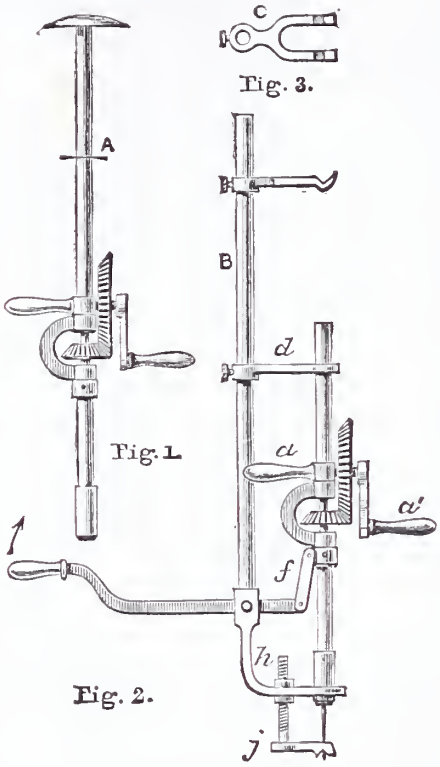
Rubber Stamp Matters.—QUICKSILVER (*Manchester*).—Quicksilver containing merely dirt may be purified by filtering it several times through a filter made in the following manner, and then squeezing it through clean wash-leather:—From a piece of clean writing-paper cut a circular disc, five or six inches in diameter, and fold it twice, so as to form a quadrant of four thicknesses of paper; insert a finger in the curved edge in such a manner that one thickness of the paper shall be on one side and three thicknesses on the other, and open out the paper in the form of a cone; prick a hole in the point of the cone with a pin, and allow the quicksilver to run through. Repeat this several times, using a fresh piece of paper each time, and taking care to make the hole no larger than necessary. Should the quicksilver contain metallic impurities, such as zinc or tin, it should be placed in a wide-mouthed bottle and covered with dilute sulphuric acid, which should be changed two or three times and the whole well shaken at intervals. The acid will dissolve the impurities, and the quicksilver must then be washed several times in pure water and dried, after which it will be fit for use. To fill the thermometer tube, affix a small paper or glass funnel to its open end, and place in the funnel a little quicksilver. Gradually heat the empty bulb by means of a spirit-lamp, which must then be removed, when some of the quicksilver will be found to enter the bulb to replace the air driven out by the heat of the lamp. This portion of the quicksilver must then be made to boil over the spirit-lamp, and when it is judged that all the air in the bulb and tube has been expelled and replaced by the mercurial vapour, the lamp must be again removed, and the tube and bulb will speedily become filled with quicksilver, care having, of course, been taken to keep the open end of the thermometer tube immersed in the quicksilver during the entire operation. When satisfactorily filled, the tube must be drawn out before the blowpipe and hermetically sealed, the tube being kept quite full of quicksilver all the time by heating the bulb. A tube of wide bore must be used for the purpose now under consideration.—QUI VIVE.

Handrailing.—T. O. (*Bootle*).—Your question on this subject has been already answered. I am endeavouring to find another writer to take up the subject.

Bicycle Enamel.—W. A. E. (*Manchester*).—I don't think you would better the enamel sold by any good maker for the article under notice. A good black enamel could be made from lamp black mixed with either bath varnish or "carriage" copal varnish. Unless you used pigments out of collapsible tubes, you would not, in most cases, get them ground sufficiently fine to make a smooth surface when mixed with varnish. You would find either Aspinall's, Wills', Davies', or any such make of enamel far better and cheaper for your purpose than anything I could instruct you to make yourself. Sorry I cannot advise as to cement. Can't you buy a little, or write to a bicycling paper?—F. P.

Graining and Marbling.—YOUNG GRAINER.—A more welcome answer to your inquiry will have appeared—the papers on graining—doubtless, before this is printed. I believe you will find them sufficient for your purpose, and providing plenty of scope for your talent. "Marbling" will appear in this volume; and both series will be illustrated as much as appears useful to the learner. I do not believe there is any *English* work published on the art and illustrated in colours as you desire, although I expect such a volume will soon see the light in Manchester. The "brush and pencil" method of marbling is the one we shall treat, as being more convenient than the "crayon" process; and to make them thoroughly successful I hope to be able to supply hand-painted samples on paper, executed by a medallist in the work, at a price to suit students, providing the Editor is agreeable. Litho specimens of marbling in colour are usually very poor copies.—DECORATOR.

A Ratchet Drill.—SPOKES.—SPOKES wants a ratchet drill to drill holes from ⅛ in. to ⅝ in.; this is entirely out of the question. No hand drill will drill holes up to ⅝ in. SPOKES would sweat a good deal over a ¼ in. hole. If he wants to bore out spoke stumps, the ratchet brace with bent pinions will do it, provided he puts on enough pressure, with the drill made left-handed and the brace driven backwards, when he may possibly wind the stump out of the hub with little or no drilling. I have a machine for drilling out spoke stumps wherein the above ratchet brace forms a part. It is my own invention, and does the work very quickly and effectually. Fig. 1 in the annexed sketch is the ratchet brace referred to entire; I first of all cut the shank off at the point, A, and fit the mutilated brace to the apparatus as in Fig. 2, which shows the brace in place ready for work. In Fig. 2, B is a round ⅝ in. steel bar 22 in. long; C is a bracket formed as in Fig. 3. It is V hollowed on the upper side of each arm, as shown, 3½ in. from the centre of the bar, B, which is the distance of the drill-point from a line drawn downwards through centre of bar, B; and the top of the drill brace is also the same distance



A Ratchet Drill.

from the bar, B; C, Fig. 3, slides on the bar, B, and may be fixed at any distance to fit wheels from 30 in. to 60 in. diameter. *h* is an arm which curves from under the lever handle; at 3½ in. from the line of the bar, B, it is bored to receive the lower end of the drill brace; thus the brace is supported by this arm and that marked *d*, and moves freely up and down in them. The wooden handle, *a*, is also slotted to slide on the bar, B. An up-and-down motion is given to the brace by means of a link attached to the lower side of the D-shaped part and to the inner end of the lever handle; this link is marked *f* in the sketch. About midway on the arm, *h*, a ½ in. rod passes, with nuts on either side; this rod descends to about the length of the drill used, where a foot, *j*, is provided with a V cut in its forward end; this rests on the rim of the hub, and through the foot at the V is drilled a small hole to allow the drill to pass through; now you have the instrument complete. To use it, you rest the foot last described on the hub rim, with the hole right over the broken spoke, then push the arm, C, upwards till it jams firmly against the inside of the wheel rim exactly at the place where the new spoke is to be put in, and with the rim in the V-hollow of C. Now, the drill is in position to bore in the exact direction for the spoke. Motion is given by the right-hand handle, *a'*, and the lever handle being pulled with the left hand in the direction of the arrow, gives feed to the drill, and a very powerful feed it is. I have described this apparatus at some length as it may interest some others, if not SPOKES. As there is no drill apparatus of this form in the market, of course SPOKES would have to make one, or get one made, which would cost him from 40s. to 50s.—A. S. P.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. P. (*Heywood*); F. McC. (*Glasgow*); J. T. H. (*Liverpool*); E. T. L. C. (*London*); J. M. P. & Co. (*Nottingham*); J. P. S. (*Swanley*); F. H. W. (*York*); W. J. (*Belfast*); W. D. O. (*Newnham*); J. G. W. (*Hackney*); G. D. (*Oldham*); D. D. (*Edinburgh*); COACH TRIMMER; L. B. (*Ilkeston*); W. E. B. (*Hull*); F. C. (*Belfast*); IBEX; G. A. M. (*Chorley*); G. L. B. (*Bridport*); THEO; VICTOR CYCLE CO.

Trade Notes and Memoranda.

A SOMEWHAT bold departure is being made on the locomotives of an American railroad, by substituting solid connecting rod ends for the usual adjustable arrangement. The locomotive superintendent of the line in question asserts that his experience with engines fitted with straps and keys in the ordinary way has shown very conclusively that adjustment of the crank-pin brasses is no more necessary than of the ends of the coupling rods, especially if the crank-pin journal is of the proper size, and the best materials are used. On this road mild steel, case-hardened, has for some years been employed for crank-pins with very successful results, the only precaution found necessary being to avoid such high carbon steel as would harden to a great depth, and thus prove dangerous. It was found that the engines on this line would run from fifteen to eighteen months without adjustment of the rear end of the connecting rod being required, and this led to the adoption of solid ends in some new engines now building. These engines have cylinders 17 in. in diameter and 24 in. stroke, the driving wheel being 62 in. in diameter. The main crank-pin journal is 5 in. in diameter and 5 in. long. The durability of the brasses and pins is largely attributed to the use of hardened steel, and it is considered that the success of the new departure will be questionable if soft steel pins were employed. It is very probable that the successful working of solid end coupling rods has in a measure suggested this innovation, but we question very much if solid connecting rod ends will prove as satisfactory in working.

ANOTHER Blue Book of 104 pages, completed by Mr. Burnett of the Labour Department of the Board of Trade, deals very exhaustively with the subject of strikes and lock-outs. From this it appears that no less than 509 trade disputes, involving stoppage of work, have been recorded for the year 1888. In these the cotton trade takes the lead, numbering 155 strikes, and coal mining follows with 137. If to these branches of industry we add the shipbuilding and engineering trades, then in these four 74·6 per cent. of the disputes of the year have occurred. Of the total of 509, 392 strikes happened in England, 22 in Wales, 94 in Scotland, and 1 in Ireland. Again, in 320 instances, or 62½ per cent. of the whole, the strikes were for advance in wages. Of these 175 were successful, and 76 partially successful, the remainder having failed, or the result is not known; 54 strikes were against reduction in wages, and of these only 12 succeeded. Several miscellaneous causes make up the remainder. Then, as regards mode of settlement of the 509 reported cases, 332 were settled by conciliation, 15 by arbitration, 85 by the submission of workpeople, 23 by hands being replaced, the results of the rest not being known. As regards numbers, these strikes affected directly and indirectly 118,288 persons, and as far as is known their aggregate duration was 7,265 days. The whole of the blue book bristles with tables of statistical figures which may be profitably studied *in extenso*. And not the least valuable part of the report is the early section, wherein Mr. Burnett traces in outline the whole history of the warfare between the employees and the employed, and of parliamentary legislation bearing thereon from 1824 to 1888. Finally, there is a summary of foreign strikes, which goes far to show that the English workmen are no more guilty of driving trade abroad by striking than the workmen of some other countries. Thus, in the United States, between 1881 and 1886, Mr. Burnett states that 3,902 strikes took place, involving 22,304 establishments, and 1,323,203 hands, and that in 1888, 5,589,578 days were lost in unsuccessful strikes, and 1,972,902 in those which were successful. After giving an account of some continental strikes, Mr. Burnett concludes: "Violence and bloodshed seem concomitants of most continental strikes. Workmen appear to turn out in a transport of passion, and after a few days of violence and uproar return to work, after having been subjected to severe treatment by the authorities. Details of these foreign disputes are necessarily meagre, and in most cases even the duration can only be fixed approximately, but it is quite clear they are mostly brief, and seldom, if ever, go on for months and years with dogged persistency as often happens in England."

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [24 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT's, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured.—ETHELBERT HENRY, Alvaston, Derby. [22 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

On Sale.—Medallion Lathe with Division Plate and Medallion Machine.—J. W., 17, St. Peter's Square, Preston. [1 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health.'

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

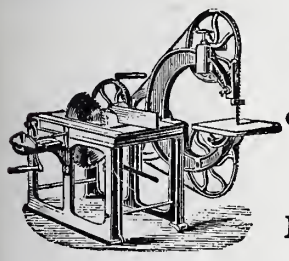
Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

LEWIS & LEWIS,

ENGINEERS,

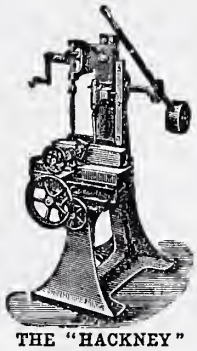
CAMBRIDGE HEATH,

LONDON, N.E.



THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,

For Hand or Power, will take in 22 in. Circular Saw, and will cut by hand-power up to 5 in. deep.



THE "HACKNEY" MORTISING & BORING MACHINE, With 8 Chisels, 1 Coredriver Key, 3 Augers, and 3 Drills.,

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.

SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

PRICE, TALBOT & CO., LIMITED,
LATE DALE & Co.,
26, LUDGATE HILL, LONDON, E.C.

SPRING CLEANING.

? How do you do? WITHOUT JUDSON'S DYES? 6d. POWDER AND LIQUID.

60th Thousand, price 1s.

Cassell's Shilling Cookery.

Post free, 1s. 3d.

WATERPROOF FLUID GLUE.

(Patent.)

By post, 1s. 3d. *and* 8d.

WATERPROOF GLUE CO.,
62, Dale Street,
LIVERPOOL.

NEW VOLUME OF

Little Folks

Commencing with the JULY PART, price 6d.

A Prospectus sent post free on application.

Cassell & Company, Limited, Ludgate Hill, London.

HOME INDUSTRIES EXHIBITION,

TO BE HELD IN CONNECTION WITH

THE NATIONAL CO-OPERATIVE FESTIVAL,

CRYSTAL PALACE, AUGUST 16TH TO 23RD, 1890.

Gold, Silver, and Bronze Medals, Money Prizes, and Certificates for all classes of work.

Schedules free upon application to WM. BROOMHALL, General Secretary, 49, Bedford Street, Strand, W.C.

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

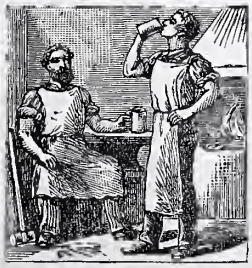
TOOLS TOOLS
MOSELEY & SON
323 HIGH HOLBORN
200 PAGE-CATALOGUE
BY POST 6P
ORDERS OF 10/- CARRIAGE PAID

MONTHLY, *4d.*

CASSELL'S TIME TABLES.

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents.
37, CHANCERY LANE, LONDON, E.C.

POST FREE ON APPLICATION.

CASSELL'S CLASSIFIED CATALOGUE.

MELLIN'S FOOD

FOR INFANTS AND INVALIDS.

MASTER MILLAR.
Aged 12 Months.

"31, *Harewood Square, N.W.*

"Mrs. MILLAR's little boy—taken the day he was a year old—brought up on MELLIN'S FOOD till then."

Samples, Pamphlet, and Prospectus Post Free on Application to

G. MELLIN,

Marlboro' Works, PECKHAM, S.E.

FROM £7 10s. fitted complete with our famous Tools.

RD. MELHUISH'S PATENT WORK BENCH AND TOOL CABINET.

Illustrated Lists Free by Post.

Excellence of TOOLS for Wood Carvers and all Metal Workers.

Bronze Medal - 1884.
Gold Medal - - 1890.

We hold the most complete Stock of Tools and Hardware in this country.

RD. MELHUISH & SONS,
84, 85, 87, Fetter Lane,
LONDON.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.
SOLD EVERYWHERE.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic WEAKNESS speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,
President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,
52, OXFORD ST., LONDON, W.
(Corner of Rathbone Place),
All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

A Four Page Supplement is issued Gratis with this Number.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

Vol. II.—No. 66.] SATURDAY, JUNE 21, 1890. [Price One Penny.

A FEW HINTS TO INTENDING PURCHASERS OF CYCLES.

BY P. B. H.

When walking along a good main road in the country, it is often both interesting and amusing, and affords a good subject for thought, to note the various, and sometimes absurd, positions in which cyclists hold their bodies when riding. Some with straight backs inclined to the horizontal at angles of 45 degrees; some with well-rounded backs like a drawn bow; others bending almost horizontal, with their noses in dangerous proximity to the front wheel, at the same time swaying their head and shoulders from side to side like the pendulum of a clock, this side motion being combined with a vertical motion caused in their endeavour to increase the propelling power. Again, how easy some others seem to glide along; in fact, judging from these latter, it seems to the pedestrians so easy that they immediately draw the conclusion that scarcely any exertion is required to ride

Fig. 1.—Rider on badly designed Safety Bicycle. Distance between Handles and Seat much too great.

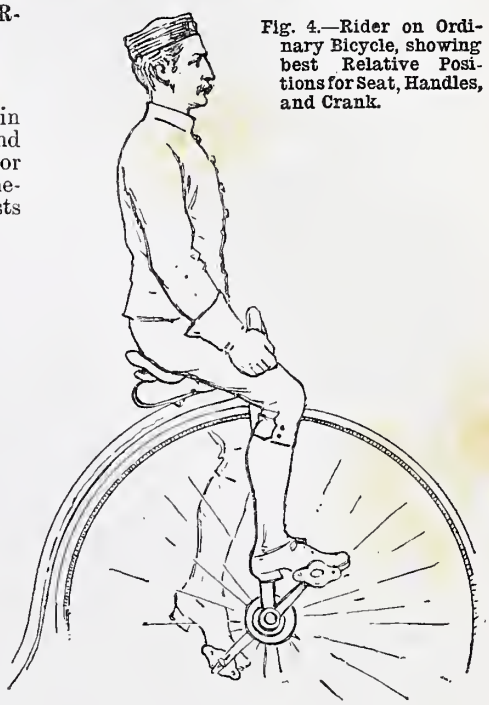


Fig. 4.—Rider on Ordinary Bicycle, showing best Relative Positions for Seat, Handles, and Crank.

Figs. 1, 2, and 3 should be carefully compared and Change of Position noted.

Fig. 2.—Rider on Seat too far back, but not so much as in Fig. 1.

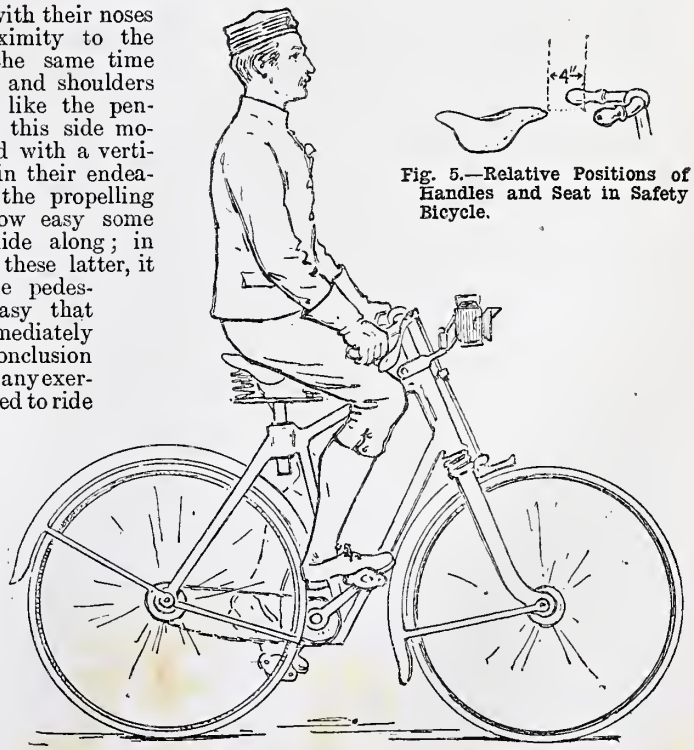


Fig. 3.—Rider on Safety Bicycle in Perfect Position.

Fig. 5.—Relative Positions of Handles and Seat in Safety Bicycle.

a cycle along the road. This appearance of ease is caused by the rider sitting perfectly upright, the power driving the machine passing imperceptibly by tension through the arms from the handles to the shoulders, and from them to the pedals, and not by the awkward, jerky motion of the body before alluded to.

Most of the positions can be traced to some peculiarity in the designs of the machines. The rider of a well designed machine, that is, a machine made to suit his build, and with the seat, handles, and pedals placed in the best relative positions to each other, can always sit upright, though some still choose to stoop, and this rider, if placed on a badly designed one, would from use still sit more upright, and appear to travel more easily than a man who had ridden an inferior designed machine continuously, and some of the latter riders would not be able to sit upright on a good machine from the habit of stooping which has been acquired by having a badly designed machine.

I shall endeavour, by the aid of the accompanying sketches, to engraft on the mind of intending purchasers the principal points which go to make a good machine, by contrast with two badly designed ones, so that any reader, though inexperienced in the art of riding, may, when buying a machine, whether new or second-hand, form a good judgment of its qualities. I shall not enter into the subject of workmanship here, as it is generally in proportion to the price that is paid.

The sketches that I have made are of bicycles, as may be seen, but the remarks apply equally to tricycles.

Fig. 1 shows a rider with exceedingly round shoulders, caused, as can be seen, by a badly designed machine. In this particular case, the great defect is that the distance between the handles and seat is much too great. The seat, as here shown, is too far back, being almost over the centre of the driving wheel, having been placed there, no doubt, to secure adhesion, which it certainly does, but at the expense of steady running, machines of this class running very "wobbly," if I may use the term. Imagine a locomotive with nearly all the weight on the drivers, and only a comparatively small amount on the leading wheels or bogie. There would be a great many more coroners' inquests in this country if this custom were followed in these quick-running engines. The seat is the correct height relatively both to the crank shaft and handles, but it should be placed only slightly behind the centre of the crank shaft, when, if the rake of the front fork were slightly increased, the rider would be able to sit straight and thus be able to use his power to the best advantage. The seat in the position which is shown in Fig. 3 gives quite sufficient adhesion for the steepest hills capable of being ridden, and at the same time the weight is distributed more evenly.

Now compare all the angles formed by the arms, body, and legs in Fig. 1 with those in Figs. 3 and 4. In the former figure the rider would, when climbing a hill, be compelled to increase the pressure on the treadles by the ungainly jerky motion of the body before-mentioned, as the pull of the arms would only have a tendency to make him more round-shouldered, and draw him off the seat while but slightly increasing the pressure on the pedals.

To sum up Fig. 1. The seat must be brought forward almost centrally above crank shaft, when the work will be applied in the best manner, which is directly downwards, and not, as shown, at a considerable angle. The rake of the fork should be slightly increased to bring the handles nearer the seat when the rider could sit perfectly upright, and apply his power through the arms without the fatiguing exertion of swaying the body vigorously about. In Fig. 2 the seat is still too far back, but not as much as in Fig. 1. The principal defect is that the handles are too high. In this case, the rider, when on a level, good road, can sit quite upright because little work is required to propel the machine, but a slight incline in the road would compel him to bend forward to apply the necessary pressure, as the pull through the arms does not help the application of the power to the pedals even as well as in Fig. 1, and you will again see the ungainly swaying motion of the body. The angles formed by the various members are again in this figure very awkward, and can bear no comparison to those of Figs. 3 and 4.

The position of the rider in Fig. 3 is about the nearest perfection that can be attained in a Safety machine. The wheels should be about 30 in. diameter. The seat is placed only slightly behind the crank shaft; thus the rider gives a vertical pressure on pedals, and his weight is more advantageously distributed in relation to the front wheel. and the rake of the front fork, together with the curve in the handle bar, brings the handles well towards the thigh. The question might be asked—"Why not curve them more, and bring them almost vertically below the shoulder?" In this case, the torsional strain in the head carrying them would be so great that they would most probably twist off.

Fig. 4 shows the rider mounted on an ordinary, and I have sketched it not to persuade any reader to buy an ordinary, but simply to show what may be considered the best relative positions for the seat handles and crank if they could only be attained in the Safety.

It does not follow that the riders of ordinaries always sit straight, but they have, if they desire, the best opportunity for doing so, and it is their own fault if they choose to ride in an inelegant position. I have seen riders bent almost double even on these machines. In all well-designed Safeties, the pedals are movable in a slot—that is, you can shorten or lengthen the stroke; the seat is also adjustable vertically, and handle bar likewise. Suppose all three fixed midway in the extent of motion—that is, the pedals in the centre of their slot, the seat and handle bars likewise. Now, to see if the machine is suitable, turn the crank till the pedal attains its lowest position, then mount the seat and extend the leg downwards, when, if suitable, the heel of the boot should just touch the pedal. This will be found a good working length. The handles should be about 4 inches away from the end of the seat, as shown in the sketch given in Fig. 5, and the top of the seat should be level with the handles.

If these instructions are followed, I have no doubt the purchaser will be satisfied with his machine, and not get disgusted with it, as a great many do, a result which arises most probably from some defect in the design. The use of the bicycle and tricycle as the means of locomotion must be regarded as extending daily in this country, and is becoming of increasing importance from a military point of view, and what I have written on the subject cannot be regarded as ill-timed or out of place.

MECHANICAL MOVEMENTS.

BY FRANCIS CAMPIN, C.E.

Converting Rectilineal Reciprocating into Continuous Rotary Motion and the Reverse—Rectilineal Vibrating and Rotary Motion, Reciprocating and Intermittent.

In the inception and development of an invention there are several stages, and in some of these peculiar difficulties present themselves, especially if the inventor is not an accomplished mechanician. Setting aside accidental discoveries—which are not, strictly speaking, inventions—the course of evolution starts from the necessity or desirability of some mechanical method of performing some definite operation, suggesting itself to some individual usually in the class of business in which the particular operation is used. Having found out a real want, the next step is to ascertain how it may be met, and if means are available whereby the desired end can be reached without incurring too great an expenditure to yield economical results.

The mistakes that occur through a want of acquaintance with the mode of action, and scope of the mechanical movements at our disposal, are familiar enough to those who have occasion to refer to any extent to the records of the Patent Office, where we constantly come upon mechanical impossibilities, and, even in our days, encounter that most ridiculous of all fallacies, attempted perpetual motion, or apparatus for creating energy. The two classes of error arise from insufficient mechanical experience in the first instance, and an ignorance of physical principles in the second; and in this article it is my intention to treat of matters purely mechanical in the hope of rendering such assistance to my readers as shall not only prevent their falling into error, but also guide them in choosing the simplest and most satisfactory combinations to secure the ends at which they aim.

It very oftens happens that a contrivance which, on first consideration, appears a simple affair, becomes, by the time it is made to perform its duty perfectly, of so complex a character as to put it quite out of the market; it is, therefore, of the first importance to design every part with an unceasing regard to simplicity, and to design and re-design, over and over again if necessary, to retain it; and as a machine is built up new ideas will arise as to the details already set out by which great improvements are often suggested.

A very helpful course to pursue, especially when novel combinations are contemplated, is to make models of each part as we progress, and this can generally be done in thin wood, working on pins and guides on a stout board, or the working parts may be made of stout millboard or of several layers of Bristol board fastened together with thin glue. This last material I have found very convenient on account of its uniform texture and freedom from grain; moreover, it does not warp after it is once made up. For tubes and other cylindrical parts, ordinary note-paper gummed together answers very well and keeps its shape admirably. If a semi-cylinder is required, it is best to make a complete cylinder by continuing to roll and gum the paper round a roller until a suitable thickness is obtained; when the whole is thoroughly dry the cylinder is cut in half longitudinally, and will retain its form. Most people will have their own opinions as to gums, but I have always found clear gum arabic dissolved in warm (not hot)

water the most satisfactory. Where pieces of cardboard have to be fixed by their edges diamond cement will be found reliable. No special tools are required for this class of card model making—a metal straightedge, a penknife, pair of scissors, a small keen chisel, and a carpet-needle in a handle for a piercer to mark centres, will suffice for all practical purposes, with a few weights to hold gummed and glued parts together until they are set.

Having opened with these few introductory remarks, I will now proceed to describe the different kinds of mechanical movements in classes according to the duties they are required to perform, and to show also methods of setting them out for practical purposes, and the peculiarities of their action.

Converting rectilineal reciprocating into continuous rotary motion and the reverse.—The most common arrangement for this purpose is the crank, Fig. 1. The length of the crank between centres B C is one half the rectilineal travel of the block A, which moves in guides of some sort to preserve the direction of its motion. If the block A moves with uniform speed the rotary motion will not be uniform; starting from the point D, the crank pin C will have its greatest velocity relatively to that of the block, and falls to its minimum speed when at right angles to the connecting rod A C, from which position it again increases until it reaches the point E. The points D and E are called dead points, because the force on the block A has no tendency when C is at either of those points to move the crank in either direction. In order to render the velocity of rotation as nearly uniform as may be required—as in a steam engine for instance—a fly wheel is fixed on the mainshaft B, but its duties and action will be treated subsequently. The dead point difficulty is obviated by having two driving cranks on the same shaft placed at an angle, most commonly a right angle to each other, so that while one is passing a dead point, the other is exercising almost its highest power; this arrangement also serves to equalise in some measure the force exerted during the revolution. It is evident that the block A will make a stroke forward and back again for each revolution of the crank. The length of the path travelled by the crank pin in one revolution is equal to the stroke, D E, multiplied by $3\frac{1}{7}$ (the ratio of the circumference of a circle to its diameter), and during this passage the block A makes two strokes, therefore the *mean* pressure on the crank pin will be the pressure upon the block A multiplied by 11 and divided by 7. If the crank pin is made so large as to extend beyond the main shaft B, as shown in Fig. 2, we have a modification which is called an eccentric, because the wheel F G H is fixed eccentrically upon the shaft; the eccentricity C B, which is called the throw of the eccentric, is equal to half the travel of the block A. Although the crank and the eccentric are the same in principle, yet practically there are considerable differences; for long travels of the block A the crank is decidedly preferable, for it is desirable to keep the crank pin as small as possible so as to lose as little power as may be in friction, and for a given pressure the work lost in friction varies as the diameter of the crank pin—this is evident, for as the pin revolves in its bearing, the friction on its circumference due to the pressure upon it must be overcome at each revolution through a distance equal to its circumference. If, however, the throw is small, the crank pin may encroach upon the shaft; these cases occur chiefly where rotary is to be converted into reciprocal rectilineal motion, and it is for that purpose that the eccentric is chiefly used. By its adoption, the cranking of the shaft is avoided, and where a number of different movements have to be derived from one shaft, it is of great advantage to keep the shaft intact throughout its length; it will then be more uniformly strong, and therefore work with more steadiness and freedom from vibration than if it is bent about. If there is no room for the connecting rod A C between the block A and the main shaft B, a device shown in Fig. 3 may be used—it is very commonly found in small pumping engines; the crank pin works in a block F, which is fitted to slide in the vertical slotted bar D E; the rod A carrying the block F is supported in guides G G. The block F may be replaced by a roller to reduce friction, but in order to allow it to act there must be some play in the slot, and this involves some blow at each change of direction of the driving block, hence there is a disadvantage to set off the gain. Without the roller, the friction is necessarily great, and the arrangement is not one to be chosen, and in any case should only be used with short strokes, as otherwise the twisting strains upon the rod A will be very considerable. With a proportionately enlarged width of slot, this arrangement can be applied to eccentric movements, and for very short travels will often be found very convenient by reason of its compactness.

If it is required that both the rectilineal and rotary motions shall be uniform in speed the combination, Fig. 4, may be used. It consists of two parallel racks D E facing each other in an oblong frame G H, carried at each end by bars A A, which lie in a straight line and work in guides I; B is a toothed segment keyed on the shaft C. When the racks are moved back and forth to their full extent, they gear with the segment B alternately, and the same thing occurs when the racks are driven by the segment; it is obvious that the periphery of the segment will move with the same velocity as the rack, and, therefore, if the motion of one is uniform, so will that of the other be. The teeth must be so set out and arranged, that exactly as the last tooth of the segment leaves one rack, the first tooth takes into the other; of course the number of teeth will be the same in the segment and in each rack, and each stroke will have a length equal to the arc of the segment measured on the pitch line. Fig. 5 shows another method of obtaining uniform reciprocating motion when a long travel is required, which, were the previous mechanism used, would require an inconveniently large segment. The driving pinion A is carried on a short shaft working in movable bearings in the vertical slot B B in fixed parts of the framing. C C show a groove in one of the side plates attached to the double rack D D; in these grooves, the ends of the shaft carrying the pinion A and band pulley G work, and so the pinion is kept in gear with the rack. After the pinion has pushed the rack to the end of its stroke, it turns round the end teeth, and operating on the under rack, makes the return stroke and then mounts to the top again, its bearings falling and rising in the slot B B at the respective ends of the stroke. The pulley G is driven by a band F F from the pulley E, which is so placed that its centre is equidistant from that of the pinion shaft whether the latter is in its upper or lower position, and, therefore, the tension on the band is constant when the pinion is driving. Of the rack and pinion methods of attaining the changes of motion now under consideration, I might give a very great number of varieties, but the object in view is to describe only such as may be relied upon as efficient, and in this connection it may also be said that moving bearings should only be used when unavoidable, as they add to the friction and liability to derangement.

When anything approaching high speed is used in parts that reverse the direction of their motion, care must be taken to have racks and toothed wheels made of tough material; if they cannot be cut out of wrought steel or wrought iron, they should be made of cast steel or "mitis" metal, to enable them to resist the shocks to which they will be subjected. Wherever toothed gear can be replaced by link-work, it is best to use the latter, as it saves noise and vibration. A friction-clutch connection by which rectilineal can be converted into rotary motion (but not the reverse) is shown in Fig. 6. A is the shaft to be driven, and upon it is keyed a disc B, having a groove cut in its circumference. To fit this groove, two friction pawls M and N, of which one is shown enlarged at O, are made, so that if pressed against it they will squeeze into the groove and bite, but if drawn in the other direction will merely slide over it. P is an end view of the driving disc showing the pawl groove Q, in which the pawls N and M work. On each side of the disc B, are arms R and S, which revolve freely upon the shaft A, but are prevented from sliding along the shaft by collars provided for that purpose; one pair of arms, R, carries the top pawl N, and the other pair, S, carries the bottom pawl M, the pawls being turned in opposite directions.

The pawl N is jointed to the arms R by the pin G and to the connecting rod D by the pin F. When the block C moves in the direction of the arrow, the connecting rod D pulls upon the pin F, and turning the pawl N upon the pin G, throws it into the groove Q, where it bites and thus turns the disc B and shaft A, the pawl M meanwhile sliding backwards over the groove, a small stop at the end of the arm S preventing its falling too far back; on the return motion the pawl N is released, and the disc driven by the pawl M connected by the pin I to the arms S, and by the pin H to the connecting rod E. The motion of the disc will be in the direction shown by the arrow at A.

Rectilineal, vibratory, and rotary motion, reciprocating and intermittent.—Vibratory motion can be obtained from rectilineal, and rectilineal from vibratory, from either the crank or eccentric, or from a toothed sector and single rack. In Fig. 7, A B is a crank on a continuously revolving shaft A, from which a vibratory motion is communicated to the rocking arm C D by the connecting rod B C. The arm C D may be made to give an intermittent reciprocating motion to a bar carried in guides, G G, by prolonging it and fixing on the prolongation a pin E, which takes into the teeth F F on the bar during part of the vibration, and thus gives an intermittent and reciprocating movement to the bar, such as might be suitable for feeding material to certain machines. In order to hold the bar at rest when it is not being moved by the pin E, which may be furnished with a roller to reduce friction, the teeth F F may be replaced by a slotted plate, H. The curved slots I I are made to the radius of the path of the pin E, and while it

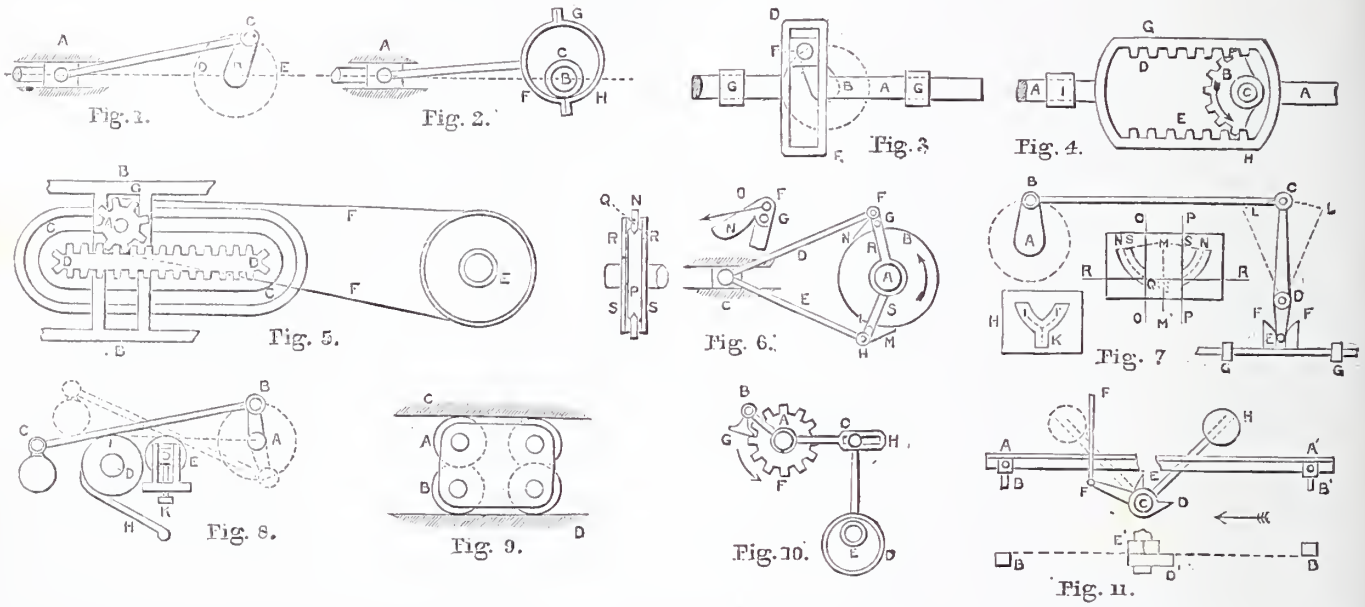
is in either of those branches the bar is held at rest, but when it descends into the part K of the slot the bar is moved. In some cases, an intermittent feed is required of some considerable extent, but no return of the feeder is permissible—a device for effecting this is shown in Fig. 8. B A is a crank continuously revolving upon a shaft A. The feed roller D requires to be rotated intermittently. There is a friction bar B C, which at the end B is jointed to the crank, and at the other end is weighted, pressing sometimes on the feed roller D, and at others on the loose roller E, carried upon a dead centre fixed to the framing. While the friction bar presses upon D, the latter revolves, but always in one direction, because on the return stroke the bar rests on the roller E, as shown by the dotted lines. The spring H presses a light brake against the roller D to keep it at rest when not acted upon by the bar B C. By making the dead centre upon which the roller E runs adjustable, the amount of motion that is given to the feed roller D may be regulated without any difficulty.

In setting out the movement in Fig. 7, the length of the crank A B will be one half the chord L L of the arc L C L; the travel of the pin E will be to that of the point C as the length E D is to D C. In order to determine the form of slot for any given travel of the bar in the guides G G, draw the straight line M M′ at right angles to the bar, and from M, with a radius M N equal to D E enlarged, describe the dotted arc N N equal to the arc of travel of the point E; draw the straight line R R at right angles to M M′ and cutting it in the point Q, then from the point Q on the line R R mark off half the required travel of the bar on each side, and through the points so found draw parallel to M M′ the straight lines O O and P P, intersecting the dotted arc at S S, then the two arcs S N, S N, brought together so that the line O O coincides with P P, and the points S S coincide, will form the upper branches of the slot; the vertical slot must be carried low enough to clear the bottom of the whole arc N N. The centre lines being thus obtained, the width of the slot is set out to suit the diameter of the pin or roller intended to work in it.

In the friction bar, in arrangement in Fig. 8, in which no back motion is allowable, the length of the crank A B must be equal to half the maximum travel required (if it is variable), then a straight line A I being drawn from the centre A to touch the upper surface of the feed roller D, the relief roller E must be so placed as to touch the line I with its upper side; and if it is made adjustable it must be so set that it cannot be lowered. By raising it by means of the screw adjustment K the amount of feed at each stroke is reduced.

It seems advisable here to point out the advantages gained by friction rollers, as I have already had occasion to refer to them; and shall again. If a pin, say, or a block, works upon a slide, then the amount of work lost in friction in foot-lbs. during each stroke will be equal to the friction resistance multiplied by the length of the stroke. For example, the friction of a smooth block on a smooth guide, both being of iron, will be about one-fifth of the pressure on the block. If, then, there is 40 lbs. load on a block moving 3 ft. each stroke, the loss by friction would be 40 divided by 5 and multiplied by 3, equal to 24 ft.-lbs. Suppose, instead of the sliding block, a pin one inch in diameter surrounded by a roller two inches in diameter is used, then the friction is between the pin and the roller carried by it; and as the pin is one half the diameter of the roller, the distance travelled by the rubbing surface within the roller will be one half of that travelled by the rolling surface upon the guide; and, therefore, the work lost by friction will be reduced by one half. In both cases the friction may be reduced from one half to a third by the use of lubrication; and when this is done, there is a further advantage in the use of rollers, because the oil is held by capillary attraction between the roller and the pin; and the pressure between the surfaces, although forcing it forward, keeps it upon the surfaces to be lubricated, and it is not exposed to the drying influence of the air; whereas, the lubricant upon a guide is pushed by the block beyond the working surfaces, and the greater part of it is at all times freely exposed to the air. It is obvious that the larger the diameter of the roller in relation to the pin the less will be the friction; but, even when there is very little room for difference, the advantage of easier lubrication will make it worth while to use rollers. It is, however, not to be overlooked, that if a single roller is used, it must be made a little less in diameter than the distance between the guides to allow it to turn; and, with very heavy pressure, this might cause rather heavy knocking.

Considering the saving of wear, especially on the guides themselves, it is worth while to take a little trouble to obviate this evil where it exists in any appreciable magnitude. In Fig. 9 is shown an arrangement of rollers, of which the simplest form will be two, A, B, running between guiding surfaces C and D. In this case, the rollers may always be in contact with the guides, and with each other, and be held in position by pins fixed in side plates. More than one pair of rollers may be used in the same block if desired; but, of course, there must be some clearance between each pair of rollers. Fig. 10 shows a device very much used for giving the feed in machine tools for shaping, milling, and other purposes. To the shaft A (which may have a screw thread cut upon it to give motion to a tool box or a table carrying work) is keyed a tooth wheel F; and upon the same shaft there also oscillates freely a bell crank C A B; the end C is caused to oscillate by the rod C E, which is actuated by the eccentric D upon the shaft E. The double pawl G is made so that in one direction it will slip over the teeth of the wheel F, but in the other direction catch in them and turn the wheel, in the direction of the arrow if in the position shown, but in the opposite direction if the pawl is turned over to the position shown by the dotted lines. This pawl and wheel arrangement is sometimes actuated by stops and a tumbler, as shown in Fig. 11. A A′ represent the two ends of a travelling table, on which are fitted adjustable stops B B′, by the position of which the traverse of the table is governed. C is a shaft carried in fixed bearings, and carrying on an arm a weight H; this arm moves between fixed stops, which limit its throw between the



Mechanical Movements. Fig. 1.—Crank and Connecting Rod. Fig. 2.—Eccentric and Connecting Rod. Fig. 3.—Crank and Cross-Slotted Rod. Fig. 4.—Double Rack and Segment. Fig. 5.—Returning Rack and Pinion. Fig. 6.—Pawl and Disc Movement. Fig. 7.—Crank and Vibrating Arm. Fig. 8.—Intermittent Roller Feed. Fig. 9.—Anti-friction Rollers. Fig. 10.—Intermittent Ratchet Feed. Fig. 11.—Adjustable Stop Feed.

position shown and that in which H would be, as indicated by the dotted lines. Upon the shaft C is fixed a boss carrying two projections, D and E, the latter lying behind the former, as shown at D′ and E′ in the plan view; so that the stop B′ will act only on the tooth D, and the stop B on the tooth E. If the table be moving in the direction of the arrow, the stop B′ will come in contact with the tooth E′ and throw the shaft a quarter round, the feed being actuated by the short arm C F and rod F F; on the return of the table the stop B will strike the tooth D, and throw the gear back to the position shown. This tumbler arrangement can also be used to reverse the direction of the table by various means which come under the head of reversing gear. The travel of the pawl G (Fig. 10) can be adjusted by making the end of the arm A C with a slot, in which the pin, carrying the upper end of the actuating rod, can be secured at any desired distance from the centre A. The use of the weight H (Fig. 11) is to keep the shaft C and its appendages at rest when not acted on by the stops B and B′.

I must reserve my remarks on release and trip movements and cams and cam bars for another brief paper.

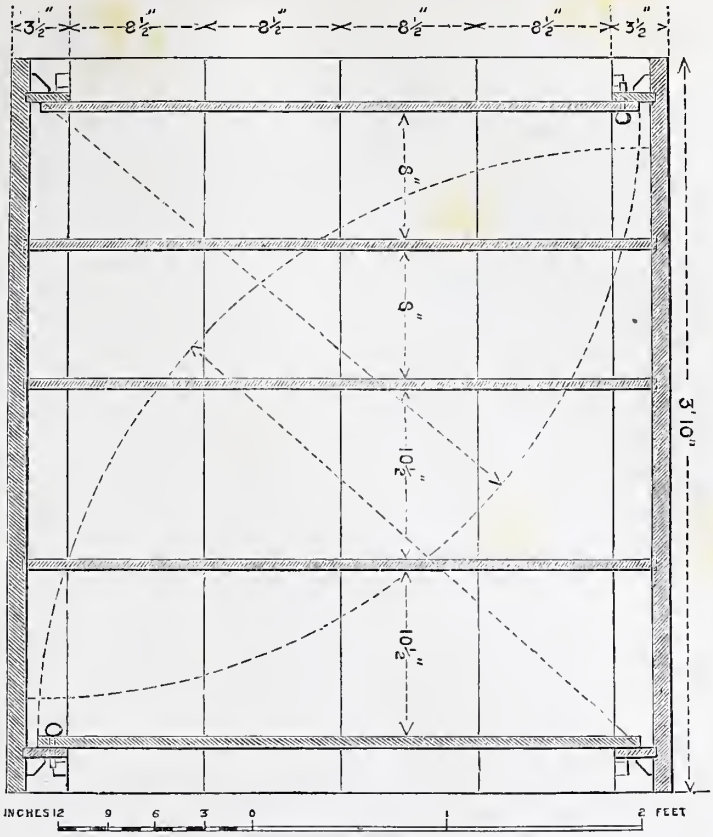


Fig. 2.—Section lengthways from Side to Side of Bookcase when open. (Scale applies to Figs. 1, 2, and 3.)

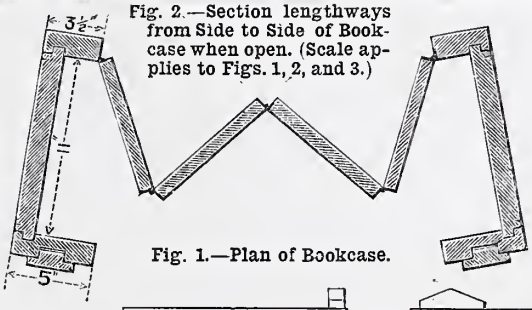


Fig. 1.—Plan of Bookcase.

A PORTABLE FOLDING BOOKCASE.

BY GEORGE H. BLAGROVE,
Author of "Decorative Woodwork," etc.

A BOOKCASE which can be folded up and packed in a small compass is likely to prove a useful article to many persons who live habitually in furnished lodgings, having their own stock of books, and now and then changing their place of abode. The idea of a folding bookcase is not new. One was described and illustrated in *Amateur Mechanics* in January, 1883, the description and illustrations having been reproduced from some other publication. But the constructive details, so essential for workmanlike execution, were wanting. The present design is new, and the construction has been, in some slight respects, modified, and, it is hoped, improved.

The plan is shown in Fig. 1, and it will be seen that the sides of the bookcase consist of two boxings made out of $1\frac{1}{2}$ in. stuff, which would probably finish $1\frac{3}{8}$ in. thick, grooved and tongued together. Between the back and front is a clear space of 11 in., to allow depth for the books. The back is formed with four pieces hinged together, each piece being made to finish $8\frac{1}{2}$ in. wide and $\frac{3}{4}$ in. thick.

Fig. 2 shows a section taken longitudinally from side to side through the bookcase when open. At each end of the side boxings a piece, 12 in. by $2\frac{1}{2}$ in. by $\frac{3}{4}$ in. thick, is housed into the front, back, and side of each boxing, and sustained firmly in position by means of angle-blocks, glued in as shown. These pieces serve to strengthen the boxings, and it will be seen from Fig. 2 that they also serve as stops, against which the top and bottom of the bookcase are closed when the whole is in use. The top and bottom are out of $\frac{3}{4}$ in. stuff, and should finish about $\frac{11}{16}$ in. thick. They are, moreover, 11 in. wide, and should finish a little under, to allow them free play inside the boxings. The same remarks apply to the shelves. The top of the bookcase is hinged to the under side of the left-hand upper crosspiece in the side boxing, and it closes against the under side of the right-hand upper crosspiece, to which it is firmly secured by means of two thumbscrews. Similarly, the bottom is hinged to the right-hand lower crosspiece, and closes upon the left-hand lower crosspiece, being similarly secured with thumbscrews. When the bookcase is to be folded up, we will suppose the shelves to have been removed. The top is now unscrewed and moved down so as to close against the side of its boxing. The bottom is next unscrewed, and it is to be observed that it must be made of such a length that it will clear the thickness of the top hanging vertically, and move up with a vertical position against the side of its own boxing. The remaining depth in the side boxings will be occupied by the shelves, two of which will be in one boxing and one in the other. There would be space for another shelf, if desired, which might be if there were many small books. Each shelf has two stub tenons, 1 in. wide by $\frac{1}{2}$ in. projection at each end, which fit into holes or mortises cut at the required levels in the sides of the boxings. One end of a shelf is shown in Fig. 3. When the bookcase is closed together, the front pieces of the boxings, which are 5 in. wide, close together, and the back pieces, being only $3\frac{1}{2}$ in. wide, have a space of 3 in. between them, which allows for the four $\frac{3}{4}$ in. pieces of the folding back to lie between them. The pieces of the back being only $8\frac{1}{2}$ in. wide, this leaves a space $2\frac{1}{2}$ in. deep by 3 in. wide between them and the front pieces of the boxings. This space is occupied by the cornice, of which Fig. 4 is a section. When the bookcase is open for use, there is a clear space of 2 ft. 7 in. between the front pieces of the two side boxings. This, then, is the length of the moulded part of the cornice, beyond which there should be at each end a tenon

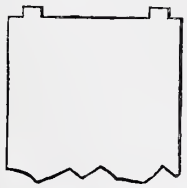


Fig. 3.—End of Shelf.

Fig. 4.—Section of Cornice.

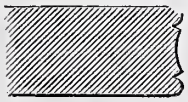


Fig. 5.—Section of Top, Bottom, and Shelves.

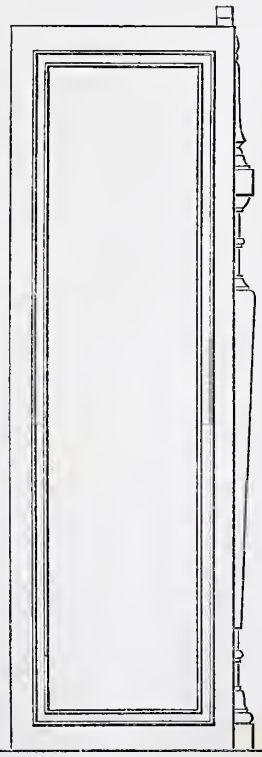


Fig. 6.—Side Elevation.

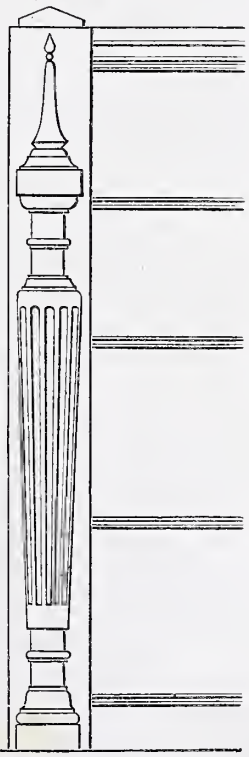


Fig. 7.—Front Elevation.

$1\frac{1}{4}$ in. deep, $\frac{3}{4}$ in. thick, and 1 in. projection, with corresponding mortises in the front pieces of the boxings, so arranged that the cornice, when fixed, shall rest upon the top of the bookcase. Perhaps the reader can improve upon the section of the cornice shown here. Fig. 5 shows the section of the top, bottom, and shelves, and this also may be open to improvement. It is easy to see how the bookcase can be opened, by means of its hinged back, so as to allow the tenons of the shelves and the cornice to be fixed in position. After this is done, the top and bottom can be fixed with the thumbscrews, and the whole will make a firm, strong piece of furniture. A side elevation and part of a front elevation are shown in Figs. 6 and 7. A species of ornamental pilaster is housed or tongued on to the front piece of each side boxing, the side of which is treated as a bead-flush panel. Here again it is left to the reader to improve upon the ornamental part of the design. The space occupied by the entire bookcase when folded for packing does not exceed 4 ft. by $15\frac{1}{2}$ in. by 10 in.

DESIGNING FOR WORK: HOW TO GO ABOUT IT.

BY JOHN WHITFIELD HARLAND.

End, Aim, and Object of Designing—Conventional Treatment—Impressionism.

Since writing my last article on this subject, I must perforce prelude present and future remarks by systematising so vast a field for speculation by subdividing and classifying its various ramifications, so that my readers in pursuing it in one direction may not lose sight of their object in an opposite one, but can come back to a common starting-point. It will then have a more logical sequence; and if I classify all designing according to its purpose or object, I shall be saved much confusion of thought, both to myself and the practical readers of Work. I shall therefore show that all designing, being a means to an end, is classifiable according to its purpose; and deduce therefrom what is the requisite power of conception and inception necessary for each particular class of designing, and instance the kind of knowledge and training most suitable for obtaining such mental power in each purposeful direction.

All designing is capable of reference to this common characteristic, its object, thus—

1. Designing for construction, involving *strength*. 2. Designing for decoration, involving *beauty*. 3. Designing for inventiveness, involving both strength and beauty.

In this classification all designing is embraced.

Designing for construction, be it for buildings, machinery, bridges, public works, furniture, or any other construction, strength is, and must be, its aim, since safety of human life is involved. Economy of material is a secondary consideration, whilst other side issues, such as sanitation, public convenience, etc., will inevitably modify all designing in this direction; mere beauty ought not to have any sway to the sacrifice of its primary purpose of strength.

Designing for decoration involves no danger to life, such as construction inherently entails, therefore the artistic instinct and imagination has free vent, unfettered by fears of future remorse, such as would inevitably haunt the designer of bad construction should human life be thereby sacrificed, to reproduce anything of beauty considered apart from strength. Hence, the most conscientious decorative designer need not consider strength of construction in any other light than insomuch as it will give force and stability to the creations of his imagination—in appearance, not actually.

The third phase of our subject, designing for inventiveness' sake, partakes of both the attributes of the two fore-mentioned classifications. Invention creates improved methods of producing, or improvements in the product required for any purpose, therefore, both strength and beauty (it is granted that their proportions may and will vary greatly) enter into the design or conception more or less in every instance.

It follows, therefore, that all design that does not aim either at strength of construction, or beauty, of some type or other, or both, is valueless, aimless, and bad. Put imaginatively, from the creation of the world—as told poetically in Genesis, with the prototype of strength portrayed in Adam, and that of beauty limned in Eve—down to the present time, it is impossible for any human being to admire or be pleased with anything weak or ugly, *per se*, although such emotions as pity, compassion, and moral condonation of such faults may be brought into play as mere sentiment. Instinctively, admiration is produced by strength or by beauty, or by a combination of both, and not by any other ideality or reality. Mental strength, power of intellect, can be equally recognisable; mental beauty, the beauty of thought and feeling, calls up the same sympathetic admiration as the physical forms of strength and beauty, but I maintain that whether mentally or physically both are absent no human feeling of pleasure can result; by pleasure, I mean the highest and best sense of the word, a plea admitted, an influence over the human spirit welcomed for its inherent good, and for the deep impression on the mind for good. This is, or ought to be, the ultimate of all design. In decoration, a moment's thought will suffice to show that if the governing idea is the producing of such an effect of true pleasure on the minds of others, usefulness as well as mere beauty will result; for children, whose minds are so much more susceptible of impression produced by their surroundings "than is dreamt of in our philosophy," will retain in after-years some associations that have beauty in them which will bear some trace of refinement, even if it is only the mere prettiness of the public-house, or the well-arranged windows of the shops, to say nothing of good pictures, happy effects of colour, and other refinements in their homes. My reason for thus entering into ethics is the very frequent recurrence amongst artists of the expression when just commencing a subject that they "do not feel fit," they "are not in the humour," "ideas do not seem to come," etc. Imagination, like the palate, requires some stimulating sauce, and I think the best sauce to tempt it is the thought of the ultimate result; not to dwell on the commencement, but to look forward to the finished conception realised; the humour for work will soon come, the fitness for the task will soon develop itself, and success will be achieved.

The first step in designing is to decide what the mind is most capable of. If the mind has a natural bent for mathematics, accuracy of reasoning, and not of a poetical and imaginative turn, with a strong will to overcome obstacles, and a strong mechanical tendency, the would-be designer should devote himself to constructive design, and qualify for his future career by thorough study of mathematics, including natural sciences—mechanics, dynamics, hydrostatics, chemistry, physics—with enough knowledge of anatomy to understand the construction of the frames of man and animals, and enough botany to teach him how trees and plants resist strains from without; and, in fact, every subject which has any bearing, near or remote, on the principles of construction in nature, or in the previous work of man. His training should be theoretical as well as practical; he should be able not only to make a drawing himself for others to carry out, he should be practically able, if necessary, to carry into practice his own drawing. As his vocation is mostly to reproduce and copy existing construction, his imagination will not require much training or culture, and may be to some extent impaired and counteracted by the study of fact to the exclusion of fiction, unless he possesses the gift of inventiveness, when imagination, curbed by scientific knowledge, will put him at once into the ranks of the third category of designing.

The alternative to this selection of a profession in designing is that of the mind which hates arithmetic and mathematics, is imaginative and dreamy, cares but little for reasoning, but tends to the refinement of voluptuous form and colour; poetical, and seeks change and variety, new themes, fresh thought, and pastures new; such a nature finds a sympathetic field for its powers in pursuit of the second category, decorative design. The studies necessary for the earlier training in this line are drawing and modelling; the education of the eye and hand firstly for the expression of form, and subsequently for that of colour; optics, including perspective, elementary geometry, botany, anatomy, light and shade; the chemistry of colours and pigments; something of architectural style and architectural history. All these, besides being in themselves useful in his future career, will have during the acquisition a marked influence on his refinement and mental culture, and assist in forming correct taste. His light reading should be poetry, or imaginative standard works, his observation of men and things ever constant and watchful, and above all, his memory (owing to the absence of mathematical study) should be constantly trained to treasure up form and colour. Foreign travel, if possible, should be undertaken, whence spring new ideas, natural effects—novel and suggestive—and that change and variety that so stimulate the imaginative mind by instituting that great educator of artists, comparison. Here the associations of the student's childhood will affect his future to an extent quite incalculable. Apart from the theory of hereditary transmission of mental as well as physical qualities, no one can but admit that if a plant, the lowest form of created life, can be subjected to the nurture of a hothouse and surrounded with all the refinements of a wise plant-culture and thereby become more symmetrical and beautiful than a similar one left to grow up in a wilderness under only nature's auspices, a human being will be to a greater extent mentally as well as physically made or marred by its surroundings whilst young. This channel leads on to endless speculative thought; but in returning to our subject, let us ask, Is our board-school system education at all, in the broad sense of the term? Are our children ever surrounded with the purely artistic forms and colouring of continental

cities, examples of the work of the Dark (God save the mark) Ages? Are even flowers, that cost so little, ever found decorating the hideously painted and badly proportioned schoolrooms; and even from a sanitary point of view, why is not their fragrance used to overcome that faint odour of a crowd we all know so well? And yet we find our statesmen wondering how it is that in artistic feeling our working-men are behind their continental *confrères*, and how it is that ideas in design, ideas which I hold have been sown like seed in childhood and youth, do not come so spontaneously with us as with foreign workmen. Fellow British workmen, amateur or professional, despise not the day of small things, surround your offspring with even the most inexpensive decorations possible—good form, good colour, cheerful light—even if their food is less choice; good examples, however cheap, of chromos, and change them from time to time; you will thus develop in their minds those ideas which will, like a grain of mustard seed, bring forth in due season, some perhaps "an hundredfold." The food for the mind is more important than the food for the body, yet how seldom is this admitted. Designing for the future career of one's own offspring is the highest form of design—it combines strength and beauty. Perhaps I am straining my subject in this latter truth, but its importance excuses my digression.

Workmen, as workmen, whether amateur or professional, are most palpably much more nearly affected by the second category of my classification of designing than either the first or third. I will then give, as in my first paper, which bears chiefly on decorative design, a few suggestions which I hope may prove practically useful. There are, firstly, many terms used every day which I prefer to consider here as so many cant phrases. There is no obstacle to free and original thought so great as this adoption of cant phrases, and in designing, the ideas following in their wake, and the monotonous trail of froth and foam they leave on the ocean behind them are valueless, colourless, and an obstruction diverting the mind from looking ahead. One of the commonest of these cant phrases is the application of the word *conventional* to the treatment of any design. Now, what on earth does this mean in nine out of ten cases? It has degenerated into a phrase to express a *motive* suggested by the form or colour of a prototype in nature, such as a flower, messed about and treated, as another cant phrase has it, æsthetically. I like to call things by their true names, and I have never been able to see that finite man can ever improve on nature, even by going back centuries, when bad drawing—which was very good if judged by what had gone before, but which modern science proves by photography to have been very "bad form" indeed—or the adoption of semi-barbarous ideas of such form and colouring as Japanese ornament furnishes, could never obtain for a moment any foothold on refined taste, but for the insane dictates of fashion. If a writer quotes from another author and does not acknowledge the source whence he derives his inspiration he is a plagiarist (a mild term for literary thief), and if an artist "cribs" from nature, form, or colouring, or arrangement, why should he systematically disavow it by pretending to adopt the barbarian Japanese style? If English artists and designers cannot paint from nature more truthfully and more characteristically than savages centuries behind them in art, in Heaven's name let it be openly confessed and put to shame at once. If we with our traditional art, with a school of painting of which we have nothing to be ashamed, cannot go to nature, and by our fidelity to nature admit the source whence our inspiration is derived, it is time to "shut up shop."

"Conventional treatment," however, used to have a meaning. It used to mean that some form was selected from nature's book, and for the purposes of decorative design it was repeated over and over again in a modified manner, either wholly or in part so as to come within the influence of geometrical dimensions and proportions. Hence the trefoil, quatrefoil, and cinquefoil of Gothic architecture; but now it is used for any debasement of which designers can possibly think. We see bands and bends, borrowed from heraldry, with patches of Japanesque patchwork; dados, with disproportionately large sunflowers, drawn as if we did not know how to draw; and small storks, and doves, and trees painted as if our sole source of knowledge was a Chinese willow-pattern plate put forth as the crowning efforts of English taste and art! Faugh! "Consider the lilies of the field." Do not let workmen mistake me. I do not advocate servile imitation of nature. Mere imitation, be it ever so clever, is not art; it is the imitation of the monkey, not the man's rendering of nature's creation. True art is this:—That a man shall endue his rendering of nature with the stamp of his own individuality of feeling, influenced by his own acquired knowledge, with his own originality of conception, his own light and shade, his own sentiment, his own telling of a sublime story in nature's words, with a pen or pencil steeped in his own vehicle, which shall hold spellbound those who care to prepare their own souls to receive its great message.

Another cant phrase, often in the mouths of those who think not at all, refers to a peculiar style called *impressionism*. Impressionists slur and blur their work until all form is lost in absolute indefiniteness, colour alone being left to tell the story; and very often the colouring is as indefinite as the form, or, rather, the absence of form. I can only regard this "school," as it is termed, as *art intoxicated*, so drunk as to blend one idea into another in an incoherent fashion utterly foreign to nature, and, therefore, to art. Nine out of ten of the "impressionists" cannot draw an outline decently; those who can, have only to finish a drawing and then soak it with water and let the colours and form run at their own sweet will into one another by capillary attraction, and they will produce a much better "impressionist" drawing than its proud professors. Impressionists in oil can readily produce their nondescript effects by putting in pure, but extraordinary and eccentric, colours, utterly untrue to nature, at one sitting, and afterwards, before drying, scumbling over all so as to blend everything together. And this is "Art," forsooth! No! but it is Fashion. It is the outcome of competition. It is one of the penalties paid for attempting to educate "hewers of wood and drawers of water" up to the level of leaders of the art education of the people.

It must not be supposed that I am seeking to depreciate Japanese designs and to discredit those who frequently adapt them to their own purposes, and use them with good effect. I merely enter a protest against too servile an imitation of them. Many contributors to WORK have used them with good effect, and will doubtless recur to them again to the benefit of its numerous readers.

MODERN FORGING.

BY J. H.

BARS: ROUNDS, SQUARES, AND FLATS—MAKING UP FIRE—FIRING TOOLS—TONGS—CHISELS.

IN the judicious choice of that which is the best method out of several possible, lies much of the skill of the experienced smith. For it by no means follows that a method by which a piece of work can be forged to shape, is necessarily the quickest, cheapest, or best; or that what may be the best method in any given circumstance is also the best under circumstances of a different character. And often a man will perforce have to adopt some method which he knows is not the best from a craftsman's point of view, because he either does not possess the iron of proper section, or the tools, or other assistance necessary.

This fact is brought home forcibly to us when we consider the numerous sections of iron required by the all-round smith. Even in large shops, where several men are employed, and steam hammers are available, it is often impossible to manipulate the heavier sections of iron. For these, very powerful hammers are required, in order that the force of their blows shall penetrate to the interior of the mass. Hence many engineers find it necessary to order for massive work specially heavy forgings, or "uses," as they are called at the rolling mills. And every smith is thus subject to limitations in the sections which he can make use of, by the power as well as by the assistance at his command.

The stock-in-trade of a smith who works single-handed, and that of an amateur, must needs be limited to small sections. With a small forge no great heat is possible, and a man working single-handed cannot manipulate any heavy sections. Then, again, bars of iron are made in lengths of several feet, and the purchasing of a fair stock of entire bars of several sizes would prove a heavy expense. It is best then to select a few entire bars of the most useful dimensions according to the class of work which it is intended chiefly to do, and when any other sections happen to be wanted, to purchase them in short lengths of some friendly local smith, or iron stores.

The principal sections of iron used by the smith are "round," "square," and "flat" bars. These are made in almost all minute fractions of ordinary dimensions, and in different qualities. The Earl of Dudley's brands are among the best known in this country, and I will therefore here make use of the published list of sections rolled at his immense iron and steel works.

The round bars are rolled in the following W.G. sizes, 7, 6, 5, 4, 3, 2, 1; and in diameters ranging from $\frac{3}{16}$ in. up to $2\frac{3}{8}$ in., advancing by sixteenths; from $2\frac{3}{8}$ in. to 5 in., advancing by eighths; from 5 in. to $5\frac{1}{2}$ in. by quarters; from $5\frac{1}{2}$ in. to 6 in. by eighths; and from 6 in. to $6\frac{1}{2}$ in. by quarters; and each of these can be rolled to "full," and "bare," as well as to exact sizes. Thus there are sixty-eight different diameters of round bar obtainable from $\frac{3}{16}$ in. to $6\frac{1}{2}$ in.

The squares advance from $\frac{3}{16}$ in. to $1\frac{5}{8}$ in. by sixteenths; from $1\frac{5}{8}$ in. to 4 in. by eighths; from 4 in. to $5\frac{1}{2}$ in. by quarters; and from $5\frac{1}{2}$ in. to $6\frac{1}{2}$ in. by half-inches; giving fifty-one sizes in square sections from $\frac{3}{16}$ in. to $6\frac{1}{2}$ in.

The flats range from $\frac{3}{8}$ in. to 12 in. wide in almost all thicknesses from $\frac{1}{4}$ in. upwards, advancing by sixteenths and eighths. Flats in sixty-five different widths are obtainable.

These bars are made in four qualities—the "ordinary," or common, "best," "best

best," and "best, best, best." The current price of the first is roughly £10 per ton, of the second £11 10s., of the third £13, of the fourth £15. But as in plates, and angle and channel irons, extra prices are charged for bars below or above certain sizes.

I need not enter into such details, but as the extras amount to from 10s. to even as much as £4 and £5 a ton in some few very large sections, and as 10s. a ton extra is always charged for quantities of any iron of less than 5 cwt., purchasers, especially small smiths and amateurs, would do well to consult the price list before ordering indiscriminately.

Good metal being rather costly, a careful smith will preserve all odds and ends of iron and steel for minute work, and for welding on to other portions, so saving the cutting off of small pieces from long bars.

It is not economical to buy inferior iron. Though advisable in some classes of common work, it is seldom so for amateurs, nor for men doing the finer classes of work. The quantities used in light work are so small that the saving is scarcely worth taking account of, while the annoyance of producing spoiled or unsatisfactory results is always likely to arise. Inferior iron, like any other inferior material, is a constant source of anxiety to its possessor. The differences in the qualities of iron are broadly these. A good iron is silvery and clean-looking, a bad iron is dull and dirty by comparison. A good iron is free or nearly free from flaws. A bad iron contains these flaws, and they show up when it is brought to a red heat. They are due to the intermixed cinder and scale left by insufficient puddling. The only way to get rid of some of these is to subject the iron to a welding heat, and hammer it thoroughly all over to consolidate it in some degree.

The more the metals and their alloys are studied, the deeper seems our ignorance respecting their qualities. Carbon, manganese, phosphorus, and silicon exercise so vital an influence upon the numerous alloys of iron and copper as in many cases to totally and absolutely change appearance and physical qualities. But in wrought iron, where the percentage of foreign ingredients is extremely small, seldom amounting to more than 1 per cent., often ½ per cent. only, those very minute percentages are found to affect the metal to an extent that makes itself very evident at the anvil. The best and most readily forged, whether hot or cold, is that which is the purest. When iron will forge well while hot, but not when cold, the "cold shortness" of this iron is due to very minute quantities of phosphorus, antimony, or silicon. When iron is apt to develop cracks while being forged hot, this "hot shortness" may be due to a minute quantity of sulphur present, whose amount may not perhaps exceed ·03 per cent., or it may be due to antimony. Only delicate chemical analysis could demonstrate the presence of these foreign elements, but the smith *sees* their results under the hammer and punch.

Before beginning work there is a proper and improper way of making up the fire for the heating of the iron.

The "stock" is the term given to the mass of hard-caked coal on a smith's hearth, between which the heat is confined; and it also in some degree forms a reserve of fuel. But its primary purpose is to prevent radiation of the heat, and to cause its concentration upon the work of the hearth. If it were not for the stock too much of the heat would go up the chimney, and the work also would be oxidised more rapidly than it is, by reason of its partial exposure to the air. The size of the stock will evidently be proportioned to the mass of the work, and its shape will be modified by the shape of the work. In an ordinary smith's fire the stock consists of two portions—one lying against the tuyere and hearth-back, the other placed opposite to the first in the direction of the coal and water bunks, the work lying mid-way between the two. The only portion of the fire that is replenished, at least to any considerable degree, in the course of a day's work is that central portion. The stock, though highly heated, does not burn away sensibly, partly because it is protected from the direct action of the blast, and partly because the upper portions are kept damp with water. Yet the inner faces, being in direct contact with fuel supplied from time to time to the central part of the fire, are at a glowing heat.

To make a fire, therefore, the stock is first built at the back and front of the hearth, and beaten hard with the slice or with the sledge, the choking of the tuyere-hole being prevented by passing an iron rod temporarily into it. The fire is then lit in the central portions with a handful of shavings and a little coal, assisted by a gentle blast.

The only firing tools necessary are the poker, Fig. 12, A, the slice B, and rake C, whose uses are obvious.

Before we can do any forging at all, tongs are necessary. There are two or three dozen tongs to a moderately well-appointed forge, but it is not necessary to get them all at once. I will, therefore, figure and describe a few of the simpler tongs that we shall have occasion to make use of immediately, leaving some of the others to be noted later on. I may mention, once for all, that each of these tools is made in several sizes to suit the character of the various kinds of work done.

Fig. 13 shows the hollow-bit tongs, used for holding rods and bars of iron. Enclosing and gripping the rod for a length of 2 or 2½ in., they take a very firm hold of it. When there are collars or other expansions at one end of a bar, the pincer tongs (Fig. 14) are sometimes employed to enable a firm grip to be taken; the jaws are veed, as shown in plan. But the tongs in Fig. 15 are more generally useful, because owing to the elongation of the V-shaped jaws the grip is stronger, and the rod or bar less liable to shift sideways.

When a bar is so long that it cannot be held with these tongs, a cranked tool (Fig. 16) called crook-bit tongs, is used. The jaws being turned round to one side permits the

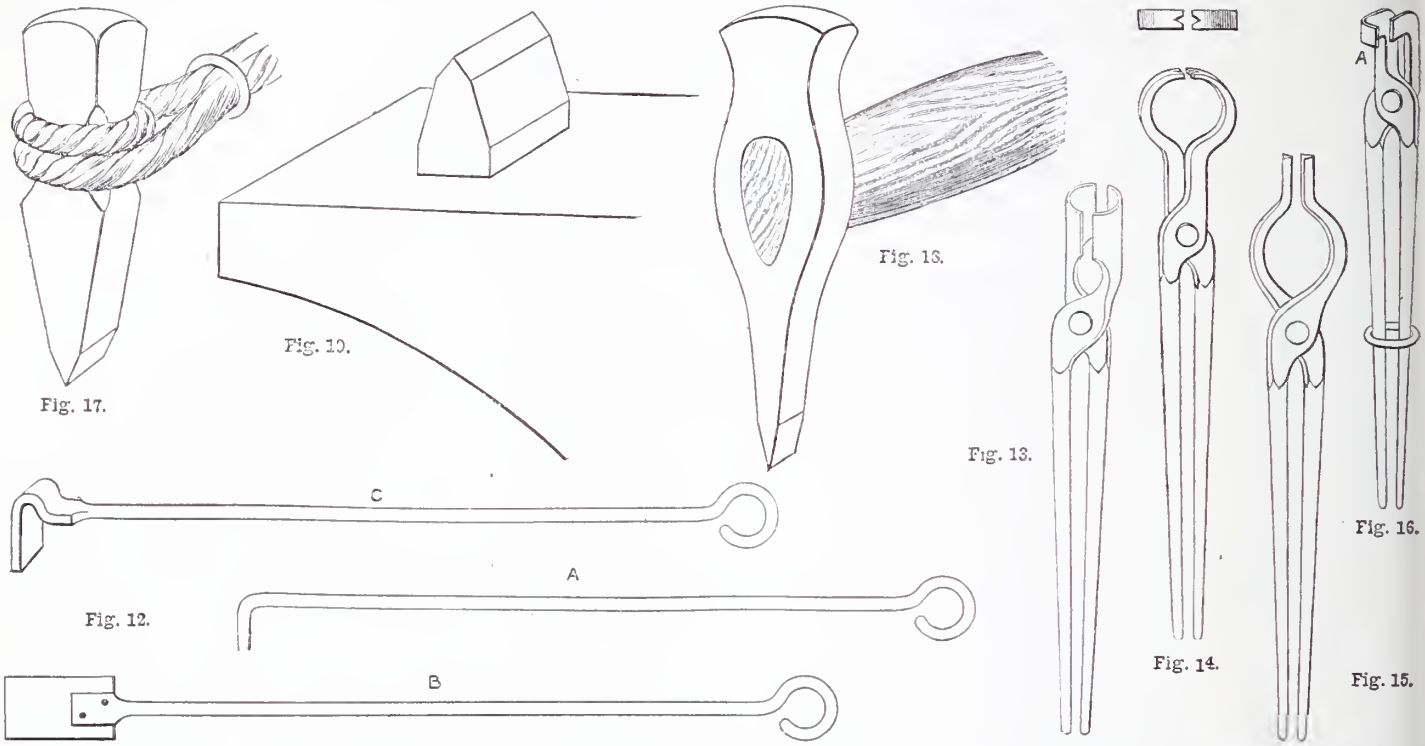


Fig. 12.—Firing Tools—A, Poker; B, Slice; C, Rake. Fig. 13.—Hollow-Bit Tongs. Fig. 14.—Pincer Tongs. Fig. 15.—Ordinary Tongs. Fig. 16.—Crook-Bit Tongs. Fig. 17.—Cold Set. Fig. 18.—Hot Set. Fig. 19.—Anvil Cutter.

bar to pass down to one side of the pivot, alongside the handles. The lip A serves to retain the bar in place, otherwise it would be apt to slip out sideways. With these four types we can commence work on round rods and square bars of iron. For flat iron, punched, and other work there are other forms which will be noticed in due course. The ring shown encircling the handles or reins of these tongs is called a "coupler." By its means the handles are tightened, the coupler being slid over them; and owing to their tapered form a tap or two with the hammer tightens the coupler on the handles. The work is thus grasped without need of any further effort on the part of the smith, who can devote his whole attention to its manipulation on the anvil.

Before we can cut off a bar we want one or two chisels, or "sets," as they are called. To cut a bar cold it is nicked round with a chisel (Fig. 17), ground comparatively thick and called a "cold set." The bar is laid across the anvil with the chisel-edge upon it, and the chisel being struck with a hammer nicks the bar. The bar is rotated slightly and another blow struck, and so on rapidly until there is a sharp indentation of the bar all round. Then it is struck sharply across the edge of the anvil and snapped in two at the nicked section.

If a bar is divided while red-hot, a

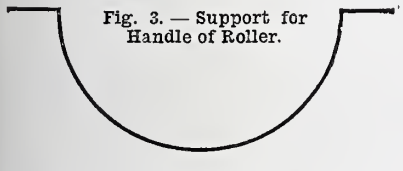


Fig. 3. — Support for Handle of Roller.

set ground comparatively thin (Fig. 18), and called a "hot set," is used, and the smith holds it in place while the hammer-man strikes it. But in this case the bar is more than nicked. The set is driven in deeply and several blows are given at one spot, the set penetrating deeply before the bar is rotated; and by the time it has been turned completely round the set has almost or entirely severed it.

If the bar is of only moderate dimensions the set becomes so hot that it would lose its temper altogether, and become soft. But after every four or five blows the smith dips it into water to cool it, and then goes on again. Often, but not invariably, the hot sets are handled differently from the swages. Sometimes, like the swages, they are provided with iron handles, or with withy handles like Fig. 17. But because they are subjected to more heat than the swages they are often handled as in Fig. 18; that is, like hammers, but *without wedges*. The wedges would be of no use, because they would shrink and become loose, and they are not necessary in the sets. For when the handle becomes loose, just striking its butt end upon the anvil jumps the set down to a firm hold, ready for immediate use. There are several other tools, as gouges and flatters, similarly handled with wood.

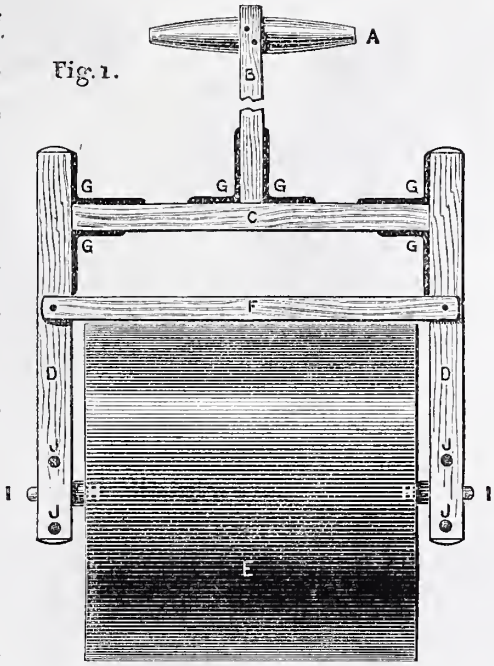
If a smith is working single-handed, then the anvil cutter is used for nicking bars. It is essentially a chisel (Fig. 19), having its edge uppermost and fitting into the square hole in the anvil by means of a square shank. When, therefore, a bar is laid upon it and struck with the hammer, the effect is to nick the under side of the bar, and rotating and striking it with the hammer will have the effect of nicking it circularly.

A HOME-MADE GARDEN ROLLER.

BY W. H. WOODWORTH, F.C.A. (IRELAND).

Having need for the use of a garden roller, and not caring to go to the price usually asked for such an article, I set to work to devise something which, if not as good, might still be a fair substitute for the commodity in question.

As I have been successful in turning out an article which does all that a roller is required to do, I shall, without any further



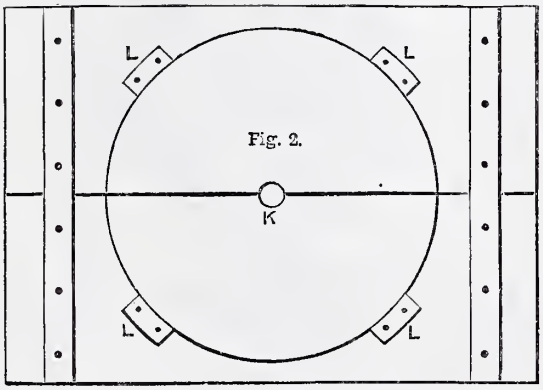


Fig. 1.—Garden Roller in Plan. Fig. 2.—Platform on which to build Roller. Refs. to Letters—A, Handle; B, Handle Bar; C, Cross Bar; D, Side Pieces; E, Roller; F, Scraper; G, Angle Pieces; H, Gun Barrel; I, Ends of Axle Bar; J, Bolts and Washers; K, Hole for Barrel; L, Oak Stops; M (Fig. 4), Hole in Frame to take Axle.

preface, describe the process by which I accomplished my object. I may say, at the outset, that any one having the slightest practical knowledge of the use of tools will be able to complete a similar one to his satisfaction.

Materials Required.—A sewer pipe, 17 in. long, diameter 14 in., $\frac{3}{4}$ in. thick; a piece of gun barrel, 19 in. long, diameter $1\frac{1}{4}$ in.; an iron bar, 25 in. long, and of sufficient diameter to allow it to work freely inside of gun barrel; six wrought iron angles such as are used in supporting shelves; four $2\frac{1}{4}$ in. bolts and washers; some well-seasoned oak battens, 1 in. × $1\frac{1}{2}$ in.; some steel laths such as are used to form lattice support in iron bedsteads; two deal boards, 3 ft. × 9 in. × 1 in.; Portland cement, gravel, stones, etc.; some strong inch screws and washers.

Having all my supplies ready, I made a rough platform (Fig. 2) of the inch boards battened together, on which to build the roller; on this I rested the sewer pipe on end, and, having drawn its external outline on platform by running a carpenter's pencil round it, I proceeded to find the centre of the circle thus formed, in which, with a bit and brace, I bored the hole K. Placing the pipe once more in its former position on the platform, I nailed pieces of wood at four points round it, L, to prevent it from shifting from its position, and placing the gun barrel (H, Fig. 1) with one end inserted in the hole (K, Fig. 2) in platform, which it fitted tightly, I secured the other end so as to be truly in the centre of sewer pipe, and filled in to about 4 in. deep with good concrete (one part best Portland cement to two parts of well-washed river gravel).

After leaving this for a day to set, I filled to within four inches of the top with rough stones — small lumps of rock, and completed filling to the top with concrete, same as at bottom, ramming it thoroughly down, and finishing off smooth with a trowel.

When this had set I had a roller (to all practical purposes of solid stone) weighing about $1\frac{1}{4}$ cwt., having an iron tube running

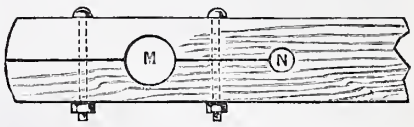


Fig. 4.—Mode of fitting Axle to Frame.

through its centre and protruding about an inch at each end.

To this I mounted a simple carriage, consisting of two side pieces, 18 in. × $1\frac{1}{2}$ in. × 1 in.; one cross-piece, 21 in. × $1\frac{1}{2}$ in. × 1 in.; one handle bar, 17 in. × $1\frac{1}{2}$ in. × 1 in.; one handle, 10 in. × $1\frac{1}{2}$ in. × 1 in., tapering towards both ends, which were rounded off.

All these parts I joined together simply by the iron angle pieces, and a reference to Fig. 1 will show better than any description the manner in which this was done.

A reference to Fig. 4 will show how I secured the ends of iron bar axle on which the roller was to turn.

One and a half inch from the extremity I bored, with a bit and brace, the hole, M, which should be slightly smaller than the bar to be inserted in it. One and a half inch from this I bored a second hole, N, of about half the diameter of the first (the object being to prevent the wood splitting during the operation of mounting), then, with a saw, I cut through the centre till I reached the smaller hole. I then wedged open this slit until the centre hole, M, was wide enough to admit of the iron axle passing easily through it.

This being accomplished, I completed the mounting of the roller by passing the bar through the hole, M, in one side of the frame, then through the centre pipe of roller, and finally out through the other side of frame. Knocking out the wedges, I tightened up and secured both ends of the axle with bolts and washers, as shown in Fig. 4. I may say that I inserted between ends of tube and sides of frame a couple of loose washers, to reduce wear and tear.

The roller and carriage were now com-

plete, with the exception of scraper and support, which I subsequently added.

This scraper is simply a piece of steel lath, 23 in. long × 1 in. wide, secured to side of frame at each end by screws and washers. Its object is to remove anything which might stick to the surface of the roller when being used in wet weather, and its edge should be sufficiently close to allow the roller to pass freely without actually touching it.

The support consists of a similar piece of steel, shaped as shown in Fig. 3, and secured to cross-bar by screws and washers. Its object is to keep the handle from coming in contact with the ground when not in use. Our roller is now complete, and nothing remains but to paint or stain and varnish it according to taste.

The roller of which the foregoing is a description I have had in use for over two years, and it has given thorough satisfaction.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

30. — Britannia Company's No. 12 Double-Geared Milling Machine.

Although the majority of readers of Work may find the smaller and less expensive articles that are mentioned from time to time in "Our Guide to Good Things" more generally useful and attractive, yet as the tools and machines and appliances of all makers who wish mention to be made of their specialities must perforce be noticed, I call attention in the present number to three pieces of useful machinery manufactured by the Britannia Company, Colchester. The powerful machine—the Company's No. 12 Double-Geared Milling Machine—illustrated in Fig. 1 is so clearly shown in all its parts that it needs but little description. It is suitable for the general requirements of an engineer's and machinist's shop. Headstock, body, and base are cast in one piece, the body being hollow, and forming a receptacle for cutters, etc. The spindle of headstock is of steel with conical neck, running in hard gun-metal bearings. The back gearing carrying a bracket which swivels entirely round it, and carries a circular work-plate, which also swivels on its own centre, giving every facility for adjusting the work bolted to it under the drill. It has two driving shafts, that for the treadle or power running to the back, and that for hand motion to the right side, and these drive the spindle by bevel and spur gearing. It has single and double gearing for small and large holes, and has both self-acting and hand feed. The treadle driving gear is made independent of the machine to fix under the bench, the wheel having four speeds to drive the speed cone fitted to the driving shaft, thus giving with the double gearing eight changes of speed. The pillar is 4 in. in diameter and 11 in. high; the diameter of spindle is $\frac{7}{8}$ in. drilling up to $\frac{3}{4}$ in. in diameter and 5 in. in depth, the distance from drill point to pillar being 5 in. The diameter of fly wheel is 18 in., of driving wheel of treadle motion, 20 in. The circular table is 10 in. in diameter, and will rise and fall $6\frac{1}{2}$ in. on pillar. Price, as hand-drill, only £6 10s.; as hand and treadle drill, £8. Top-driving apparatus for power driving can be fitted for £2. It is illustrated in Fig. 2.

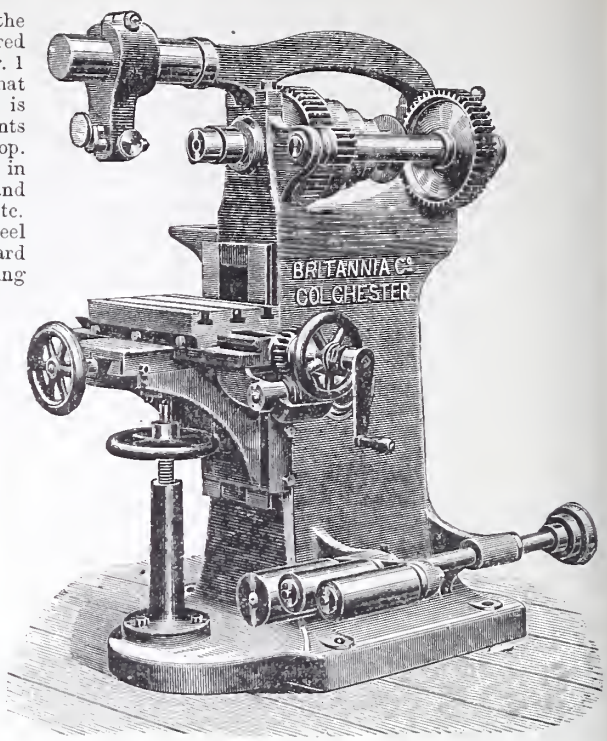


Fig. 1.—Britannia Company's No. 12 Double-Geared Milling Machine.

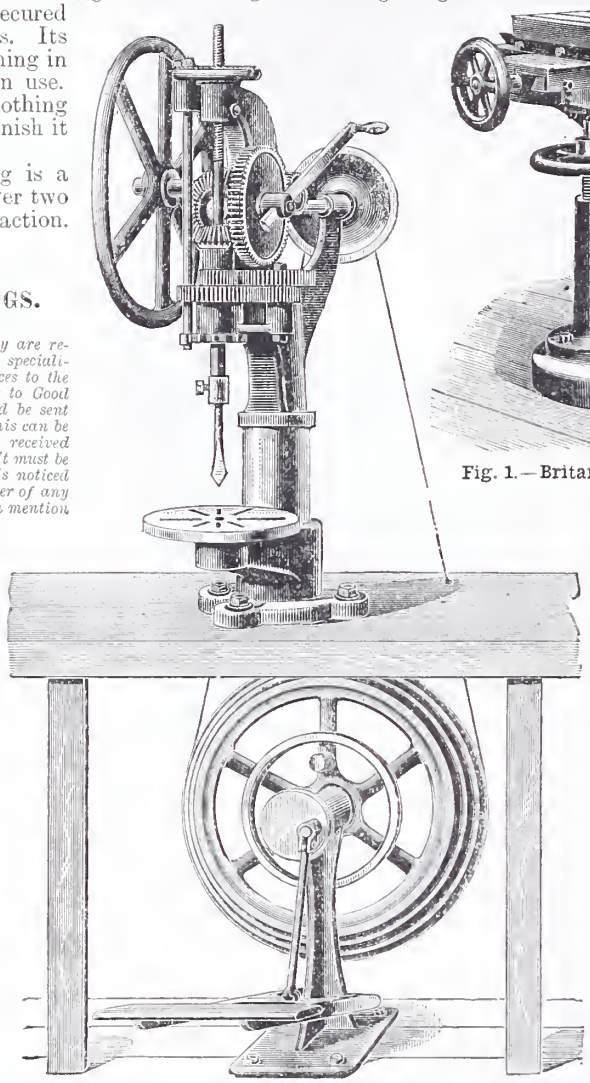


Fig. 2.—Britannia Company's No. 5 Bench Drilling Machine.

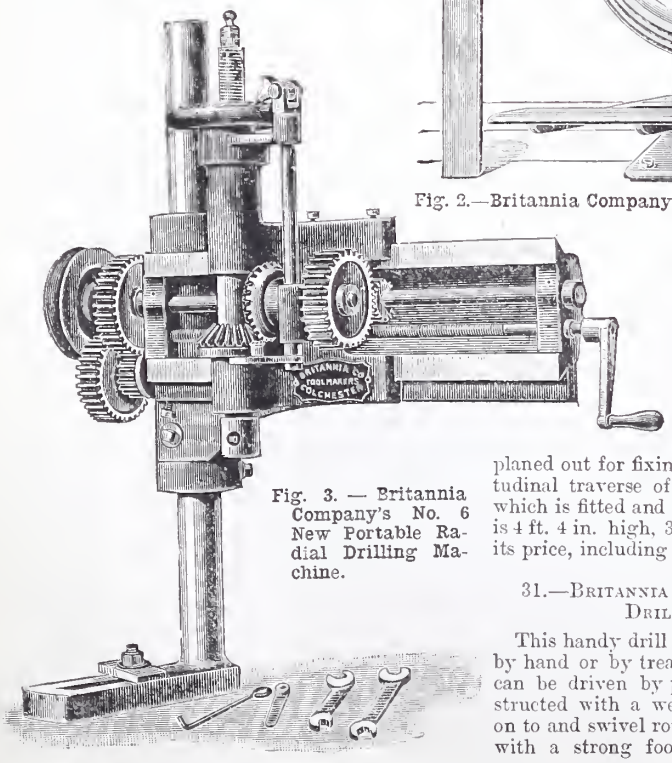


Fig. 3. — Britannia Company's No. 6 New Portable Radial Drilling Machine.

is put in and out of gear with eccentric motion. The knee slide is fitted to the front of body, and rises and falls 14 in. The longitudinal slide is 24 in. long and $7\frac{1}{2}$ in. wide, and has a transverse traverse of $7\frac{1}{2}$ in. The work-table is 14 in. long and $8\frac{1}{2}$ in. wide, with T-slots planed out for fixing the work. It has a longitudinal traverse of 18 in. The entire machine, which is fitted and finished in a superior manner, is 4 ft. 4 in. high, 3 ft. wide, and 4 ft. deep; and its price, including top driving apparatus, is £45.

31.—Britannia Company's No. 5 Bench Drilling Machine.

This handy drill for light work can be driven by hand or by treadle, or both combined, and it can be driven by power if desired. It is constructed with a web section body, turned to fit on to and swivel round a stiff turned pillar, cast with a strong foot to bolt on to the bench,

32.—Britannia Company's No. 6 New Portable Radial Drilling Machine.

This machine is intended to take the place of the old ratchet brace, and is well adapted for bolting to locomotive frame-plates or similar work for drilling and reamering holes up to $1\frac{1}{2}$ in. diameter by 4 in. deep. It consists of a strong steel tubular pillar forged on to a wrought iron slotted foot, as shown in Fig. 3, capable of being turned to any desired angle, and capable, when bolted in position, of drilling all holes within a radius of 18 in. from centre of pillar. The steel spindle is $1\frac{1}{2}$ in. in diameter, driven by strong gearing, arranged to drive either from a swinging counter-shaft, as used in locomotive shops, or from a fixed counter-shaft, if desired. It has both a variable self-acting feed and hand feed. The drill will rise and fall on the pillar for 18 in. The bevel and driving gear is $\frac{5}{8}$ in. pitch. Prices, for swinging counter-shaft, £22; for fixed counter-shaft, £27; counter-shaft to sink, if required, £2 10s. This machine, as well as the other two noticed above, is well made and carefully finished. The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Timber Frame.—J. R. (*Idless*).—You must understand that a roller feed log frame is not suitable for English-grown timber, but the rack log frame is. In the roller feed very crooked timber cannot be sawn, but with the rack feed both crooked and straight may be sawn. For converting logs into thick planks, the rack circular saw bench is the quickest, if the saw is large enough to span the piece to be sawn. For very large logs a very large saw is needed, which will require a deal of power to drive it, and a good practical man to sharpen and to work the saw. If J. R. intends cutting logs above 22 in. deep, I would recommend the rack log frame, but if below that depth the rack circular saw bench will suit his purpose best, and will do a greater amount of work in a given time, providing he has plenty of power to drive it and a good man to keep saws in order and to work them; for it must be understood that more skill is required in the working and sharpening of circular saws than in frame saws. Write at any time in reference to working or fixing saw-mill machinery, and I will do my best to give a satisfactory answer.—A. R.

Dulcimer Stand.—F.W. (*Doncaster*). — With reference to the stand about which F.W. asks, it is used, as he aptly puts it, to "rear the back end up" when playing, so that the upper notes of the instrument may be brought more easily within reach, and also to facilitate striking the notes clear of each other. Music, wire, and all other fittings, as well as instruction books, may be purchased of Messrs. Chilvers & Co., St. Stephen's, Norwich.—R. F.

Tinman's Pattern Book.—G. J. P. (*Manchester*).—There is such a book as you mention; it is called the "Sheet Metal Worker's Instructor," and gives full directions for striking out the various patterns required in that and kindred trades. I have not seen it, but have heard it spoken of very favourably. The price of it is 10s. 6d., and it can be had of the author (or his successors, for I believe he is dead), R. H. Warne, 94, St. Augustine's Road, London, N.W. The articles on sheet metal working will be continued in due course.—R. A.

Teeth of Wheels.—TANCRED (*Liverpool*).—You will find the information you require in full detail in an article on toothed gearing, by Francis Campin, C.E., printed in our issue of November 30th, 1889, page 581, Vol. I. No algebra is used, and the illustrations make clear the method described. —F. C.

WORK Numbers and Index.—B. J. (*London, W.*).—All back numbers of WORK can be obtained through any bookseller, or upon application to the publishers, Cassell & Co. (Limited), London, E.C. An index of Vol. I. of WORK is ready, and can be had of any bookseller, price 1d.—F. J. C.

Publications.—J. R. — "Mineral Water Trade Review" is published by J. G. Smith, 165, Queen Victoria Street, London, E.C. Britten's "Watch and Clock Makers' Handbook," price 5s., is published by Spon & Co., 125, Strand, London, W.C.—F. J. C.

Gesso Work. — C. B. (*Highbury*). — A former paper on this art appeared in WORK, No. 25, which gives full particulars concerning the materials and the method of working. Gesso composition and tools can be obtained at the studios of the Society of Artists, 53, New Bond Street, W. C. B. would do well to get No. 25 of WORK, and the two other papers on the subject that followed.—E. C.

Lending Library.—J. B. (*Tiverton*).—It would not be possible to give effect to your scheme. If you have the desire to interchange books, I have no doubt that an advertisement to that effect in our "Sale and Exchange" column would bring you into contact with any others of the same mind as yourself. Try such a step.—F. J. C.

A Simple Incubator. — WHATELEY (*Birmingham*) asks:—"(1) What is the best kind of oil to use for the lamp? (2) Should the eggs be turned, and what temperature maintained during the process of incubation? (3) How long is it before the eggs are hatched?"—[(1) Any kind of oil will do for the lamp—either paraffin or colza; but the latter is safer in the event of an accident. (2) Yes; the eggs should be turned, and a temperature from 103° to 106° kept up. (3) With hens' eggs you may obtain results in about three weeks.]

Looking Glass.—LANE (*Nottingham*). — I send you a sketch which, I think, will give you what you want, viz., something to match the first prize bookcase I made for WORK (see pp. 695, 696, Vol. I.). You will notice that the shelves at the sides are very similar, with the difference that, not having the sides of case to support them, I have substituted turned columns. The two bottom shelves could easily be supported on brackets, and the columns going from these upwards; this would have the advantage of leaving the mantelshelf clear of any obstructions; but for my part I always prefer to run a standard of some sort down to the mantel if possible, to obviate the appearance of the upper part falling towards you. The top shelf is retained, but, instead of having a cove under it, it is supported simply by the turned columns mentioned above. The plainness of the shelf directly over the large square is relieved by a short piece of gallery rail at each side. I have purposely made this sketch rather plain, with the object of giving you the opportunity of adding any ornamentation, etc., as you feel inclined.—E. D.

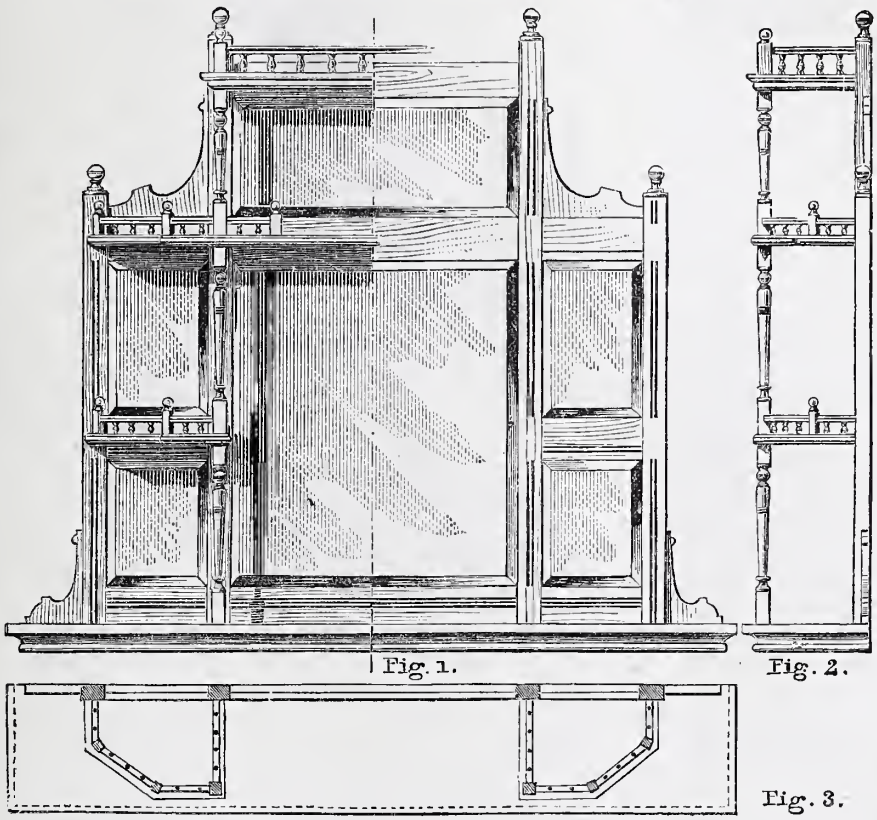


Fig. 1. Fig. 2. Fig. 3.

Looking Glass.

Barnes's Foot Power Saws.—H. B. (*Carlisle*).—W. F. and John Barnes & Co., of Roehford, Illinois, U.S., America—English importers of Barnes and other American machinery, Churchill & Co., 21, Cross Street, Finsbury, London, E.C. Their 1s. catalogue is admirable, and contains illustrations of many American tools and much interesting information.—F. A. M.

Pinhole Camera.—WELLWISHER.—If you have read the article on "Pinhole Photography" in No. 17 of WORK, I do not understand what instructions you can want to enable you to make a camera for this kind of photography. All you require is a box and dark slide to hold the plate. In the front of the box the "pin hole" takes the place of the ordinary lens. If after you have read the article above referred to, and cannot manage to make the camera (?), let us know on what points you want advice, and we will see what can be done to help you. I am afraid though that any one who wants directions how to make such a simple thing would not be able to use it when made.—L. J. P.

Foreign Stamps. — ERNEST (*Longton*).—These are best preserved in a book. If you have not a proper stamp album, you can easily make one from any ordinary note or manuscript book. Cut out every third page all but a margin about an inch wide; this is to counterbalance the thickening of the book when the stamps are inserted. Now head the different pages, arranging the countries in alphabetical order, taking those in Europe first, then those in Asia, Africa, and America respectively; remembering that whilst for some countries, such as Greece and Russia, one page is sufficient, for others, as England, France, etc., more are required. By no means paste or gum the stamps in, but proceed as follows: gum some thin paper and allow it to dry—the gum paper often given with postage stamps does capitally — and cut it up into little pieces about ⅜ in. by ½ in. Take one of these pieces and double it in half lengthways with the gum outside, stick one half to the stamp, and then the other to the book. By this means the stamps are preserved and yet can be taken out at any time without destruction or spoiling, as is the case if gummed in. Arrange the stamps according to their date of issue, or if you do not know this, to their original value, and endeavour to be continually replacing them with cleaner and more perfect specimens to increase their market value.—F. B. C.

Stylographic Pen. — P. J. M. (*Glasgow*).—I cannot give you all details of the interior of a stylographic pen, but I can give you some particulars which may be of interest to you. The holder of the pen is hollow and forms the ink reservoir. The "needle is fixed inside in some way, but loosely, so that when writing it is pressed back; it is solid and merely serves as a conductor of the ink through the small hole in the point, which is protected against wear by a small nosing of some metal. I do not think an amateur could manage to make a stylographic pen. I have used one for some time and find it a great convenience—in fact, I am using it to write this. My pen cost 5s., and it is quite equal to some of the more expensive—no pun—makes. The feeling when using is more like that of a pencil than of an ordinary pen. It writes all one thickness of line, not light and heavy strokes, and requires to be held upright. It is not conducive to good penmanship.—D. D.

Cleaning Gold Bands. — G. S. (*Nunhead*). — The simplest material I know of for this purpose is liquid ammonia diluted with the same amount of water, and the way of using it will be by rubbing the lace, with something damped with it. For example, a soft rag, or better, some soft paper such as tissue paper; the latter should be crumpled up into a compact mass. Before applying either to the lace, squeeze out all the moisture you can, then rub your lace round and round with it carefully, and finish up with tissue paper or a piece of cloth that is quite dry. If you use great care you might do as I should myself, and that is as follows: Moisten a soft brush that has been used for polishing plate with whiting, or else a soft tooth brush lightly charged with whiting, and rub it across a clean piece of wood to remove as much of the whiting as possible, then put a drop or two of diluted ammonia on the brush, and brush the lace tenderly. The things you have to avoid in this latter process are too much fluid and too much whiting, which, if it does fill up the lace, will be a rare bother to get out again. So far the method of cleaning can be applied to lace anywhere, but if it be in the form of braid and is removable, then after the gentle rubbing with whiting and brush it can be rapidly washed with soap and hot water in which some twenty or thirty drops of the diluted ammonia have been added to each half pint of water, and again you must use a soft brush, and do it rapidly; do not let one end soak in the basin while you are doing the other. Finish up by pouring some scalding hot water on it, then shake it and dab it as dry as you can in the folds of a soft cloth, and place it in some warm place where it will be dried gradually, such as an oven, with the door open until it is dry. It may curl or twist a little; if

it does, and you cannot get it straight again when it is replaced, it can be ironed, but the hot iron must not come in contact with the lace. Again, I must repeat that this washing must be done quickly.—H. S. G.

Photographic Lens.—J. M. R. (*Aberdovey*).—If this correspondent wishes a full reply to his queries it is necessary he should learn the business of an optician; he can scarcely appreciate the meaning of his questions if he thinks they could be answered in the limited space of correspondence columns. A photographic lens is essentially an instrument for collecting rays of light and transmitting them in a parallel form on to a sensitive surface. The greater the curvature of the glass the shorter the focus, and *vice versâ*. The two principal classes are portrait and landscape. The portrait form gives *exceedingly* sharp definitions over a small area, and has what is usually termed a round field. Whereas the landscape form has a flat field but with less absolute sharpness, thus covering a larger space with a *distinct* image than the portrait form will. The question how to make plates is too ambiguous. There are many kinds of plates, of what kind is information required?—E. D.

Silicine Glass Painting.—W. G. H. (*Liverpool*).—The tint N is a sepia tint produced by dark brown mixed freely with "Silicine" medium. I may repeat that this colour should be especially well mixed with the medium, using a palette knife for mixing, not the brush.—F. B.

Sawdust and Tar.—D. C. D. (*Ireland*).—Undoubtedly there is a way of making such fuel blocks, as the following will show. In the days of the Crimean War small blocks made from such substances, and probably fine coal dust worked in, were submitted as a patent fuel to the Government for sending out to the seat of war. They burnt rather rapidly, however, and were made chiefly for kindling wooden logs for burning in the trenches. At the present day a quantity of blocks of patent fuel are made in the South Wales towns of Swansea, Newport, and thereabouts, which are exported abroad as well as used to a small extent in the United Kingdom. How far the method or processes are patent I cannot say; their size is about 10 in. by 6 in. by 6 in., and these burn for some time, but nothing like so successfully as coal. Coal dust, I believe, is largely used in the making of them. Concerning the chief part of your question, I should think they are turned out without much trouble from the moulds, but whether the latter are of metal, and whether requiring any preparation for ensuring this result, I cannot learn. Personally, I don't think the game will be "worth the candle" in your case, although under some circumstances it might be worth going into experimentally.—F. P.

Bedstead Varnish.—F. W. R. (*Norfolk*).—Most manufacturers of varnish and liquid paints make a cheap and durable class of enamel, or coloured varnish, solely for implements and iron goods, but, as you require it solely for domestic use, a tin of any good maker's enamel would answer. If you wish to varnish it only, "Church," or hard drying copal varnish is the best for such work. It is never advisable to mix dry powder pigment with varnish for such a purpose as you require. Your best plan would be to first wash with soda water and rinse well with clean water, then either paint the bedstead with quick and hard-drying paint, made from the pigment and turps and varnish of equal parts, and finish with a coat of varnish; or else to use enamel ready prepared, but two coats may be necessary in the latter case.—F. P.

Draught Screen.—G. S. (*Paisley*).—There are so many varieties of draught screens that it is hard without clearer questioning to reply distinctly. The ordinary screen of three or four folds covered with some textile may be seen in every upholsterer's window. For a stout one special reversible hinges are sold, but as these are somewhat costly, many prefer to study the humble—or kitchen—clothes horse, and fashion joints of webbing after its pliable yet hardly workmanlike joints. Most screens have an after embellishment of scrap pictures, cretonne, Japanese gold leather paper, or some such stuff. The framework is just a simple skeleton of wood, that is rigid enough to keep its shape, but as light as may be safely chosen. When the frame is covered, take care to prove that your calico or canvas *does* shrink when wet by trying a sample. I remember a large four-fold screen that hung in classic but unnecessary folds when wet size was applied. Use also copper tacks, to avoid the undecorative line of rusty spots, that will certainly attend tin tacks sooner or later. Any more detailed queries will receive careful reply from E. B. S.

Splitting Laths.—P. A. (*Hanley, Staffs.*).—Unless timber is cleft or split at the first and when it is somewhat damp, it is unadvisable to try to split "evenly, small laths about ¼ by ½ in." If P. A. can get plasterers' laths or the stuff they are split from, or, better still, see a lath-render at work, by all means do so, but failing these he had better be content with sawn stuff, if he wishes it for kite standards or any similar purpose. The lath-renders use a tool like a chopper, but the handle and the holding are different, and they also require a shield for the left wrist, without which last the splitting tool would perhaps do serious injury to the operator.—B. A. B.

Writing Desk.—PLEASURE AND PROFIT (*London, W.*).—As our favourite "Shop" is always so crowded with applicants, I cannot say so much about this desk as I should like; it is not for the want of attendants, but for the lack of space, that we must be brief. I presume this is the very article you mean by a "desk with sliding shutter to cover drawers inside and to lock up with flap outside." When the drawer (Fig. 1) is pulled out, the shutter slides away from sight, and the flap flies round to the front. To shut the desk the flap is put back into its place and the drawer pushed in. Now it has never been my pleasure to handle one of these articles, although I have engravings of it. I cannot say that I can tell you exactly how they are made to work. It is a very difficult thing indeed to get a manufacturer—unless he is a personal friend—to allow one to examine any of his articles sufficiently to enable one to understand thoroughly the method of their construction. However, if the desired result can be attained it matters little how the article is made; therefore, although I have never seen the inside of one, I have worked out the following description, which, no doubt—as the chances are a "million to one"—will be found to be the correct one, or nearly so. A convenient size will

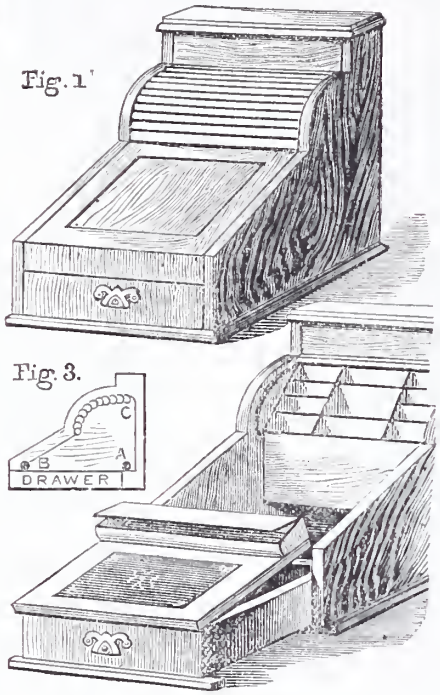


Fig. 2.
Writing Desk.

be: sides, 16 in. wide and 14 in. high; length of flap, 12 in., and width, 10 in.; length of drawer, 12 in.; and width of the entire article about 13 in. The shapes and sizes of the stationery compartments are quite optional; but a clear space of an inch or so must be left at the top, back, and bottom of them. On the inside of the sideboards, round the circular part, at a slight distance from the top edge, runs a groove which is continued down the back (see Fig. 3). For the shutter, several laths, *i.e.*, rather narrow strips of wood, are glued on to a piece of canvas, and work in the above-mentioned grooves. No more laths are necessary than are sufficient to cover the opening. The end lath must be thicker than the others. On the back of this shutter, the ends of two pieces of stout, strong string are attached; the other ends being fastened to the back of the drawer. These strings travel round either a rod, pegs, or wheels, fastened at about points A and C shown in Fig. 3. When the drawer is pulled out it pulls the string and thus pulls the shutter. To close the shutter we want more string; two ends fastened to the *front* of it; and two to the edges of the drawer near the back. Pegs, wheels, or a rod must be fitted at point B in Fig. 3, for this part of the string to travel round. I should advise you to have the flap merely pivoted or hinged—not made to *fly*. If made as the latter it will require a spring. As an improvement, I have intended the front piece above the drawer to be fixed to the flap; and with three more pieces and a lid—with a fastening, of course—it will form a neat pen-box. Fig. 2 explains this. A narrow piece of the front of the bottom board should be cut off and attached to the front of the drawer at the bottom; it will then keep the drawer steadier than it would otherwise be. For the making, ½ in. wood would be as suitable as any, with a bottom board ¾ in. thick. The stationery box will be made of very much thinner wood. Get the carcass of the job together first; then fix the pegs, wheels, or rods and the string; lastly, fix in the stationery box. A lock on the drawer will be quite sufficient whether a spring on the flap is used or not. The end of the flap must fit just underneath the edge of the shutter.—J. S.

Carved Wood Impressions.—W. S. (*Mile End*).—You do not say the size of the panels you wish to mould, nor if they are portable or fixed, still less the important point of all, if they are undercut. So in place of a special reply I give the following:—All that is required is some modelling clay, plaster of Paris, and a little oil. No tools are needed, except a penknife, which is used if the cast should require paring. A paper knife may perhaps be added for flattening the clay. Both the clay and the plaster should be of the finest description. The clay costs 4s. per cwt., the plaster 5s. per cwt. Both can be obtained from James Stiff & Son, London Pottery, High Street, Lambeth. The clay should be kept in a crock, and water added when required to keep it in a moist state. When a cast is to be taken, a lump of clay should be placed on a board and cut into slices about an inch thick. This is best done by placing a string round the clay and pulling it through, holding one end of the string in each hand. A great deal depends on the clay being of the right consistency—like putty. If too hard it will not enter the crevices, and if too soft it will stick there. If too soft it must either be left for a night to grow harder, or, if wanted in a hurry, placed in the oven; if it is too hard water must be added, and it must be kneaded to an even consistency throughout. When the slice of clay is ready, the object from which the cast is to be taken must be lightly brushed over with oil, and the clay laid on it and firmly pressed in. The back side of the clay must then be made quite flat, and the edges trimmed with the knife or paper knife. The clay must next be carefully removed and laid upon a board, and a wall of additional clay built up all round, sufficiently high to contain the plaster that will presently be poured in. The dry plaster should now be placed in a bowl, and as much water added as will barely cover it. If mixed up with a spoon it will then be about the consistency of thick cream. It should be at once poured into the clay mould. It will take about twenty minutes to half an hour to harden. It ought not to be touched until it is quite hard, except for the purpose of scratching any inscription which may be desired upon the back. When the clay is removed, it may be found desirable to pare the edges of the cast with the penknife. A coat of stearine, which can be obtained from any chemist, helps to keep the cast clean. The method described applies to ornament in low relief only; objects in high relief have to be cast in pieces, and the process is more complicated.—E. B. S.

Incubator.—D. F. A. (*Winona, Ontario*).—The chief and distinguishing feature of Hearson's "Champion" incubator is the arrangement for regulating the temperature: this is patented, and the full details I do not know. D. F. A. may be able to learn from the following description:—The vital feature of this excellent incubator—the flue—which heats the tank is formed like the letter T sideways, thus ⊣, the lamp being under the upright arm, and a damper is arranged so that the heat is either allowed to pass upwards and away, or if the damper is closed the heat is compelled to pass through the horizontal flue, which thereby heats the water in tank. The movement of this damper is dependent upon the expansion of a thin metal capsule, or lozenge-shaped receptacle, which contains a certain liquid boiling at the required temperature. Our readers will see at once that a contrivance which does not diminish the source of heat, which to a lamp would be difficult and perhaps dangerous—certainly hurtful to its efficiency—but shunts it and gives visible token in the slightly open valve that the temperature is enough and slightly to spare, is exactly what is needed.—B. A. B.

Fixing Brass Plate to Wood.—F. J. C. (*Maidstone*). There are many cements recommended for fixing brass on wood, etc., many of them having been already mentioned in WORK; but our experience has taught us that the best way to make sure of your brass adhering is to use small screws or pins; first drill your holes in the brass, then make a corresponding small hole in the wood with your "brad" so that the screw or pin may not split it. You will find this last longer than any cement, but if you do use cement such as jewellers', etc., the best way is to warm a little and put it on the wood where you want the brass to fit. Then heat the piece of brass and lay it on, when you will be able to force it down into place. Let it cool and chip off the cement all round. If you do not use the pins or screws try plaster of Paris.—M. S. S.

Bookbinders' Materials.—J. R. (*Birmingham*).—The best place to buy bookbinders' presses and sewing frames, or benches as they should be called, that I know of is at Mr. McKinnon's, Carrick Street, Glasgow. We used to get them there long ago, and were always well satisfied. Messrs. Geo. Royle & Sons, Lovell's Court, Paternoster Row, London, also supplies them. If J. R. writes to either of these addresses stating his requirements, I am sure he will get suited.—G. C.

Index to WORK.—F. E. (*Wakefield*) and numerous other readers are again informed that an Index has been prepared, and is on sale as advertised in No. 52 of WORK, and can be had from any bookseller, or from the publishers, Messrs. Cassell & Co. Price 1d.

Windmill Sail Paint. — MILLWRIGHT (*Doncaster*).—The substance you mention, coal tar, is, doubtless, a good one for your purpose. Pitch is used to a considerable extent in the manufacture of certain black varnish. Most of these preparations, however, are more for ironwork and heated situations than for your purpose, and I am inclined to think there would be some prospect of such a coating cracking and chipping off, from canvas especially. So far as my practical experience and knowledge go, I believe a liquid made from boiled linseed oil and patent (paste) driers would be a far more durable and protective coating for the canvas. Seven pounds of the latter to one gallon of the oil would do. This class of liquid is used to make sailors' oil-skins. You could please yourself about adding any pigment to this.—F. P.

Varnishing and Sizing Oak Frames.—J. B. (*Manningham*).—Give the oak two coats of thin size, then varnish with crystal varnish. If the frames are of flat oak, and are at all dark with age or dust, scrape with a piece of glass before sizing. —F. B.

Patenting an Improvement on an Existing Patent.—HANDYCOME should get a copy of the specification of the existing patent and examine it carefully, and see how far that patent is elastic. It may be that the original patentee has made provision for such an improvement as H.'s, or for a similar one. Should such not prove to be the case, H. should obtain protection for his improvement (simply as an improvement) and then wait on the proprietor of the already patented article and make arrangements with him for working the original patent and the improvement together. If no such arrangement can be arrived at, H. will have to wait for the expiration or determination of the original patent before he can make his improvement available.—C. C. C.

Organ Matters.—Z. Y. X.—Cyphering is caused by damp swelling the woodwork of the action, rusting of pins or wires, bending of wires, weakening of springs, wrinkling of pallet coverings, and innumerable other accidents or defects, but damp is the most frequent cause.—M. W.

Dulcimer. — L. G. (*Middleton*).—I tried in my paper on the dulcimer to make everything as plain as possible, and flattered myself that I had succeeded; but I find, alas! that I am not quite so clever as I thought myself. Allowing for one or two slight inaccuracies which have crept in, the paper and diagrams I hoped would be sufficiently explicit for anybody. The idea I intended to convey on page 490, Vol. I., was that if one block of wood, 18 in. long, 3½ in. wide, and 2¾ in. thick, was divided along its whole length by the diagonal mark shown in Fig. 1, the result would be two blocks, each of which would measure on its freshly cut or sloping face 3½ in. As a matter of fact, the measurement would be somewhat less, but the method of getting out the blocks remains the same.—R. F.

Sheet Brass.—G. M. (*Bradford*).—If you cannot get the kind you require of local ironmongers try Messrs. Tonks & Son, Birmingham, or Evered and Co., Drury Lane, London, W.C. Price, about 11d. or 1s. per lb. according to the state of the market; in ordering state what gauge and size you require it.—R. A.

Spelter Solder.—A. C. (*Bradford*).—You can get spelter in small quantities at almost any good ironmonger's or metal merchant's. Mr. H. Ponder, 40, Drury Lane, London, W.C., will supply you if you write enclosing remittance to cover cost of material and postage. With regard to using it, instructions have been given in No. 42 of WORK, page 660.—R. A.

Picture Composition.—H. G. (*Bishopsgate*).—For gilt frames a little putty is used to fill up the chip and then dry bronze powder put on with the brush; the putty has enough moisture to hold the bronze. Black frames—heelball is used, same as shoemakers use; hold it over a light, and let it drip in until well filled, then rub smooth with a piece of cloth. White frames—a little Aspinall's white enamel, or white lead; get a *large* kettle of boiling water; see that you have plenty of water, and it must boil; take two large cups full of flour in a pail, and halfpennyworth of alum; mix well with a little cold water, only sufficient to wet it, and stir all the lumps out. Keep stirring and gently pour boiling water; it will get thick and turn yellow colour; it is then as good a paste as you can possibly get. We use in our factory a bucket per day.—G. R.

Ticking of Alarm Clock.—CLOCK (*Stamford Hill*).—The annoyance is due more to increased sensitiveness on your part than to increased loudness of the ticking of the clock. Sound may be deadened by enclosing the clock in a wooden case lined with sawdust, kept in place by green baize.—G. E. B.

Bennett Battery.—CHIP (*Bridgnorth*).—Only the upper part of the cells should be soaked in hot paraffin wax to prevent the solution of alkali from being spoiled by air. The inner cell should be air-tight above the solution. If you soak the whole of it in wax you will not get any current.—G. E. B.

Light Hand-Cart Wheel.—W. S. (*Newcastle-on-Tyne*).—The easiest way of making a light wheel for your hand-cart is by making it cart fashioned, being easier and simpler than coach fashioned. Get your oak naves turned in the lathe 7 in. by 8 in., and then let the smith fret them with two iron bands which keep the naves from splitting when driving the spokes in. Fig. 1 shows the oak spokes dressed off cart fashion, and are 24 in. long, 2 in. wide, by 1½ in. thick when dressed off. You say that you want ten spokes in each wheel. Get your compasses to divide the nave into ten equal parts, an inch from the line which is marked on the nave. When you have divided the nave make a mark at each one, and bore straight down half way; bore all the others the same, then fix the nave in the frame described and illustrated in No. 15, Vol. I., with the face towards you. Next get a face-stick or spoke-boy, and screw it to the nave so that you can work the stick about; now insert a piece of whalebone in tightly, the dimensions of which will be ¾ less than the distance between the tenon of the spoke and the stick; this you will see in Fig. 2, which shows the nave cart fashion, and the face-stick with the spoke in the nave, and you will see how a wheel is dished; moreover, it is to guide you in driving the spokes in straight, as the front of each spoke must just touch the cane or whalebone. You therefore get a spoke and place the end upon the nave, letting the front of the spoke be in a line with the one already run upon the nave. Get your pencil and run round the

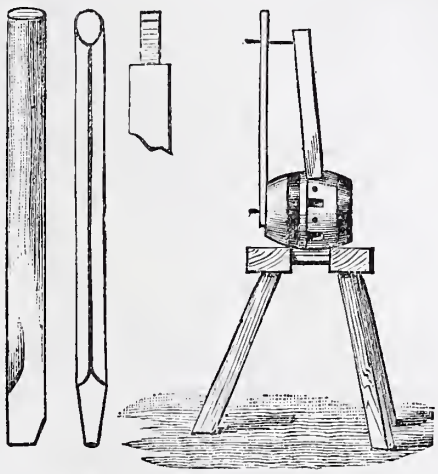


Fig. 1. Fig. 2

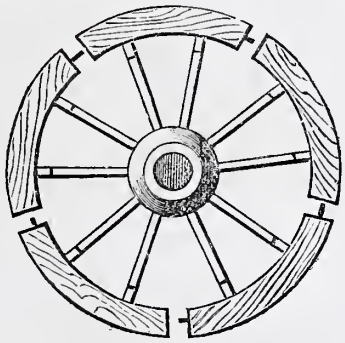


Fig. 3.

Light Hand-Cart Wheel. Fig. 1.—Spokes. Fig. 2.—Cart Nave, Spoke-stick in position. Fig. 3.—Showing how the Wheel is put together.

two sides and the back, then pare out the mortise and drive in the spoke. In driving keep trying the stick to see that you are driving straight; when a spoke is driven in up to the 3 in. compass mark on the face of the spoke. You mortise and drive in the others alternately, leaving a space between for a mortise and spoke; if you drove in the spokes one after the other the nave would split into two halves. You now get your felloes: these are of ash 2 in. square thickness; as you are not a wheeler you will not have a 3 ft. 9 in. felloe pattern. To make one get a piece of pine, lay it on the floor or fasten to the wall, and describe a circle with the compasses set 22¾; set the compasses again 20¾; now divide this circle into five divisions, each one being a felloe, and be sure that one of these felloes is marked upon the board, as you want to saw this pattern out. When sawn and dressed out, place it upon your ash felloes and mark all round; saw the ends off straight and plane them up, having one side planed straight and true. You now get a scriber, made with a short staff 24 in. long; one end is narrowed at the side like a wedge to fit between the spoke on the nave; measure from this end 13 in. and insert a sharp bradawl in at the mark; let the end of the staff rest upon the nave between the spokes, and mark each spoke at both sides. Next saw the ends of the spokes off up to this line. Measure 11 in. on the staff and insert the bradawl in, or 2 in. lower down than it was before. Mark each spoke all round; this is for shouldering and tenoning the spokes. Get a piece of hard wood and bore an inch hole in; make the tenons 1 in. diameter, and keep them straight; keep trying to see if you can fit this mortise on the tenon; keep paring the tenon down until you can; at the top you can have the tenon a little slack, but have it to fit on the shoulder or end of tenon. You now lay the wheel down on a block with the face up and place your felloes resting upon the tenons; let a felloe rest upon two spokes; the half of felloe or the joints always also come in the centre between two spokes, or meet the ends abutting against each other; fit these felloes all round, sawing a little out of the joints if required; when right, mark the mortise out of the felloes by running your pencil alongside of the tenons; also draw a line traversing the joints. Next number the spokes and felloes to correspond when putting them together. Square and mark the lines at the inner and outer side of the felloes. Next find the centre between the lines and bore an inch mortise hole; also with the ½ in. bit bore a hole in the end of the felloes to hold a 2 in. dowel ½ in. round iron, therefore bore 1¼ in. in each end, boring in the direction of the traversing line, which you marked at the side of the felloe; take the average off the inner edge of the felloe and dress it round at the front; at the back of the felloes, which will be at the back of the wheel when on, you only dress between the mortises. You now fit your felloes upon the spokes. All the felloes are put on just a little at first until they are in their places, then they are all driven up and wedged. Saw the wedges off level with the sole of the felloe and plane the joints on the sole straight. Give the wheel a coat of paint, and when dry have it hooped. After the tire is on dress the joints off level at the inner side, and dress the sides off smooth, and box the nave, and fit in the bush. It is needless to say that there is machinery to do all this, but I hope that this description will be plain to enable you to work by until my articles, which I am writing, on making wheels appear in WORK.—W. P.

Book on Metal Plate Work. — PLUMBER (*Slade*).—Millis' "Metal Plate Work," 9s. (Spon). This is a useful book for your purpose.—F. J. C.

Ebonite.—H. J. G. (*Coventry*) asks for information "as to composition and details of process for making ebonite." Ebonite is composed of india-rubber, sulphur, and some black colouring matter. With regard to the details of the process the limits of "Shop" admit only an outline. The indiarubber is prepared in a machine called a masticator—which generally consists of an iron cylinder in which a fluted drum revolves—with about 30 per cent. of finely sifted flowers of sulphur and sufficient colouring matter. When these substances are thoroughly mixed the material is placed in a prepared mould made of plaster of Paris and of the required shape. This is then placed in a steam boiler and subjected for two hours to a heat of 315°, and a pressure of about 12 lbs. to the square inch. When cold the article is ready for carving—turning in a lathe or otherwise finishing in the same manner as ivory. From this sketch of the process you will see that special machinery and power is required, and that, having regard to the nature of the ingredients, and to the necessity for high temperature and pressure, there is no "short cut" to the manufacture of ebonite. Ebonite may be purchased in sheets of various thicknesses at about 6s. per lb. at such houses as Elvary & Co., 31, Conduit Street, New Bond Street, W., and Elephant House, 46, Lower Sackville St., Dublin.—OPIFEX.

Battlesden Cart.—L. M. (*Roscrea*).—I do not know of a firm that will supply both shafts and iron work for Battlesden. Noting your address I recommend you to apply to J. Potter, North Wall, Dublin, for shafts, wheels, etc., and Henshaw & Son, Christ Church Place, Dublin, for springs, axle, etc. I am glad you appreciate WORK, and wish you success with the Battlesden.—OPIFEX.

Dye for Brown Leather.—C. S. G. (*Somerset*). —You can make a simple black dye for brown leather by the following recipe: Boil a handful of iron shavings in, say, a quart of good vinegar, and let it stand for eight or ten days; heat again and let stand for the same length of time. Strain off the liquor and bottle for use. I do not know that there is such a thing as "jet black oil." You can, of course, colour any oil by the addition of lampblack, etc. There is an oil called "mollus-corium," which is dark in colour, but not black, and which may be got at almost any saddler's. I also give you a recipe for another very dark oil, but as I do not know what you want it for I cannot answer for it. Olive, or rape, oil, 1 pint; oil of turpentine, 2 oz.; mix and add gradually 6 drs. sulphuric acid; leave the bottle open till cold.—OPIFEX.

Cut Work in Printing.—E. J. J. (*Romford*).—"Cut work" means printing engravings at hand press or machine. "Modern Printing Machinery" (Cassell & Co., 21s.) contains a chapter on this subject. It cannot be treated in WORK at present in consequence of the pressure of other subjects.—J. F. W.

Brass Engraving Tools.—BRASS EYE (*Southgate*).—The tools used for cutting sheet brass are various, according to the size and thickness of the metal. For cutting the thickest metal large shears are used, fixed to the ground by a heavy iron stand; the metal is then held between the shears while great force is brought to bear on the end of the knife. Metal up to a very thick gauge is cut this way. For thinner metal there are, we believe, one or two patents. They have one at Harrison's, Drury Lane, very much after the style of a small mangle, which pulls the metal in and cuts it at the same

time, all that is needed being to guide it. But for the use of BRASS EYE we should advise a scriber or fret saw, to be obtained at any tool warehouse. We cannot tell exactly at what temperature brass will melt, but zinc and copper (of which two metals brass is composed) melt at 680° Fah. and 1,994° Fah. respectively.—S. M. S.

Galvanic Battery.—R. R. (*Limehouse*) asks:—"Will you kindly explain to me the simplest way to make a galvanic battery for home use?" Such questions as these cannot be satisfactorily answered in "Shop," because the writer fails to state what "home use" is intended for the battery. By "home use" I should understand that the battery was required for ringing electric bells, working model motors, or working a shocking coil. Now, for each of these purposes a different battery will be needed, and I cannot undertake to describe some two or three batteries on the mere chance of one of them being the thing wanted. In asking for information on batteries, you must give me some idea of the work to be done by the battery.—G. E. B.

Copper Bronzing.—H. T. (*Wolverhampton*) asks:—"Could any kind reader of WORK tell an amateur the solution for copper bronzing, and how to use it?" This is another indefinite query. A bronze appearance may be given to copper by dipping it in a solution of sulphide of ammonium. See article on "Bronze," p. 613, No. 41, Vol. I., and also article on "Brassing," p. 598, No. 38, Vol. I., of WORK. If this does not suit you, please write again and tell us exactly what you require.—G. E. B.

Pocket Accumulators.—T. W. A. (*Dulwich*).—The containing cells are made of ebonite, and the lead plates are cut to fit these. You will find information on how to make accumulator plates in a reply to D. S. (*Holloway*), on page 477, No. 30, Vol. I., of WORK. I do not know of a book on the subject of making pocket accumulators, but this will, doubtless, receive attention in these pages at some future date.—G. E. B.

Magnetic Belt.—W. C. (*Dukinfield*).—(1) Some pieces of hard crinoline steel two and a half inches in length, magnetised as directed in replies to V. R., ANXIOUS (*Liverpool*), and others in back numbers. (2) These pieces of steel should (theoretically) be sewn into the belt about an inch apart, with north and south poles alternate. (3) Any number of these you may desire, or the belt will hold. Quilt each magnet in its place between two pieces of jean, line the belt with red flannel, and bind the edges with soft leather. If you think this will do you any good, by all means make one. You will be benefited by the employment, and the belt will comfort your mind as long as you have faith in its curative properties.—G. E. B.

Capability of Battery.—A. G. R. (*Southport*).—The battery is a single fluid bichromate of potash battery. The red and amber crystals are those of bichromate of potash; the purple-black and dark ruby-red crystals are those of chrome alum deposited from the partly spent solution above. Throw all the solution away, and the crystals also, unless you want them for experimental purposes. Dissolve the dark crystals by pouring into the cells a little warm water acidulated with muriatic acid. When the cells are clean, charge them with a solution of chromic acid (three ounces in one pint of water), acidulated with three fluid ounces of sulphuric acid. Clean the zincs, and reamalgamate them with mercury; also clean all connections, and see that they are perfectly in contact with each other. You will now have a battery similar to that illustrated in my forthcoming articles, "Model Electric Lights" (Fig. 11), and it will serve a similar purpose. It will light up a 10 volt. 5 c.p. incandescent lamp, or, perhaps, a 10 volt. 10 c.p. lamp. It will not be suitable for electro-plating, although, in a pinch, some few jobs might be done with it, if you couple all the zincs to one leading wire and all the carbons to the other.—G. E. B.

Silicine Glass Painting.—PAINTER (*Cork*) can obtain silicine materials through J. Gilbert, 120, Patrick Street, Cork. I am sorry I am not in a position to recommend any work on gilding and embossing on glass, but I believe Messrs. Brodie and Middleton of Long Acre publish books of that nature.—F. B.

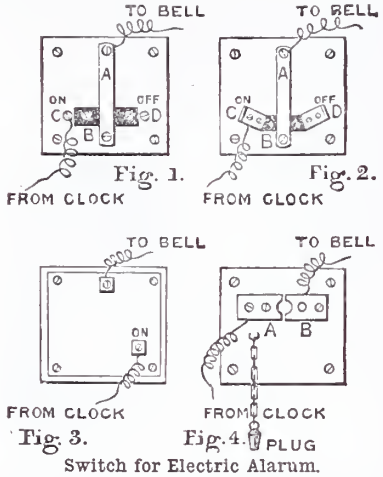
Safe.—R. C. W. (*Lewisham*).—If the room is, as you say, a dry one, the moisture must be in the formation of the safe. The only thing I can suggest is that you should dry them occasionally. You might also keep some chloride of calcium in the safe, as it absorbs moisture very readily. Of course as it deliquesces it will require occasional attention; or your safe might admit of a wooden casement, with or without partitions, being placed inside it—especially if it be a safe without fittings. Doubtless the moisture proceeds from the sand in the safe's walls.—D. D.

Address of Vendor of Electrical Goods.—A. H. (*Ashton-under-Lyne*).—I do not know the address of a vendor in your town. The goods can be sent by post. Try Messrs. T. Gent & Co., Braunstone Gate, Leicester.—G. E. B.

Clocks.—TIM BOBBIN.—Some papers on "Clocks and Clock Cleaning" will appear shortly.

Canvas Canoe.—T. H. D. (*York*).—The best covering for a collapsible canoe is a kind of canvas known as "crash." It is very strong and closely woven, and splendidly adapted for canoe making. You can obtain it at most linendrapers in widths of about 5 ft., and of any length. After you have stretched the canvas on frame, give it two coats of boiled linseed oil, letting the first coat dry thoroughly before applying the second, which will take two or three days; after this give it two coats of good paint, when you will find your boat perfectly waterproof. The paddle should be made of fir or yellow pine, in three pieces. The handle should be oval, and the blades at right angles to the broadest part of the oval.—G. J. E.

Switch for Electric Alarum.—H. M. (*Hatton Garden*).—Wood for all three forms of switch: Half-inch pine, teak, mahogany, or beech, $3\frac{1}{2}$ by $5\frac{1}{2}$ inches, planed and polished. Fittings: Switch arm, A, spring brass $\frac{3}{16}$ in. thick, $2\frac{3}{4}$ in. in length, by $\frac{7}{16}$ in. in width. Drill hole for half-inch round-head brass screw at one end, cut off head of round-head brass screw, and solder to other end. Fig. 1.—Fix a thin strip of boxwood, ebony, ebonite, or gutta-percha at B by two flat-headed brass screws, slightly countersunk. Insert two round-headed brass screws at C and D to act as stops for the arm, A. Place a thin brass collar or washer under the upper part of A, clip the line wire between them, and secure with a round-headed brass screw. The end of the other line wire will go around the two screws at C. Fig. 2.—Make the stops and contact pieces (C and D)



Switch for Electric Alarum.

of $\frac{1}{16}$ in. brass, bent up at the ends, and fixed to the board by two brass screws, countersunk level. Fill in the space between the ends of these with a thin strip of boxwood or ebonite. Fix the wires as shown in the figure. Fig. 3.—If you do not care to see the connections for the wires in the face of the switch, make the pivot for the arm like a bolt, and secure the wire to a nut beneath, as shown. Fig. 4.—This shows a cheap form of plug switch. A and B are two strips of $\frac{1}{8}$ inch brass, nearly but not quite touching each other. In the centre is drilled a half-inch hole brooched taper from the outside. In this is fitted accurately a taper plug of brass, which may be hung by a chain when not in use. Place the plug in the hole when the switch is wanted on. From these I think you will get an idea how to make a cheap switch for your time alarum.—G. E. B.

Mica.—G. P. (*Edinburgh*).—You ought to be able to get mica in Edinburgh. Lamp dealers, gasfitters, etc., use it in the form of "mica tops," and they, dealing with manufacturers, should have no difficulty in procuring the raw material for you. I am supposing you want only a small quantity, but if I am mistaken you might apply to Grew & Bridge, Summer Row, Birmingham. They, however, only supply wholesale, I believe.—D. A.

Horse-Power Lathe.—ÉCOLIER.—A $6\frac{1}{2}$ in. lathe can be driven by the foot; you may, therefore, reckon the power required to be that of one man, say $\frac{1}{8}$ of a horse-power. An engine capable of exerting $\frac{1}{4}$ of a horse-power would be suitable, and you can put a fast and loose pulley on the right-hand end of the crank shaft of the lathe and drive it direct from the engine. The size of the fly-wheel depends on the speed of the engine. A $\frac{1}{4}$ horse engine might have a wheel of about 16 in. diameter, and be bored to fit a $\frac{7}{8}$ in. shaft. I have written a series of papers on the construction of such an engine to appear in WORK with working drawings. F. A. M.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—ELGEE; IVANHOE; CARTRIDGE; DIAMOND; CORKONIAN; J. S. W. (*West Bromwich*); W. B. (*Costlegate*); R. L. H. (*Glasgow*); THE ALLIANCE ALUMINIUM CO., LIMITED; F. A. W. (*Handsworth*); T. H. (*India*); T. J. (*Liverpool*); J. W. (*Swindon*); R. T. (*Paisley*); E. C. B. (*Leytonstone*); BOOKBINDER (*Woolwich*); J. C. (*Belfast*); C. A. (*Birmingham*); SCULPTOR (*Chester*); W. D. (*Bath*); C. J. H. (*Birmingham*); G. B. (*Accrington*); W. BROS. (*Hereford*); COSMOS; C. C. & CO., LIMITED; A. R. (*Scorrier Saw Mills*); PENSEZ A MOI; F. M. (*Thornton*); W. G. S. (*Bristol*); G. M.; E. J. (*Barnsley*); J. W. R. (*Horbury*); DOUBLE GLOSTER; PAINTER; AMATEUR; MARBLE; JOINER; G. L. (*Halifax*); F. G. H. (*Kent*); J. C. (*Heywood*); J. B. (*Doncaster*); A. W. D.; CHORLEY; W. R. (*Heaton*); A. B. (*Salford*); W. D. (*Liverpool*); BRITANNIA CO.; J. T. E. (*Seacombe*); POLYSMATTER; J. M. (*Midhurst*); SECOND HAND; G. A. N. (*Wolverhampton*); J. N.; IGNORANT; F. G. H. (*Kent*); J. S. K. (*Kirkcaldy*); E. B. C. (*Coseley*); W. H. N. (*Oldham*); A CONSTANT READER; J. K. (*London, E.*); J. P. (*Bridgetown*); INVALID; N. F. F.; A. H. (*Ripon*); J. R. W. (*Portsmouth*); G. B. (*Accrington*); W. B. (*Thirsk, York*); A NEW READER; T. H.; AN ENQUIRER; F. J. P. (*West Bromwich*); F. C. (*Leytonstone, E.*); E. E. (*London, E.*); W. J. S. (*Caversham*); AMATEUR (*Kilkenny*); J. G. B. (*Bearsden*).

Trade Notes and Memoranda.

MESSRS. ROBERT WETHERILL & CO., of Chester, Pa., are to build the largest Corliss engine in the world. It is to be used in the steel works of Messrs. Carnegie, Phipps & Co., at Homestead, Pa. The cylinder will be 54 in. by 72 in., and will weigh 40,000 lbs. The fly wheel will be made in ten segments, and will weigh 200,000 lbs. The crank pin will be made of the best forged steel, and will weigh 1,700 lbs. The shaft will be made of standard steel, and will weigh 40,000 lbs. The easting will be of iron. The total weight of the engine will be something over 500,000 lbs., and will furnish 3,500 horse-power.

PAPER or pasteboard may be rendered waterproof as follows:—Mix four parts of slaked lime with three parts of skimmed milk and add a little alum; then give the material two successive coatings of the mixture with a brush, and let it dry.

SOME interesting experiments were made the other day in the vicinity of Copenhagen with tree-felling for military purposes by dynamite. The object was to ascertain the saving of time and labour effected by this method, and the results were exceedingly satisfactory—far more so than is understood to have been the case elsewhere. Trees of so much as three feet in diameter were brought down in some twenty to twenty-five minutes, whereas the time occupied by ordinary felling would probably have been ten times as much.

THE most powerful electric light in the world is said to be one at the Houstholm lighthouse, on the dangerous coast of Jutland. It is of 2,000,000 candle-power, and is visible 40 miles.

FILES can, it is said, be recut by cleaning them in acidulated water between two plates of carbon and closing the circuit, so as to form a real voltaic cell.

THE tramways in London consist of nearly 117 miles of line. The principal companies are the North Metropolitan, owning 41 miles; the London, nearly 22 miles; the London Street, just over 13 miles. Five other companies between them hold 41 miles. These are the South London, Southwark and Deptford, London Southern, North London, and West Metropolitan Tramways. There are, at present, several London tramway companies whose receipts barely equal their expenses. This little fact will materially reduce the 5·79 per cent. return shown by the three great successful companies, and the 3 per cent. at which the County Council can get money would not leave much profit.

A TELEGRAM from Constantinople received in London states that the Sultan has issued his Imperial irade, dated the 13th inst., to Mr. J. K. Pilling, of Sackstead, near Manchester, for the construction of a railway from Damascus to the natural harbour formed by the Bay of Acre, with branches to divers other places. It is believed that the projected line will divert into that country the considerable export trade of Syria and Arabia, and tap the rich agricultural district of the Hauran. The trunk line from Damascus to the sea will be 115 miles long, and the junction from the great caravan route to Mecca will be at Cæsarea Philippi, the ancient Dan.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [24 R

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured.—ETHELBERT HENRY, Alvaston, Derby. [22 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [26 R

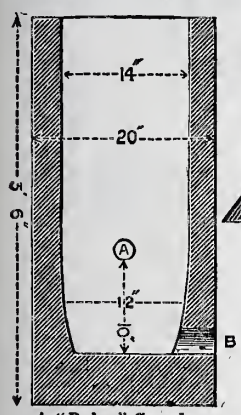
Amateur Photographers are invited to send for Trade List of Photographic Printing.—ETHELBERT HENRY, Alvaston, Derby. [1 S

Designs.—100 Fretwork, 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 sheets, 2s. 6d. All post free. Lists sent free.—F. COULTHARD, 113, Old Christchurch Road, Bournemouth. [2 R

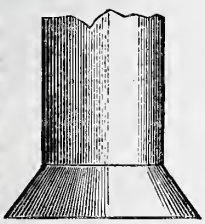
I.—LETTERS FROM CORRESPONDENTS.

Artificial Marble. — E. T. (*London, E.C.*) writes:—"Having observed in WORK on several occasions a desire to obtain a good imitation marble, and as I know one that is not very expensive, and far superior to those that you have mentioned in WORK from time to time, I thought that it would not be out of place to write and place it at your disposal. It is not difficult to make; it does not require many tools; and when it is finished properly it is most difficult to tell from the real article unless on very close inspection. The ingredients required are Keen's superfine cement, Keen's coarse cement, colours to match veins, marble, etc. Tools: Small trowel, some stopping tools (one will do), rushes for fining up, a stone for fining up beading, and some ordinary French polish for polishing (or it may be polished with putty powder if preferred), a piece of glass for bench for slabs, and moulds for other articles, such as columns, brackets, etc.; the moulds are the ordinary plaster moulds varnished inside with spirit varnish; some raw silk in bunches, cut into lengths of about one yard and knobbed at the ends to keep it from unravelling. The method of making is as follows:—If for slab, place the glass bench perfectly flat and thoroughly clean it; now mix some fine cement in a basin and colour it as required for veins (it should be about as thick as cream); now take the skeins of silk and dip them well in the colour; just run them down lightly with the hand on removal to prevent them from dripping and lay them on the glass, well opening them out to represent veins. When the slab is covered with the silks, mix some more cement without colouring of about the same thickness, and dipping the hand into it sprinkle it on the glass lightly until the silks are covered; the cement should now be about ⅛ in. deep; now carefully remove the silks and wash them and hang them up to dry for future use; now carefully smooth the cement over with the trowel, care being taken not to smudge the face; when perfectly smooth, coarse dry cement can be lightly sprinkled over the top to draw out the water, carefully removing it with the trowel when wet; it can (the slab) now be left for a couple of hours, after which it must be backed up (strengthened) with coarse cement to any thickness required and left till morning, when it will be found properly set; it must now be removed from the glass, stopped, fined up, and polished, and I am sure the result will be found highly satisfactory. This is a similar kind of thing to what was advertised and sold some time ago as Athenian marble. Of course for brackets, columns, etc., the silks must be spread out over the moulds and the same process carried out."

Amateur Iron Founding.—E. P. D. (*Sherborne*) writes:—"Perhaps it is not generally known that iron can be melted in a crucible on a Rownson and Drew's fan forge; I enclose drawing of a furnace called a "baby" cupola, which used to be used years ago in the production of small articles. It is made of very stout sheet iron, about 3 ft. 6 in. high, and 20 in. diameter. The bottom is first rammed up with sand, a suitable 'former' is then put inside, and the whole rammed up with a mixture of sand and fire-clay. 'Gannister' lining would do much better. The blast may be got from a smith's bellows. These little cupolas answer very well when properly managed."



A "Baby" Cupola.


HOOD

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Lincrusta Hanging. — B. G. (*Hampstead*).—Until very recently, lincrusta was sent out by F. Walton & Co. with a backing of thin calico or some such fabric; it is now substituted by a brown paper backing. The best paste for fixing is about half each of flour-paste and glue. Make the paste thick, dissolve the glue—the 6d. per lb. article will do—by heat, and then mix. The glue will require to be thoroughly amalgamated with the paste, and the latter should be properly made and free from lumps. This is the paste used generally by the trade for lincrusta, Japanese papers, anaglypta, etc. Trim them all with a cobbler's knife and metal straight-edge upon a bench, cutting the article slightly inwards from the face, and so ensuring the face of the joints meeting nicely. The roller must not be used on such articles and designs when rolling is likely to injure the "relief" or raised parts. A few small upholsterer's *gimp pins* should then be tacked in to keep the joints well down until the paste sets; the heads of these will not show if you get them light or dark according to the colour of your material. The lengths of lincrusta and any other thick and heavy material should always be cut, trimmed, and matched to the exact size *before fixing;* it could not be done upon the wall or ceiling in a workmanlike manner. Having been familiar with lincrusta since its introduction some ten years ago, when Mr. Walton called his invention "Linoleum muralis," and when it required, of course, a special cement to fix it with, I shall be able and pleased to give you any further help in such matters. Although, for the present, a special paper upon its uses and treatment may not be much called for, its treatment in connection with graining and imitation of carved woods will be considered in the "Art of Graining."—DECORATOR.

Photo-Mounts and Sizes. — J. A. MCLEOD (*Glasgow*). — Mounts are usually cut to suit the photographs, the amount of trimming being decided by the subject of the picture itself—in many cases a ¼ in. less way would be right; that is, less than the negative from which the print is made. Prints are of the following dimensions: 3¼ in. by 4¼ in., 6½ by 4¾, 8 by 5, 8½ by 6½, 9 by 7, 10 by 8, 12 by 10, 13 by 8, 15 by 12, and 11 by 8. In some cases much larger negatives are made, and the subjects masked down to the sizes above; in such cases the opening of mounts would have to be as large as the sizes enumerated. Bronze ink is made by rubbing down a sufficient quantity of Bessemer's gold-bronze with thin gum-water. Red-gold ink is made by carefully triturating gold-leaf with gum-water. The gold paper (bronze) is machine-made on a large scale, and is retailed at 6d. a sheet. Red-gold paper is made by laying down gold-leaf on a suitable paper, but the edges of mounts are frequently gilded by brushing over them gold or bronze paint. The papers for edging are also brushed over the backs with a strong solution of gum with which a little sugar has been mixed.—D.

Belt Saw.—J. C. (*Cork*).—One of the hand-worked band-saws made by Hindley, of Bourton, in Dorsetshire, will prove much cheaper than anything you could make. Send to him for price list.—J.

Books on Pattern Making.—W. H. P. (*Loughborough*).—"Pattern Making," 7s. 6d., published by Lockwood; "Iron Founding," 4s., published by Whittaker; "Mill Gearing," 6s., published by Spon; "Templeton," 6s., published by Lockwood; "Machine Design," 6s., published by Longmans. Read occasional articles in *Industries, Practical Engineer, English Mechanic,* WORK, by the author of the first two books in this list.—J.

Ointment Vending. -- BIRKENHEAD can sell without restriction any ointment or other compound *not* containing a poison within the meaning of the Pharmacy Act. Should his ointment contain a poison within the meaning of that Act, such as, say, precipitate of mercury (said to be an ingredient in Holloway's ointment), he should shelter himself under the Government stamp, and can further protect himself from piracy by a patent. To quote from the official circular of the Patent Office: "Communications with respect to the preparation and supply of medicine stamps appropriated to a particular medicine, or as to the liability to stamp duty of so-called 'Patent Medicines,' should be addressed to the Secretary, Stamps and Taxes, Inland Revenue, Somerset House, London, W.C." As regards "chip boxes" for his ointment, let him try Messrs. Ayrton and Saunders, Liverpool, who are makers of repute. From them he will best get information as to sizes and prices.—C. C. C.

Hinges for Screen.—D. S. (*Auchenheath*).—If you had read what has already appeared on hinges in WORK, I do not think your question would have been put. Your difficulty appears purely an imaginary one, evolved out of your own inner consciousness. Of course the screen will fold unless you do something egregiously wrong in fitting the hinges on. Imagine one of the folds to be a door, and the other one to be a wall to which it is hinged. Where is your difficulty then? You may either use "screen" hinges for double action, or butt hinges fastened to edges of frames, or back flaps on the face of the framing. With screen hinges the folds will work both ways, with the other kinds only one way. You may also use hinges of webbing *à la* folding clothes-horse.—D. D.

Carving Tools.—HOMO (*Wellingborough*).—It is quite impossible to tell you what are the best sizes for tools for executing carvings to designs given in WORK, for much depends on the sizes in which they are to be made. A good deal also depends on the amount of detail you intend to work in; as, if you only want good broad effect, of course you do not require so many tools as otherwise. I take it you are a beginner at carving; if so, most of the designs which have been given are not suitable for first attempts; and my advice is, get a few simple tools, straight, not bent—say, half a dozen—of moderate size, and add to your list as your skill increases.—D. D.

Mail Cart Wheels. — J. S. C. (*Bradford*). — No doubt by now you will have received a reply from Mr. H., as I went to see him, and he said that he had been ill, and was unable to do any corresponding, as he does not keep a clerk or any assistant to help him in the shop. Had you written to any of the others whom I recommended you would have received a reply the next day. Have you tried "The Victor" Cycle Company, Grimsby?—W. P.

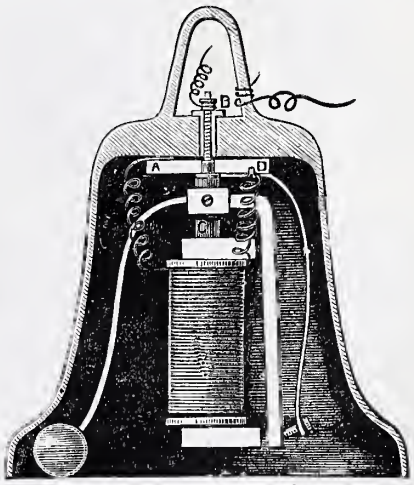
Fretwork.—W. B. (*Inchinnan*).—You have been singularly unfortunate in the method you have adopted for transferring designs to wood, for you could hardly have a slower or more tedious one, though there are plenty quicker and easier. One of them is to trace the design by means of carbon or manifolding paper on to the wood. Lay the carbon paper between the wood and the design, then go over this with a hard pencil or style. By the same means—carbon paper—you may multiply designs to be stuck on the wood. If you have one piece of fret cut, and want to keep copies for reproduction, the simplest method is to take heel-ball rubbings on paper, and stick them on to the wood to be cut. By this means you may dispense with tracing or drawing at all, as you can stick the original design down.—D. A.

Queen Anne Sideboard.—GLASGOW.—It is impossible to give answers to questions within a fortnight, and you need not be surprised at not getting an answer yet. The subject is quite within the scope of this magazine, but you must remember that everything cannot be attended to first. "Wait a little longer," and you will, no doubt, find your wishes gratified. I am unable to recommend you any better book than WORK.—D. A.

Pantograph.—R. A. S. (*Stainley*).—This may be got from any artist's colourman. If you cannot obtain it in Ripon, ask some one in this trade to procure it for you from Lechertier, Barbe & Co., or some other wholesale firm with whom he may deal.—D. D.

Fire-Proof Box.—H. H. (*Sidcup*).—I know of no way by which you could make a fire-proof box which is not at the same time a "safe." This you say you do not want to make; and I may add that safe-making is not a branch of labour in which an amateur could hope to succeed. Of course you can make a wooden box, and to some extent render it less combustible than it would otherwise be by treatment with some of the preparations used for such purposes. Your idea, though, seems rather too much of a fad; for the only thing that would resist the intense heat of a conflagration is a thoroughly good fire-proof safe; and a small box such as you contemplate would surely be kept as far as possible from any risk of fire. The best thing I can suggest is that you should make a double box, and fill the space between with some non-combustible; but I am afraid, from your inquiry about rule, that you have hardly sufficient knowledge to enable you to do so. Before the marks or scales on your rule can be explained, you must say what they are. If you do this, no doubt you will have your desire gratified.—D. D.

Jensen Electric Bell.—C. D. (*Rochester*).—I give, as requested by you, a rough sketch of a Jensen electric bell in section. This will enable you to trace the connections. One of the line wires is connected to the loop of the bell. In practice the wire is connected to the bracket on which the bell is hung. One end of the bobbin coil is brought into close contact with a cleaned spot on the bell at A, and is clipped there by the box-wood disc, which insulates the movement from the bell. The other end of the bobbin coil is attached to a screw which holds the contact spring at D. This spring is also insulated from the rest of the movement by being fixed to the box-wood disc, so that it does not touch the metal of the core. The other line wire is fixed to the binding screw, B, on the top of the bell, and this screw also helps to hold the core of the bobbin in its place. The course of the current is, therefore, from B, through the core, C, and its armature, by way of the contact spring, then through the coil, and back through the bell at A. As you know how to make the fittings, this will set you right, will it not?—G. E. B.

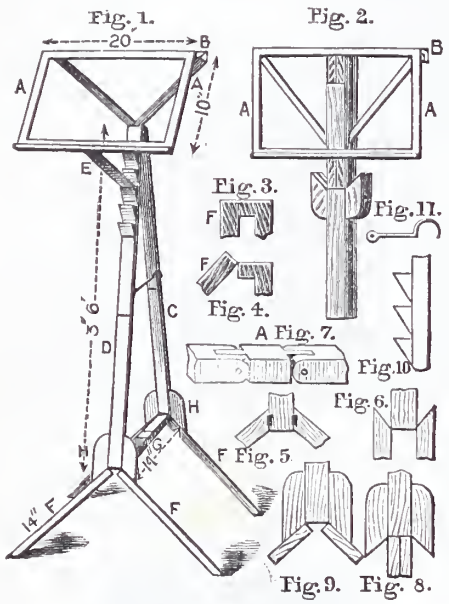


Jensen Electric Bell.

Burnishing Gold.—GOLD LEAF (*Halifax*).—In Vol. I. (No. 38) you will find nearly a column of "Shop" devoted to an answer on gilding. The subject of burnishing is therein explained in as lucid a manner as space permits; I must, therefore, ask you to turn up that answer, which I suppose you have overlooked, otherwise you would not have written your query. Respecting the second item, gold leaf is affixed to glass, the surface of

which has been well cleaned and polished by a very weak gelatinous solution. Russian isinglass is the best, and a few shreds only are required to be dissolved in a half pint of boiling water to make it sufficiently strong for the purpose. The addition of a few drops of spirits of wine is usually recommended, but such is not necessary. The size requires to be free from the slightest taint of greasiness, and should be strained through the purest white blotting-paper. The portion of glass to be gilded is floated with the size by a camel-hair tool; the gold is then laid on. When the first gilding is thoroughly dry it is necessary to refloat the work with size and gild it the second time, otherwise imperfections of the gold leaf and its manipulation would be apparent when backed with black japan. If it is letters to be gilded on glass, draw them first on paper same as desired on glass and fasten temporarily to back of glass. Then you can see where to gild. Keep the work on the slant whilst gilding and the superfluous size will run off. After second gilding is dry coat the gold with thin clear size. Then convey your letters in the proper *reversed* position, by means of a pounce, and write the design with best black japan. When the writing is dry, clean off the superfluous gold with wadding and warm water. This is a rough outline of the process, space will not permit more at present. The subject of gilding with gold leaf is a very pleasing one, but when the worker can lay a book of gold his knowledge of the subject is just commencing.—DECORATOR.

Music Stand.—FIDDLER (*Glasgow*).—Have you seen my music stand described in pp. 552 and 553, No. 35? It is a folding article, but can scarcely be called portable. However, to meet your requirements I have specially designed the folding and portable stand here shown. You do not say whether



Music Stand and Parts.

you are tall or short, although I presume you are the former, as I generally find that fiddlers are majestic and imposing individuals! Pray, excuse the insinuation. This stand can be made to any dimensions; but in case you may experience some difficulty in deciding the sizes, I give some which will doubtless prove suitable to you. But you must bear in mind that a great deal depends upon your height. Your case seems to be that you want an article which will fold up into a very small space—here, then, is just the thing. You must not complain of the number of hinges, etc.—they, or similar connections, are absolutely necessary. The music frame (of which for the pins, etc, see No. 35) might be 20 in. by 10 in. This is hinged to a triangular backpiece, Figs. 3 and 4 (in which F represents the frame). On each side of the bottom extremity of this last-named piece are hinged the supports, D and C. To save as much space as possible I have marked the measurements on the drawings, so I need not repeat them. D and C are divided and hinged at the same distance from the top of the stand as from the extremity of F F. A good strong hook (such as Fig. 11) must be fastened to either D or C to keep them from collapsing when extended. At the extremity of D and C are small blocks (Figs. 8 and 9), which keep the feet, F F, firm. These feet can be seen in the last-named diagrams, open and shut. The cross rail, G, is connected at each end by hinges to the rails, D and C, and is made in the middle, after the manner shown in Fig. 7. The length of the piece, A, in this diagram is according to the thickness of the supports and feet; it must be as long as these thicknesses combined. The *under* part of the music frame should be cut away to admit the rail, E (Fig. 1), which is hinged to it so as to fold *underneath* it, the other end of it being quite free. By having notches along the upper part of D, similar to those shown in Fig. 10, the frame can thus be adjusted to any desired angle. If the blocks, H H, are also hinged, *to fold outwards*, the stand can be stowed into even a smaller space, as the feet will fold over on to D and C, and the rail, G, can be placed higher up, thus allowing the hinges on D and C to be also placed higher up, thereby permitting them to fold smaller. One particular thing must be remembered, the distance from the hinge on the end of the rail, G, to the middle of that rail must be the same as the distance from that hinge to the hinge in the middle of the upright supports—I mention this in case the rail, G, should be required shorter on account of the wide spread between the feet at the bottom of D and E. To fold the stand, close together D and C by pushing *upwards* the middle of G—the feet will fall together. Then release C and fold over the bottom halves of D and C. Figs. 5 and 6 show how D and C are hinged to the triangular frame at the top of the stand. As you want a light stand do not have the rails, with the exception of D and C, more than ½ in. thick.—J. S.

Banjo Book.—G. D. F. (*Sheffield*).—You say that you are about to make a six-stringed banjo, and would feel obliged for information where to purchase a book of instructions. I suppose you require a book teaching you how to make a banjo, if so, there is no book published on that subject. I have a paper in hand on banjo making which will appear in this journal as soon as I can find time to finish it. If, on the other hand, you require a book of instructions how to play the banjo, there is one for the five-stringed banjo by Ellis, price 2s. 6d.; ditto by Ballantine, 1s. 6d.; ditto by Roylance, in two parts, 1s. each. For six and seven strings there is Ballantine's, 2s. 6d.; Ellis's, 1s., also one at 6d.; W. Williams', 1s.; and many others, which I will mention if required.—J. G. W.

Patent Agent.—E. W. M. (*Redhill*).—I cannot undertake to mention in these columns any firm of patent agents, but if you send a stamped and directed envelope to me I may be able to help you.

Electrotypes.—A. W. (*Manchester*).—Your electrotypes, 7 in. by 4 in., should have a shell of at least 22½ grains in the square inch, or about the thickness of No. 32 B.W.G. This will take 630 grains of copper. As copper is deposited at the rate of 18 grains per hour ampère of current, it follows that you must have a current of 35 ampères to get the required deposit in an hour, or a current of 1 ampère flowing for 35 hours through your solution. If you wished to get 630 grains deposited on 28 square in. in an hour, you would have to connect your mould by means of thick copper straps to a source of current capable of yielding 35 ampères per hour, because the conductors must be able to carry the current at a pressure of not more than 1 volt. If copper is deposited at a high pressure, it is apt to be unsuitable for electrotypes. You will see from the foregoing that it will be difficult for me to say how long it will take to properly coat your moulds with copper whilst using current from the two Daniell cells described in your letter. The cells will only yield a current of 2 ampères on a short circuit, and this would be very much reduced by the resistances of the conducting wires, the coating of the mould, and the depositing solution. I advise, therefore, that you make up three such cells as you propose; connect these in series to start the deposit, until the mould is covered; then connect several wires to various parts of the mould and arrange your cells in parallel with connecting wires and anode to finish off deposit at a higher rate. Connecting the cells in series means connecting the zinc of one to the copper of the next, and so on through the series. Connecting in parallel means connecting all the copper of the cells to the anode, and all the zincs to the wires leading to the mould. The best rate to obtain a good tough deposit is found by actual trial, as experience alone can teach you how to use your own tools to the best advantage.—G. E. B.

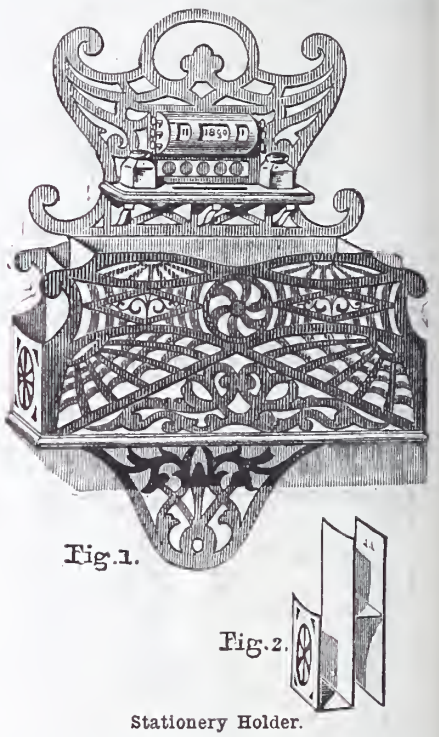
Clock Regulating.—CLOCK.—Having shortened the pendulum, you must make it up by putting a new wheel, or wheels, or pinions. If a new scape wheel was put it would, perhaps, be sufficient, but then you would almost be certain to find the pallets would not suit; another third wheel would probably correct it. If you will take your clock to pieces and count the number of teeth in the 'scape wheel, the next or third wheel, and the one with the long spindle which carries the hands and is called the centre wheel, also the number of leaves in the 'scape and third pinions, also give me the exact length of pendulum at present, I will tell you then how you can alter it to make it go correctly. The cost would depend on how many wheels or pinions would have to be changed, also by who did it; and when I know what will be required I will tell as near as I can the price it should be.—A. B. C.

Lantern Slide Painting.—Several having written asking for instructions on this subject, I will place the required information in the hands of the Editor at an early date.—O. B.

Repoussé Work.—M. S. (*Gateshead*).—Haslope's "Repoussé Work," 2s. 6d., 170, Strand; Gawthorp's "Hints on Repoussé Work," 6d., 16, Long Acre. At the latter address illustrations and prices of the kind of tools required may be obtained gratis.—J. G.

Phonograph.—A WOULD-BE ELECTRICIAN.—The old-style phonograph, with tin foil cylinder, may now be bought for some 40s. or 50s., or perhaps less. Advertise for one in the Sale and Exchange column of WORK. It is being superseded by the more modern graphophone."—G. E. B.

Stationery Holder.—M. A. (*Suffolk*).—I daresay you will find this stationery cabinet suitable for what you require. I do not think there is anything exactly like it in the market, my purpose being to give you something a little fresh. I have taken it for granted that you want it to contain foolscap, as well as note-paper and envelopes; and I have also shown a date box, and penholder, and ink-bottle shelf. Foolscap and other large sheets can be placed in the large compartment, envelopes in the top spaces on each side, and note-paper in the spaces under them. The length of the large compartment should be about 13¾ in.; depth, 8¾ in.; and the width, 4¾ in. The compartments on either side will be 4¾ in. long, 2 in. wide, and about 4¾ in. deep. I have not drawn this sketch to true perspective, so that you will find both sides of the various parts of it are exactly similar and the same size. To reproduce the design the required size, draw a number of squares, any size, but all of equal proportions, on a sheet of plain paper; then draw the same number of squares on this small sketch. You will then find it is not a very difficult job to copy it. Or you might use a pantograph, one of which is described in "Shop" in No. 42, page 669. If, however, you cannot accomplish the enlarging, I will draw out full-size designs (which it is almost impossible to do in the pages of WORK) and send them you, if you will forward me your full address, through the



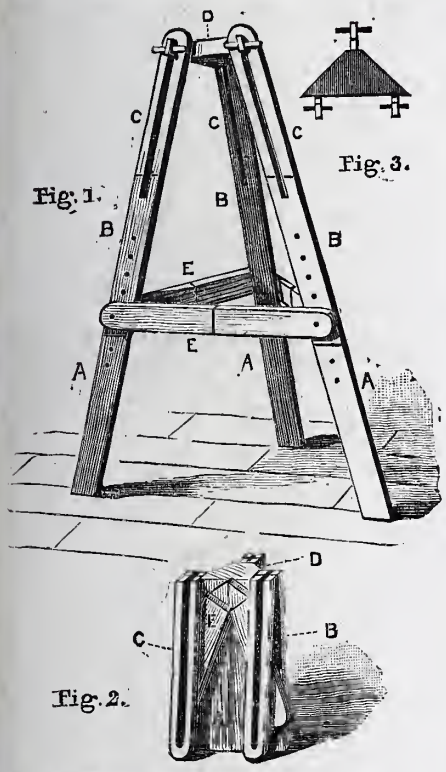
Stationery Holder.

Editor. The small shelf may be of any size, and should be shaped to admit the ink-pots, and also for the penholders. You might purchase a small date box and attach it—they are so cheap that it is needless to make one. Fig. 2 shows the boards necessary for each side; you can tell the sizes of them from the dimensions I have given for the compartments. I have shown this as an article to hang on the wall, but, by leaving out the fretwork below the bottom of the compartments, it can be made to stand on a table. If you have it as this latter, I should advise you to fret-cut the other side the same as the front, and have the top fretwork running along and down the middle of the foolscap compartment, thus dividing it into two. To give it an effective appearance, you might fasten some nicely-coloured silk, satin, or velvet behind all the fretwork.—J. S.

Magic Lantern.—MARION asks for instruction to make a magic lantern for home use. This is too big a subject for "Shop." I am, however, preparing an article on the subject, which will, I think, help MARION and others. I also intend to describe various appliances to use with it, such as microscope, polariscope, etc., by the use of which interesting objects which are usually seen by one at a time may be viewed by a number at once.—O. B.

Intensity Coil.—J. M. (*Nottingham*).—To get three separate strengths from your coil, bring out the finish end of the first coil to a binding stud on the base of the instrument. To this same stud connect the commencing end of the second coil, and bring the finish end out to a second stud. To the second stud attach the commencing end of the third coil, and bring the finish end out to a third stud. If now you have a switch lever to move from one to other of these studs, you may get at pleasure a shock from one, two, or three coils, all differing in strength.—G. E. B.

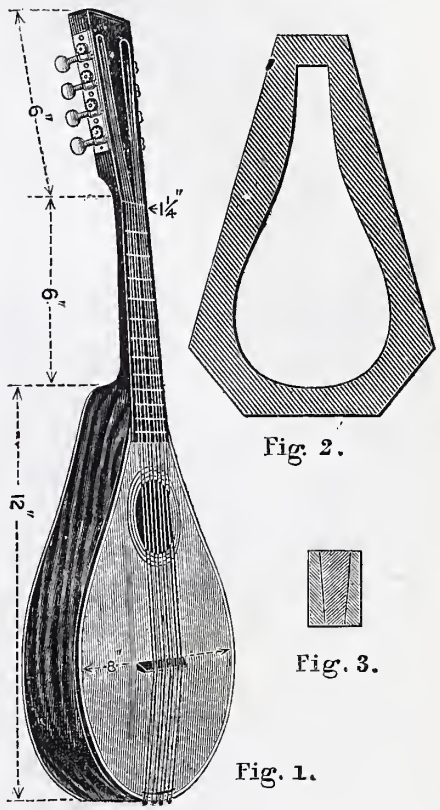
Painter's Easel.—F. B. F. (*Oswestry*).—The space you require an easel to fold into is very small, but still I have managed to design the one here shown. Before giving sizes, I must explain the construction, as no doubt you will look at the drawings for a long time in vain if I do not do so. Fig. 1 shows it open, and a firm job will be the result if made properly. To fold it, A, A, A are pushed inwards and upwards; then E, E, E are pushed upwards, at the same time closing together B C, B C, B C; then D (which is shown by itself in Fig. 3) falls downwards through the grooves in C, C, C, to the notches in the tops of B, B, B; after which C, C, C, fold outward over B, B, B. A glance at Figs. 1 and 2 while reading the above will fully explain. The total length of each leg or upright might be five feet, width two inches, thickness one inch; but, of course, you will know what dimensions will suit you best. They might be rounded on the top; and after the necessary grooves, etc., are cut, they should each be divided into three equal parts, and hinged to fold as described above. Unless you have the cross rails, E, E, E, the easel will be almost useless; and you must have these to fold upwards, as in Fig. 2, otherwise they will be of little use. To allow them to be pivoted and to work properly, you must cant the sides of B, B, B. You will require several hinges (twelve in all) and six pins or rivets, but this cannot be helped, unless you have it



Painter's Easel. Fig. 1.—Easel expanded. Fig. 2.—Easel closed and folded. Fig. 3.—Movable Block at top of Easel.

to fold up into a longer compass than you asked. You can accomplish this by either preserving A and B all in one piece, or by leaving this as shown, and having B and C in one piece (which will then not require any grooves in them). In this easel no piece comes right apart from its fellow-pieces, and this is what I always aim at in designing such things. You might, by a little thought, manage to pack it into a smaller compass, by having the various pieces to detach from each other, but, by doing so, you might find when you settle on a spot in which you wish to sketch, that you have left one or more of the pieces behind you. How then? According to the length and position of the rails, E, E, E, so depends the stretch you will have between the legs, and, consequently, the angle at which your canvas will be when upon the peg, for which latter bore as many holes as you please in B and A. I should advise you to do as I have done—make a small rough model of it with some ordinary firewood. Then you will be able to determine whether one according to the pattern will suit you, and also get at the length you will prefer, E, E, E. These latter rails must be as thin as possible, as C, C, C fold over the ends of them, and will, of course, prevent their laying quite flat. The pin at the back of D will have to be longer than the others; and all three should be strong and thin. To get more slope for your canvas, you should shorten the back leg. To open it, you will, of course, reverse the order of folding it. It is almost unnecessary to say that it must be made in a good strong wood, and that the hinges must be nicely fitted and strongly screwed.—J. S.

Mandoline Making.—MANDOLINE (*London, E.C.*).—The name of the instrument you have sketched is called the Bandurria, and is strung with six double strings; the 1st, 2nd, and 3rd are gut, the 4th, 5th, and 6th are silk covered with wire. You have only marked eight pegs, therefore I presume the one you require describing is the Neapolitan mandoline strung with four double strings; the 1st and 2nd are thin steel, the 3rd and 4th are steel covered with wire, and tuned the same as a violin, G, D, A, E. The American style of mandoline will be much the easiest for you to make (see sketch), so I will confine myself to description of that alone. The first thing that you must do is to make a full-sized drawing of the instrument on a piece of paper or board to sizes marked on sketch; you can make it larger if you choose, but you must remember that the larger you make it the lower in pitch it will have to be tuned. The depth from back to belly, say, $2\frac{1}{2}$ in., or to your own fancy. Having drawn out the outline, draw a line across finger-board where the nut will come; the nut is the strip of wood or ivory at the extreme end of finger board which supports and keeps the strings in position, then mark the bridge 4 in. from bottom. The next thing to be done is to mark off the frets. Take a pair of compasses, or spring dividers in preference, and divide the distance from the nut to the bridge into eighteen equal parts, that is to say, set your dividers to about $\frac{3}{16}$ in. from point to point, and putting one point exactly on the inside of nut, work the dividers along the drawing until you come to the bridge, counting as you go along. If the point of the dividers at the eighteenth part finishes exactly on the bridge, then the distance between the points of your dividers will give you the exact distance from the nut to the first fret; if the point of dividers comes short of the bridge at the eighteenth space, you must open them a shade and try again until you do get it right; or if they come over the bridge *vice versâ*. Having marked the first fret, divide the space from the first fret to the bridge into eighteen parts, that will give you the distance of the second fret from the first, and so on with the rest of the frets, dividing the space from each fret to the bridge until you get as many frets marked as you require. You can put more frets on than are shown in sketch; if you put seventeen frets you will get the notes, C, G, D, A, at the seventeenth fret. Having marked the seventeen frets, mark the sound hole in place; make it about 2 in. in diameter, letting the edge come close to the seventeenth fret. You will now have a working drawing from which you can make any number of instruments of that particular size. The frets may not be absolutely correct according to the science and theory of music, but you will find them practically so. The neck could be made out of a piece of walnut, beech, mahogany, or other hard wood; the belly of Swiss pine, or, failing that, a piece of nice dry pine; the back and sides of sycamore, walnut, rosewood, maple, etc.; the finger-board, ebony or hardwood stained black. In drawing out the neck you can make it a little wider where it joins the body of the instrument, say, $1\frac{1}{8}$ in. or $1\frac{1}{4}$ in., tapering down to $1\frac{1}{4}$ in. at the nut. Get a block of wood 2 in. thick and a little larger than the outline of your drawing (hard wood will be the best; failing that, a piece of pine would do), plane it up true, then draw the outline of body of instrument upon it, take it to a sawmill and get it cut out with a fret saw. You will now have a mould cut to the exact shape that you want your instrument to be when finished (see Fig. 2). Cut out the piece for sides or ribs $2\frac{1}{4}$ in. wide, $\frac{1}{8}$ in. thick; clean up the side of piece that will be the outside of instrument when finished; make it as hot as you can without burning it, then bend it round inside the mould, taking care to keep the side that is cleaned up next to the mould. You will require small iron cramps to fix round the mould to pull the veneer to the shape of mould, or, failing these, notch out some pieces of wood wide enough to clip over the inside and outside of mould; cut some wedges, and drive in between notch and outside edge of mould. If you cut the narrow part of mould longer than you require the body of mandoline, it will give you room to get your sides in and to pull them to shape. Now take a block of wood, fit it tight in narrow part where the neck joins the body (the neck is fixed to this block), make it the exact depth of sides, take out the block, and cut a taper groove in it $1\frac{1}{4}$ in. deep; the groove at the part of block that comes against the belly must be $\frac{3}{8}$ in. wide, tapering to $\frac{1}{8}$ in. at the part that touches the back. The reason for tapering the groove in block is that when the neck is properly fitted and glued in it is held fast and prevents the strings from pulling it forward. Glue in the block. Take a strip of veneer $\frac{3}{8}$ in. wide and glue it on the inside of sides all round, again using the cramps. When the glue is dry dress off level with sides, make a piece of pine $\frac{1}{2}$ in. by $\frac{1}{4}$ in., and long enough to go across at the widest part; notch a little out of the fillet that goes round sides, cut the piece of pine tight in at widest part, notch a piece out of each end to allow it to drop down level with sides, and glue in. This piece helps to support the back and prevents it from getting split or smashed in. Prepare the wood for back, mark and cut to shape, and glue on. Allow the narrow part of back long enough to cover the heel of neck when it is fixed, and dress off after the neck is fixed. Prepare the neck, letting the part that joins the body of instrument be deep enough to meet the back; cut a tenon on end of neck; taper shape to fit groove in block tight; the face of neck must be level with top of belly when fixed. If you are going to use a machine, cut out the slots in head, boring the holes for the barrels of the machine to go through and screw on (see sketch); or the machines can be screwed on underneath the head, and holes bored for the barrels to come through; the barrels of the machine will then project like ordinary pegs. If preferred, pegs can be used instead of the machine; the last named is the best for the mandoline, steel strings being easier to tune with the machine; the least move of a peg will throw them up or down a lot in pitch, much more so than gut strings. Glue in the neck, cut the belly to shape, glue a fillet along the inside of top edge of sides, fit a piece of pine across the widest part about where the bridge comes, glue in, fit a block at bottom end of instrument to support the pins that hold the ends of strings, glue in, then glue on the belly, first cutting the sound hole. After the back is glued on, the body can be taken out of mould to fit the neck, but before taking it out of mould it will be advisable to glue the fillet round the sides for the belly the same as was done for the back. Having got the belly glued on, dress off the neck level with belly, and the edges of belly and back level with the sides; prepare the piece of wood for the finger-board, about $\frac{1}{8}$ or three $\frac{1}{16}$ in. thick, making it long enough to come to the edge of sound hole; glue it on, dress off level with the neck, cut a groove across the neck for the nut, made



Mandoline Making. Fig. 1.—Mandoline. Fig. 2.—Mandoline Mould. Fig. 3.—End of Neck showing bevelled tension.

ditto out of ebony or ivory, and fix; mark the frets on neck, and cut the grooves for the fret wire with a fine saw; be sure the wire fits the grooves tight or the frets will drop out. The best fret wire is made of German silver, and can be bought at music warehouses. The best way to mark the frets off the drawing on to neck of mandoline is to lay a thin narrow strip of wood on drawing, mark the frets on strip, then lay the strip on the neck and mark it. Be sure you cut the grooves for frets square across. After fixing fret wires, file off the corners so that they do not cut the fingers in running along the neck. Next bore holes at the bottom of instrument for the pins to fix the strings to. Small round-headed screws would do, or ivory pins can be purchased. Four pins only will be required, each pin holding two strings. Clean up and polish to your satisfaction, and then put on the strings; the first is fine steel, the second a trifle thicker, the third a thin covered string, the fourth a trifle thicker. Make a bridge same as one in sketch, and put exactly the same distance from the nut as you have in your working drawing; if you do not, your frets will be all false or out of tune when you finger the strings. I forgot to say that the back and belly should be $\frac{1}{8}$ in. thick or a shade under that thickness. Tune up your instrument, purchase a plectrum (a piece of tortoiseshell to strike the strings with), get an instruction book, and practise diligently. The more you play on your mandoline the better you will like it, and also be able to show it off to your friends to the best advantage. If there is anything in this you do not quite understand write again, and I will endeavour to put you right.—J. G. W.

Modelling Wax.—LOVER OF WORK (*Manchester*).—An ordinary modelling wax may be made with beeswax and Venice turpentine—say, in the proportion of three to one—melting in an earthen pipkin, and stirring with a tallow candle. The colouring matter (Venetian red, or whatever may be preferred) should be stirred in whilst the composition is hot. A harder or a more plastic material may be formed by varying the proportions of wax, Venice turpentine, and grease. The composition is highly inflammable, and needs much care in the melting. If a small quantity of wax only is required, it is better to buy it ready prepared from the artist's colourman.—M. M.

Battery for Incandescent Lamp.—J. D. N. (*Glasgow*).—Kindly see replies to other correspondents on this subject, and read carefully my future articles on "Model Electric Lights."—G. E. B.

Casting Lead Caps to Leclanché Carbons.—N. M. (*Hirwain*).—After casting the lead caps, whilst the lead and carbon is still hot, well coat the cap with Brunswick black, and let this soak into the carbon just below the cap, so as to form a black band ⅜ in. wide all around the top of the carbon. If the caps and carbons are cold, first make them scalding hot before applying the Brunswick black. If treated in this way they will work for two or three years or more without showing signs of corrosion.—G. E. B.

Battery for Coil.—H. E. A. (*Hackney*).—(1) You cannot have a handier battery for a coil. Of course, the solution will become exhausted after the battery has been used several times. The cells must then be recharged with fresh solution, and the zincs re-amalgamated. (2) Leclanché cells are not suitable for working large coils, but two cells might work your small coil. (3) You will get no good effect from the second coil by sending into its primary a current from the secondary of the first. You must have a longer coil to get stronger effects. Am glad to hear of your success with the electric bell.—G. E. B.

Windmill for Electric Lighting.—WINDMILL (*Kent*).—A windmill is rather an unsteady and unreliable motor for the purpose. However, as you intend trying it, allow me to give you a few hints in its construction and mode of working. The speed of the windmill itself may be partially controlled by a series of levers connected with the vanes of the mill and a ball governor. As the speed of the mill increases, the vanes are opened, and thus less surface is exposed to the wind. Any engineer will tell you how to do this. The speed of the machinery to work the dynamo may also be regulated by a pair of cone pulleys and shifting strap worked by levers controlled by ball governors. The strap is shifted by the varying speed from one part of the cone pulleys to another, and thus corrects any great increase or decrease in the speed. The device is in use at potteries and elsewhere, but I have not time or space to describe it here. Even with the speed of the mill thus regulated, it will be advisable to adopt the precaution of having a fusible cut-out in circuit with your dynamo and lamps, to provide against overheating the carbons with a sudden rush of current.—G. E. B.

Varnish.—KING BRUCE.—Sorry I cannot oblige you with the recipes you ask for. I do not believe in the policy of "home-made" varnishes, but in your case I fancy there is every reason to persevere. The nature of your goods requires something which will quickly harden and keep quite free from stickiness, hence a methylated spirit varnish is, I think, the only safe direction to work in. The best commercial "white hard" is used for light woods, fancy work, etc., and the brown hard for dark woods. The colour appears to trouble you most. I can only advise you to seek counsel with a thoroughly experienced French polisher, one who makes his polishes, and see what he advises for colouring. I should think the stained varnishes would be as cheap as anything for you, and these spirit varnishes are, I believe, least liable to blister for your purpose. Besides the above commercial varnishes, there is on the market a "patent glaze," used by brush makers for finishing work, previously coated with white or brown hard. If you do not succeed in getting the aid I indicate, write me through the Editor and I will try some of the leading varnish makers for help.—DECORATOR.

Steel Bronzing.—NEMO (*Manchester*).—It is a very difficult matter to both understand your question and answer it with any degree of confidence. Having submitted it to Mr. G. E. Bonney—our able writer on all that appertains to plating—who does not know of any such process whereby brass and iron may be "steel bronzed," the representative of "the brush" appends a few lines which may assist you. I suppose the surface you wish to get is a *bright* steel appearance and not like oxidised silver. I have covered wrought iron *grille* work with silver leaf to imitate the solid *argent*, and have also treated modelled, decorative materials to get "steel" colours and effects. Silver leaf is laid, like gold leaf, upon *gold size*; but silver discolours very rapidly, and should be coated immediately after laying with a solution of white shellac in methylated spirit. "Silver bronze," so called, in powder and liquid forms, can be bought which are much nearer steel, in colour, than the silver leaf. The powder is rubbed with a piece of wash leather upon copal varnish when nearly dry. A coat of grey colour quick drying paint before bronzing is advisable. Silver can be lacquered down by stains in the varnish if desired.—F. P.

Oval Drawing.—A. B. (*Clapton Park*).—You give me a diagram, not of an oval, but of a segment either of a circle or an ellipse, which I cannot determine; you do not say what you require it for, so I am almost inclined, like most people do when they are asked a conundrum, to "give it up." Still, you want some information, and though you have not asked for it properly I will do what I can to supply it, and, if you find it is not exactly what you require, write again, and explain as fully as possible what you do want. Firstly, an oval, or, more correctly speaking, an ellipse, is the periphery of a section of any cylinder or cone which is not parallel to the base or the axis, and which does not intersect the base. It is the only conic section which occurs in the cylinder also. To make this clear, Fig. 1 is a cone, Fig. 2 a cylinder; the line, A B, in both shows the plane of an ellipse; A B dotted line shows another elliptic plane; if through either of these lines (or any other line which is neither parallel to axis or base, and does not intersect it) you saw the solid into two, the pieces sawn will show an ellipse, and if laid flat upon paper and a line in pencil be drawn round it on the paper, such line will be a true and perfect ellipse. Now according to the angle at which the section is cut, so will the proportion of the ellipse be; the nearer it is to a parallel of the base, *i.e.*, square

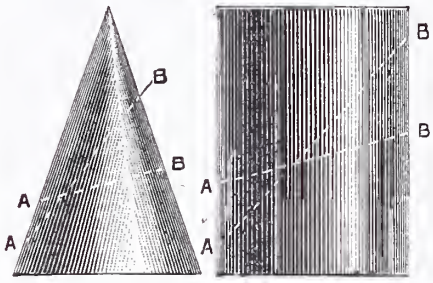


Fig. 1. Fig. 2.

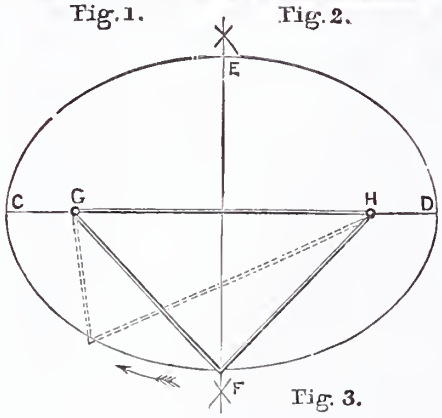


Fig. 3.

Oval Drawing.

with the axis, the nearer does it approach to the circle—which we know the base of both cylinder and cone are, as it is one of their definitions. The converse, the more acute the angle of the section with the axis of the cone or cylinder the more removed the ellipse becomes from the circle—that is, the longer it becomes in proportion to its width. So much for proportion. Now for size. As any circle may be drawn from a centre with any radius you like—inches, feet, miles, degrees, etc.—so can an ellipse be produced, but it must be from two centres influencing one another. Mathematically, it can be proved that if the major and minor diameters of an oval be known, or decided upon, or given, the two centres, or "foci," as they are called, can be found and the periphery drawn correctly from them. Practically the rule is to draw a line representing the major diameter—viz., the extreme length of the ellipse—and then bisect it at right angles, *i.e.*, divide it exactly into two equal parts and draw a line square with it through this point; now take half the minor diameter, and from the bisection mark off the two ends of this diameter, *i.e.*, get the length of the width of intended ellipse, centered at right angles (square) to the length; mark in pencil (see Fig. 3) these points thus, C D, E F; these may be omitted when you have thoroughly come to understand the method of working. Now, C D represents any length you like, and E F any width you like. Now you take in the compasses as length half of C D, and with one leg at E describe a small arc crossing C D, and again with the same leg at F do the same. If your lines, C D and E F, are exactly at right angles, and correctly bisected, these short arcs will intersect exactly upon the line, C D; if not, you have not been sufficiently accurate, and you should erase the line, C D, and re-draw it through the intersections of the arcs, taking care that the points, C and D, are equidistant from the line, E F. Now into the board on which your paper is fixed put two strong needles or pins at the intersections of the arcs, viz., at G and H, firmly pressing them until they are rigidly fixed; then stick another pin at E or F, and tie tightly round them a piece of inelastic thread, so that it cannot stretch. This forms a triangle, inside which, after removing the third pin, at E or F, place a sharp-pointed pencil, and, keeping the point in contact with both paper and thread, bearing outwards, draw the line the thread compels you to draw; such line will not only pass exactly through the points marking the major and minor diameters of the ellipse, but can be demonstrated to pass through all other points of the true elliptic orbit. Further, all ellipses so drawn, either inside or outside this ellipse, where the proportion of major to minor diameter is the same, irrespective of size, will, and must, be parallel to the first. As an additional proof of this method, if you are curious on the matter, I give you a means whereby you can describe—that is, draw—an ellipse mathematically correct from (apparently) one centre, of any size or proportion you want with a pair of pencil compasses only and a piece of turned wood, or, in fact, any cylinder. Hold firmly a sheet of stiff paper round your cylinder, and, with any radius you please, try to turn a circle with your compasses on the curved surface. Result, a true ellipse when the paper is once more flat!—J. W. H.

Paint Addresses.—PAINTER.—Messrs. Aspinall's factory is situated at New Cross, London, S.E. As the specimen colour cards—which the student of colour was advised to procure in connection with the papers on "House Painting"—issued by Aspinall are doubtless made up at some considerable expense, you cannot expect to get one with every 10½d. pot. The retailers have a limited number given them, and they naturally go to the best customers. If you wrote direct to the firm for one and enclose a few stamps I dare say you would get one. The best book on sign writing yet published is the "Art and Craft of Sign Writing," 21s., published at 15, St. Anne Street, Manchester. Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., publish many works dealing with writing, graining, and decorative art; write for catalogue. The first named and latest published, "The Art and Craft," is thoroughly reliable, and a sound investment to a working man.—DECORATOR.

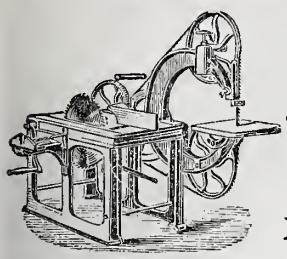
IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Boat Building.—E. L. R. (*Oxford*) writes to BOATHOOK (*Manchester*) (see page 30, Vol. II.):—"The fault of your boat is you have not given it enough floor. Such a boat as that requires a deal of floor, something of this shape, except just fore and aft. The only thing you can do is to pull it to pieces and build another. You should get someone to show you a boat of that sort. As to width, length, and depth, that is all right."

Boat Floor.

Cutting Music for American Organette.—HERR VON MUTZ writes in reply to AMATEUR MUSICIAN (see page 814, Vol. I.):—"I infer from your *nom de plume* that you know a little of music, if so, it will serve you. There are rules for harmonising melodies, but they and their exceptions would occupy a whole number of WORK, for they are embraced in the extensive subjects—'harmony' and 'counterpoint.' To use an accompaniment of common chords similar to what you have got would have the effect of the 'vamp' on a banjo, and be entirely unsuitable for an instrument with a sustained tone like the organette. Why not cut your sheets from music already harmonised, pianoforte music, or, better still, music arranged for the English concertina? I do not know the compass of your instrument, or I could advise you better. However, you could not do much better than use music arranged for the latter instrument, as there is much of it arranged in four-part harmony, and is very effective. I have cut excellent pieces from it myself. Boosey & Co. and Chappell & Co. publish a variety of shilling books. I can recommend Boosey's 100 secular airs, 100 sacred airs, and 50 national and patriotic airs—the latter is excellent. Certainly, if your instrument is not chromatic you would require to transpose some of the airs into the key your instrument is arranged in. This would not be a difficult matter, granting you have an acquaintance with music. Suppose your instrument be in C, and a piece you selected be in D, you would simply lower all the notes in the piece one note; if in A you would raise all the notes a third, and so on with all other keys. In setting out the music, you would use a strip of stout paper wide enough to pass freely beyond the width of the reeds, and long enough to contain the tune and a short blank for joining the ends to make it continuous. Then set out a staff or template marked to the distances the centres of the reeds are apart, faintly line out the length of your sheet from the staff, afterwards set out the number of bars in the tune in equal divisions, remembering that the wider your divisions the quicker you will have to turn your sheet through, and the more power you will get from the bellows, and *vice versâ*, so you will have to determine a suitable pitch of the bars for your instrument. Afterwards sub-divide the bars to obtain the length of the different notes; be careful to leave a slight distance between the different notes or chords to detach them, except where a slur is marked on the music."

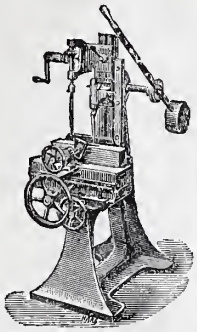
LEWIS & LEWIS,



ENGINEERS,

CAMBRIDGE HEATH,

LONDON, N.E.



THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,

For Hand or Power, will take in 22 in. Circular Saw, and will cut by hand-power up to 5 in. deep.

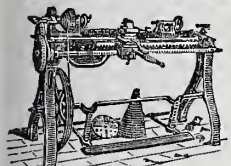
THE "HACKNEY" MORTISING & BORING MACHINE, With 8 Chisels, 1 Coredriver, Key, 3 Augers, and 3 Drills.

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS, TOOL MAKERS, DUBLIN.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES FOR SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. ESTABLISHED 1858.

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

JUST PUBLISHED, price 1s.

SCIENCE APPLIED TO WORK. By JOHN A. BOWER. With 66 Illustrations.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

JUST PUBLISHED, price 1s.

SCIENCE of EVERY-DAY LIFE. By JOHN A. BOWER, F.C.S. With 49 Illustrations.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents. 37, CHANCERY LANE, LONDON, E.C.

WATERPROOF FLUID GLUE.

(Patent.)

By post, 1s. 3d. *and* 8d.

WATERPROOF GLUE CO., 62, Dale Street, LIVERPOOL.

MANUALS OF TECHNOLOGY.

Edited by PROF. AYRTON, F.R.S., and RICHARD WORMELL, D.Sc., M.A.

THE DYEING OF TEXTILE FABRICS. By J. J. HUMMELL, F.C.S. *With Numerous Diagrams. Seventh Thousand.* 5s.

STEEL AND IRON. By W. H. GREENWOOD, F.C.S., M.I.M.E., &c. *With 57 Diagrams from Original Working Drawings. Fourth Edition.* 5s.

SPINNING WOOLLEN AND WORSTED. By W. S. BRIGHT MCLAREN, M.P. *With 69 Diagrams. Second Edition.* 4s. 6d.

CUTTING TOOLS. By Prof. H. R. SMITH. *With 14 Folding Plates and 51 Woodcuts. Third Edition.* 3s. 6d.

PRACTICAL MECHANICS. By J. PERRY, M.E. *With numerous Illustrations. Third Edition.* 3s. 6d.

DESIGN IN TEXTILE FABRICS. By T. R. ASHENHURST. *With 10 Coloured Plates and 106 Diagrams. Third Edition.* 4s. 6d.

WATCH AND CLOCK MAKING. By D. GLASGOW. 4s. 6d.

CASSELL & COMPANY LIMITED, *Ludgate Hill, London.*

NOTICE.

In **No. 350** of

Cassell's Saturday Journal,

Price ***1d.,*** is commenced a New Serial Story of Life in the Far West, entitled

"CALAMITY JANE."

*** In this story are pictured a series of exciting incidents illustrative of life and character in the "City" of Deadwood. To this famous Western gold-mining settlement a New York lawyer and his wife betake themselves in quest of fortune; and in vivid colours the author depicts their varied adventures—their perilous journey by road, with the midnight attack on the stage coach, their life amidst the rough and lawless mining population of Deadwood; and particularly their association with the mysterious personage called "CALAMITY JANE," and the remarkable chain of events which followed it.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

ASPINALL'S

INCOMPARABLE,

COLOURS

BEWILDERING,

BEAUTIFUL.

PRINCESS.

TO AMATEURS.

The roughest proscenium, or fittings, knocked up for the occasion in Hall, School, or Country House, may be made not only beautiful, but very like the real thing by a pot or two of ASPINALL'S ENAMEL at the cost of a few shillings, and the success of a show is frequently enhanced by bright surroundings. *Verb.sap.*

SOLD EVERYWHERE,
In Tins, or post free, 7d., 1s. 6d., and 3s.
For Baths, 9d., 1s. 9d., and 3s. 6d.,
FROM
WORKS, LONDON, S.E.

ASPINALL'S EBONICA,
A JET BRILLIANT BLACK, FOR
Cycles, Basket Carriages, Bedsteads, &c.
Sample Tin, 9d., post free.
COLOUR CARDS POST FREE.

ENAMEL.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6D. OR FOR 7 STAMPS
BIRMINGHAM. [33

GRATEFUL—COMFORTING.

EPPS'S COCOA

BOILING WATER OR MILK.

Bovril

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril

WILL KEEP ANY LENGTH OF TIME.
SOLD EVERYWHERE.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic WEAKNESS speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,
President of the British Association of Medical Electricians,
Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS
Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,
52, OXFORD ST., LONDON, W.
(Corner of Rathbone Place).
All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE
"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."
These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 67.] SATURDAY, JUNE 28, 1890. [PRICE ONE PENNY.

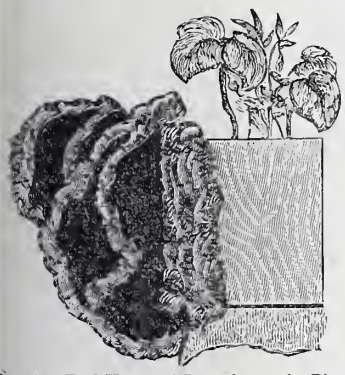


Fig. 2.—End View of Box shown in Fig. 1.

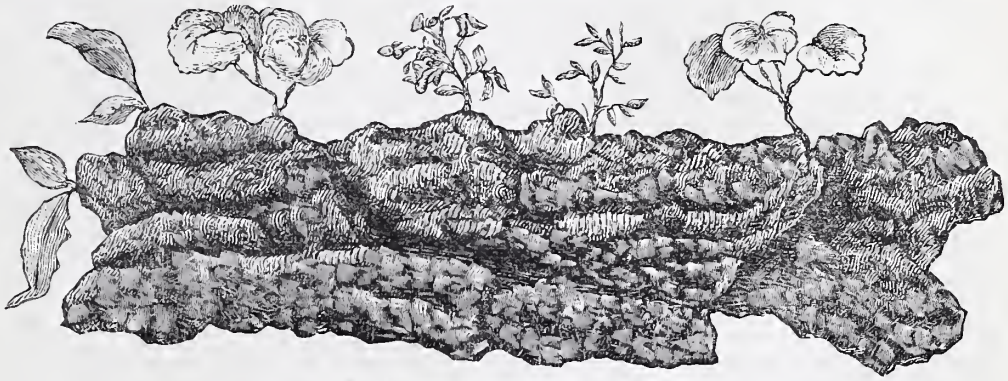


Fig. 1.—First Example of Window Box artistically treated.

WINDOW BOXES—ARTISTIC AND INARTISTIC.

BY F. ROPER HALIDAY.

NOTHING, perhaps, adds so much to the appearance of a house, nothing is so pleasant to the eye, so cheerful, so agreeable, as to have bright flowers about, growing and luxuriating in all their beauty. It greatly adds to the mansions of the rich and well-to-do, but it redeems the cottages of the poor from squalor and poverty, and raises them fifty — nay, five hundred — per cent. in the eyes of the lover of beauty. And for this great boon, which costs so little, we do not require a garden, not even soil; we merely buy a few plants in the spring at the cost of a few pence each, put them in our window boxes with some manure, and our houses are redeemed from the commonplace for the entire summer, and in winter also, if we like to fill the boxes with evergreen shrubs. The wonder is that they are not more general—in fact, universal—but I suppose the reason is that the difficulty of obtaining suitable boxes, elegant and artistic, yet cheap, seems insuperable. How to overcome this apparently unsurmountable difficulty is the object of this paper; but first allow me to remark, by the way, that some people appear to think that flowers will not grow in all aspects. I can only say that mine are in the most unfavourable position, due north, and exposed to all the cutting winds, and yet they bloom beautifully all the summer; the secret is—if it is any secret at all—don't use any soil more than is in the plant pot when you get it; fill your window box with good horse manure; take your plant (with the soil at the roots) out of the pot and plunge it in the manure; it will want nothing but a little water for the rest of the summer. And now to resume; for this is not a treatise on gardening, and I have digressed a little.

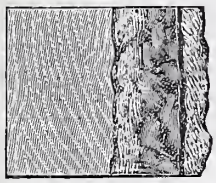


Fig. 6.—End View of Box in Fig. 5.

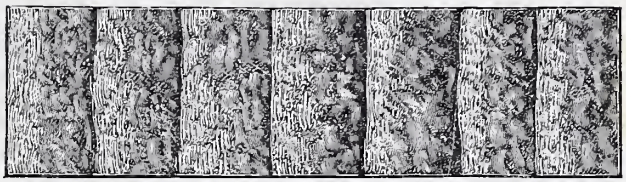


Fig. 5.—Window Box inartistically treated.

The window boxes one sees are nearly all unsatisfactory. If you make a deal one and paint it green, it has a common look, and seems to let down the appearance of the house; if you nail strips of cork on (as shown in Fig. 5), it is most inartistic and commonplace to begin with, and in a few months looks very seedy and forlorn indeed: in fact, nothing has a more woebegone appearance than one of these boxes, black, dirty, one of the strips off, and some of the others crooked, the soil damp and sodden, with a few struggling plants in it, more dead than alive: it always reminds me of the misery and decay of the tomb. Tiled boxes are very nice if well made, and with good tiles in, but they are rather expensive to buy or make, and then have not the fresh rustic appearance of Figs. 1 or 3; they have a much more formal character—suitable, perhaps, to some houses, but quite out of place in others, while those I am about to describe will suit any house, mansion, or cottage in town or country; they perhaps look best in a beautiful garden, surrounded by lovely trees, flowers, shrubs, etc., but they are not out of place anywhere. Virgin cork is the

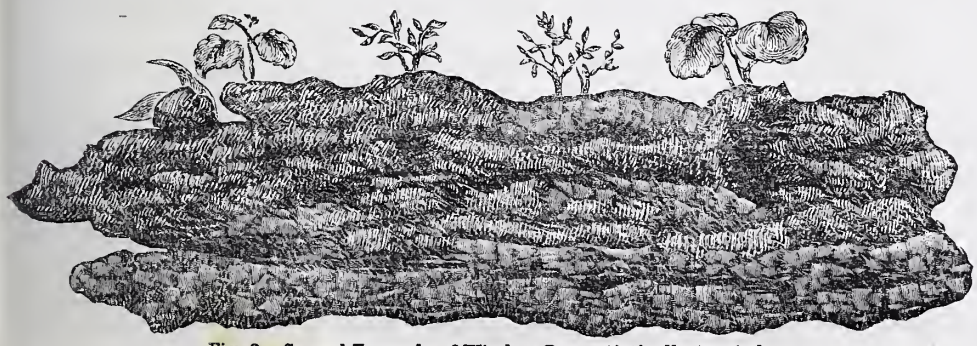


Fig. 3.—Second Example of Window Box artistically treated.

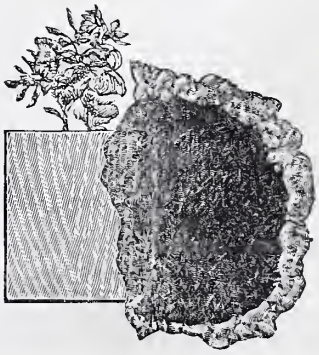


Fig. 4.—End View of Box shown in Fig. 3.

substance they are covered with, but in the application of this material lies all the difference between success and failure.

And now for the methods of procedure. The window boxes must be made, first, of ¾ in. deal, planed both sides, and nailed or screwed together. If you use joiners' tools this will be an easy job; if you have to buy, you can obtain them from the carpenter or case-maker at a very cheap rate. They are to be the full length of the window sill, just to fit in easily, 6 in. high, and to project over the stone about 1½ in.: this will give sufficient space in the box for the plants, and allow for the curl of the cork to come under the bottom edge at front (see Fig. 2). When finished, the boxes should be fastened to the woodwork of the window with screws for security: this by the way, as we have now to paint them, and put the cork on. I nailed my cork on after the boxes were fixed, but a better way, perhaps, would be to put the cork on first, being careful to mark the boxes with a pencil along the edge of the stone and brickwork, and not let the cork trespass beyond this line at bottom and sides, or they will not fit; also do not forget to bore a number of holes in the bottom of the boxes for the escape of the water. I once lost a boxful of plants owing to neglect of this precaution; the water must run away freely, or the plants will die at once. Having got your boxes ready, give them a good coat of paint outside: the colour does not matter, as the boxes are hidden, only the top edge being visible from the inside of house, the paint being merely for preservation. Now procure your virgin cork. This rough outside bark is sold in lengths of about 24 to 36 in.; get them as large, rough, curly and scabby-looking as you can: the rougher the better. I got a large bundle, the remains of some bazaar decoration, for about a shilling, sufficient to cover three window boxes, and had a lot left over, but I have no doubt it can be bought in any town at a cheap rate. Having got your cork home, proceed to select suitable pieces for the boxes. Box No. 1 in the illustration is covered with five or six pieces, the cork being nailed on the box lengthways, one piece overlapping the other (see Fig. 2), the centre piece going on last; there is now a grand opportunity for the display of your taste in the arrangement of the cork, and as no two pieces are alike, everything depends on the discretion you display in fixing. The cork should not be cut or trimmed much; arrange it in as natural a manner as possible. Box No. 3 is covered with one piece of cork, half round (see Fig. 4): this box looks grand, very curly-looking, and jagged: it looks like a piece from "The Monarch of the Forest" at one's own door, or rather window. I may mention that this virgin cork lasts remarkably well: it stands any weather, and never seems to change or decay; it gets black and dirty-looking, it is true, but this we can obviate. Having got your cork on, then, and being well pleased with the effect, you can use the boxes for one season, if you like, with the cork in its natural state.

You will see (by reference to Figs. 2 and 4) that the boxes have a very full half round appearance, the cork projecting very much in front, curling round over the top and bottom, and sticking out irregularly at the ends: this helps the appearance considerably.

And now for the painting. I have as great a horror of shams and deceptions as Ruskin has, and kept my cork for a season or two in its natural state. Well, it was all right, but the time came when it was so black and sooty that something had to be done, and I had to decide either to remove the boxes or paint them. I was not willing to part with my beloved flowers, so I had to paint. I approached the subject with fear and trembling, as nothing looks worse than crude paint; white was not to be thought of, and garish colours gives one the horrors; however, I attacked them, and was so pleased with the result that I was sorry I had not done them sooner, the effect was so delightful. I will describe the process as minutely as I can, as if not properly done, the whole job will be spoilt. First procure some white paint; if bought ready mixed for use, pour off most of the oil, and add some turps, to cause it to dry dead; then with some yellow ochre try to get the colour of cork as near as possible. You will have to let it down with black, and also add a little red, and perhaps a touch of green; by careful mixing you will gradually get the colour of cork—a little darker, if anything. With this paint the cork all over, going into all the nooks and crevices, till it is all a uniform dead colour—one coat will be sufficient. When done it will look as if it had been painted with clay, probably; let this dry, and then take a little of the same colour mixed with plenty of dead white rather stiff, and drag over all the projecting parts with a large brush; if this latter tint is mixed to the proper shade, you will find it have a wonderful effect: it accentuates all the prominent parts and causes the others to retire, and transforms what was previously a dull, lifeless-looking mass into a crisp and beautiful object, the prominent light parts looking as if they had been worn grey by years of exposure to the weather. To finish the job, you now mix two tints of green, one dark and the other bright and clear: chrome or emerald green will effect this, mixed with a little bright yellow, to take off the crudeness of the green. You now give the artistic touches by applying the dark green in some of the crevices here and there, and touching it with the bright; also mix a tint or two of red, say burnt sienna, light red, etc., and touch some of the prominent parts to give the weather stains: this finishes the job, and if done with taste and discretion, will have a charming and beautiful effect.

CIRCULAR SAWS: THEIR ADJUSTMENT AND MANAGEMENT.

BY M. POWIS BALE, M.I.M.E., A.M.I.C.E.
Author of "Wood-working Machinery," "Stone-working Machinery," "Saw-mills," etc.

I WILL now specify the remaining three causes to which the running out of truth of circular saws is to be attributed.

(19) Driving pulley on the saw spindle being of too small diameter, or too narrow on face, causing slipping of belt and consequent marking on the wood, or running driving belts at too short centres.

(20) Using a "frozen" saw.

(21) Saws running at too high or too low a speed.

With reference to these I may say:—

(19) The use of driving pulleys too small in diameter and too narrow on the face is a fruitful cause of saws buckling, on account of the heat set up in the bearings through the use of narrow belts, which have to be strained excessively tight to drive; consequently, the undue pressure and friction on the bearings cause excessive heat, which is conveyed through the spindle to the saw plate. At the same time the belts themselves very much more rapidly deteriorate. Wide single belts are to be preferred to narrow double ones. In American practice the pulleys for driving circular saws are made somewhat larger in diameter and much wider on the face than they are here; consequently, the arc of contract, grip of the belt, and driving power are increased and the slip largely reduced.

Although I am aware that they are considerably wider than most of those in use here, it may be taken as a good and safe rule that pulleys on saw benches carrying saws up to say 4 ft. diameter should have driving pulleys wide enough to carry belts of a width of one-fourth the diameter of the saw, and for saws above 4 ft. in diameter a belt of one-third the diameter of the saw may be used with advantage. Anything extra in the cost of pulleys or belts is rapidly repaid by an increase of work of better quality than can possibly be obtained with narrow belts; at the same time the bearings and belts themselves last longer. With wide belts the necessity of using "quack" remedies for increasing the grip, which often damages the belt, is done away with; it is necessary, however, to keep the belts pliant, and this can be done by an occasional dressing of mutton fat and beeswax in equal parts. Castor oil is not by any means a bad dressing for leather, and it renders it vermin-proof. In driving saw benches, in fact all wood-working machines, running belts at short centres must be avoided, as it is bad in every respect, and greatly increases the troubles of hot bearings, torn belts, etc., above alluded to.

(20) English users of circular saws may possibly smile at the idea of a "frozen" saw, as we are not as a rule blessed with very cold weather in this country, but even a moderate amount of frost has a very distinct effect in many cases on the working of circular saws, especially should they be of thin gauge. In cold countries, or in very cold weather, the effect is so great from the contraction of the plate at its smallest part, *i.e.*, the eye, that the saw will become "rim bound," and not run true till the frost has been taken out of it by friction, or by a dose of hot water.

(21) The question of speed is a factor of immense importance in the proper working of circular saws; should they be run either too fast or too slow the result is equally unsatisfactory. In the first case the saw becomes pliant and wavy, and in the latter the work turned out is of bad quality and less of it. For ripping all ordinary kinds of wood a speed of 9,000 ft. per minute at the points of the teeth is now generally recognised as a standard speed in this country. This can, however, in the case of cross cutting, be increased with advantage another 1,000 ft. per minute. In sawing very hard woods the speed of the saw should be somewhat reduced, say about one-fourth. By using thick gauge saws, and therefore wasting wood and power, higher speeds than these may be attained.

I will conclude my remarks on working saw benches with a few gentle hints (some of these may not be new, but I take it they will bear repetition in some establishments I wot of). If a saw bench is used for small and large saws, occasionally the latter will run untrue, from going at too high a speed. For quick rough sawing a swaged set tooth has much to commend it, especially with tough and difficult woods and large saws, as they are much less liable to be strained than if set with a blow or spring set. In sawing difficult woods they are liable to spring away

from the saw considerably in the centre of the log; consequently the boards sawn are thicker at each end. To obviate this, instead of sawing in the usual way all from one side, a cut should be taken alternately from each side of the log; this will keep the boards uniform. Should a saw crack in working, to prevent a short crack from extending, drill a small hole at the end of it.

For ripping purposes most of the filing or saw sharpening should be done on the face or front of the teeth; the backs or tops should be scarcely touched at all. The face of the tooth should never be filed to a fine edge, but a very slight bevel should be left. A round gulleted tooth is less liable to crack than one filed to an angle. In gulleting with emery wheels work with a light pressure, and if necessary go over the teeth several times; if the wheel is forced and the saw plate burnt it is much more liable to fracture. In filing teeth for swage setting make them sufficiently hooked at the points that the swage will readily spread them, also be sure that the points of all the teeth are wider than the rest of the blade; the tops and backs of swage set teeth should be filed square across. In bending or spring setting always use a gauge; in setting saws with a blow or spring set, care should be taken that the teeth only are set say about one-third of their depth, and that the plate itself is not strained, or it will be found to heat rapidly when in work and run out of truth.

In filing saws, file every alternate tooth from one side of the saw, then reverse it, and file from the other side; never file all the teeth from one side of the saw, and, if it is spring set, set after the same fashion. If in working the saw heats at the rim, and the teeth are of the right shape for the wood and properly sharpened and set, hang or line the saw to lead very slightly out of the wood. If the saw should heat at the centre and the spindle and bearings are cool and in proper order, reverse the above and let the saw lead into the wood a little.

For thin sawing, such as light box work, frame backings, etc., a "ground off" saw can be recommended to effect a very considerable saving in wood, and, if carefully sharpened and handled, will do very excellent work.

For very accurate dimension sawing, such as pattern-work, etc., a saw "ground hollow" on both sides and run without set can be used with advantage, as it will cut extremely true and leave a fine surface.

If timber carriages and rails are used for bringing the wood up to and taking it from the saw, it is important that they be fixed to run exactly true with it. Should the wood be presented to the saw even at a very slight angle, this is multiplied to a considerable extent in a long log, and, if the cut be once commenced, a very considerable leverage must be put upon the saw to keep it anything near the line.

When having saws hammered, be sure they are placed in competent hands; I have seen saws that have been hammered by so-called experts that might have been better done by a blacksmith's striker.

For guarding circular saws and preventing accidents I can recommend the following arrangement: Make shield of sheet steel formed as an arc of a circle, and against the saw; the shield rises before it and rests on the top of it till the cut is completed, when the counterpoise brings it back to its original position. It is important that the driving power be uniform in its speed; if there is much variation, the quality of the work will vary accordingly.

AN AUTOMATIC ENLARGING WORK-TABLE.

BY JAMES SCOTT.

Simplicity of action is the main object to aim at in designing an article of the kind I here show. To have something that possesses a certain amount of utility, but which is likely to exhaust one's patience in obtaining that utility, is far from what any of us desire, and therefore it is that simplicity of action should receive due and careful attention.

In this small table, the action is as simple a one as can possibly be obtained. In the centre of the table is a small spindle. When this is turned in a certain direction, *the five compartments* shown in. Fig. 2 *open at the same time.* When these are open, and the spindle is turned in the reverse direction, the five compartments (or, as I shall hereafter call them, boxes) close together.

I have intended the article to be of use principally to ladies as a work-table, but probably some readers may find the table, or the idea adopted to work it, of use to them in some other direction.

It requires very little examination to comprehend the convenience of having the five boxes made to open at once. I do not know whether I shall be right in supposing the following as an illustration, as, doubtless, *ladies*, who require to be called such in preference to being termed *women*, would not be found guilty of committing such a breach of *ladies'* etiquette; but I will suppose that one of them finds it necessary to sew a button on to some part of either her husband's or children's garments. Now any one who watches such a process as button sewing, knows fully well that it does not consist wholly and solely of *sewing on* the button—here I am reminded of the cooking recipe in which the writer said, in reference to preparing a goose for the table, "first catch your goose"—the button must first be found; and as there are so many kinds of buttons, and the particular sort required may not be within the first box opened (supposing they only opened one at a time), the convenience of the table as I represent it will be understood.

With regard to this article, I can say, what sometimes I have been unable to say concerning some of my previous articles, that, although, as usual, the appearance of the article has been a secondary consideration on my part, it will not make an unpleasant addition to the furniture of a drawing room. But with its appearance, however, I cannot claim much in the way of newness; the newness simply consisting in its automatic arrangement, which, I hope, may be sufficient to entitle the table to a little amount of credit.

The making of the table will be as simple as its action. The shaping of a top board and a bottom board—the former a trifle over 18½ in. in diameter and ¾ in. thick; the latter 18½ in. in diameter and ½ in. thick—will not be beyond the skill of most of my amateur friends. Neither will the turning of the pillar, nor the shaping of the claws; both of which, however, in the absence of the required skill, may be obtained from any turner's and wood-carver's respectively.

Then, again, should the shaping of the rails required as sides for the boxes also be considered difficult to accomplish, they as well can be performed by the sawyer or carver. "But," someone murmurs, "you are telling the amateur to get his table made; and then he will, after gluing it together, claim the credit of its manufacture." Oh no, dear reader, I do not advise, should the different necessary parts be bought, the builder-up of them to claim the credit of the making; neither do I recommend that, when showing the table to his friends, he should say, "I bought the pillar from So-and-so; the claws from So-and-so; the circular framing from So-and-so," etc. Such a course would necessitate many repetitions of the information, and in time I am afraid the honest soothsayer would become unhappy. I have given the simple information that some of the parts can be obtained ready-made, because of late I have found that it is sometimes advisable to give the very simplest information. Now, although nearly all the table may be bought piecemeal, it is supposed that the automatic part, etc., shall be home-made—this is a very gentle term, but it will convey my meaning.

In Fig. 3 is shown a plan representing the inside construction of the table. The circle in the centre indicates the spindle. To this is joined five rails, the end of each being at 8½ in. distance from the centre of the spindle; which latter might conveniently be 1½ in. thick. The end of each rail should be shaped as shown by A in Fig. 7. Five thin strong spindles, with attachments similar to those shown by B in Fig. 7, will work along the insides of the boxes, the ends of the longer rails being, of course, outside the boxes. To the end of A is pivoted B in such a manner that allowance is made for the intervening thickness of the box. The depth of A is shown as rather more than that of B, the reason for this being on account of the thickness of the bottom of the box, the bottom edge of A being intended to touch the top of the table bottom board.

Each box will be 8 in. across, measuring from point to point, and about 2½ in. deep, and if ⅜ in. thick, that will be found quite sufficient. The back board of each will be quite straight, and shaped as in Fig. 8. The cutting need not extend right to the middle of the board, as a very slight turn of the spindle and, consequently, a very slight movement on the part of the rails will effect the opening. The framing for the boxes, and also that required as stationary between the table top and bottom boards, can be obtained from two circular wooden rings, each 18 in. in diameter (outside measurement). They should be either pivoted or hinged.

The boxes will look effective if lined with some such material as silk, satin, or plush.

The only fixed connection the table top will have with the bottom board will be that afforded by the small stationary pieces of the framing, and, therefore, these pieces must be strongly joined.

The centre column should be turned from stuff not more than 2½ in. thick, and, of course, the pattern of it is entirely optional. The top end of it will be joined into the table bottom board, and for additional strength it is advisable to have a square or circular block (Fig. 11) glued round it to the under part of the bottom board.

In Fig. 9, I have given a sketch of one of the claws. If the squares on my drawing are reproduced on to a sheet of paper or block of wood, each square being three times the size of those in the diagram, the correct enlargement of the claws will not be found a difficult matter. The thickness of each can be better determined during the making, but 2 in. diminishing towards the bottom end will be found suitable. The manner of the junction of the claws with the centre pillar is shown by Figs. 5 and 6.

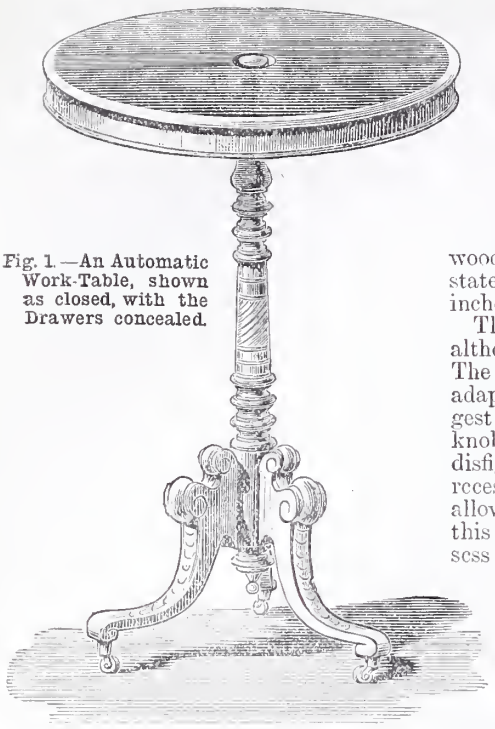


Fig. 1.—An Automatic Work-Table, shown as closed, with the Drawers concealed.

The small centre spindle need in no way interfere with anything on top of the table; as, if the latter is shaped as shown in section in Fig. 10, the top of the spindle will be below the surface of the table top.

This table would look very well made in rosewood, and lined within the boxes as before stated. The total height of it will be 28½ inches: it should not be higher.

The table is by no means difficult to make, although at first sight it may appear so. The uses to which such a table may be adapted are various, and will readily suggest themselves to the readers. The sunk knob in the centre of the table top is no disfigurement, the only thing against the recess being that in some houses it might be allowed to become a receptacle for dust; but this would be the fault of those who possess it, and not of the table itself.

Four boxes could be used instead of five, but after careful consideration I have decided that the preference should be given to five boxes. And now I leave it in the reader's hands.

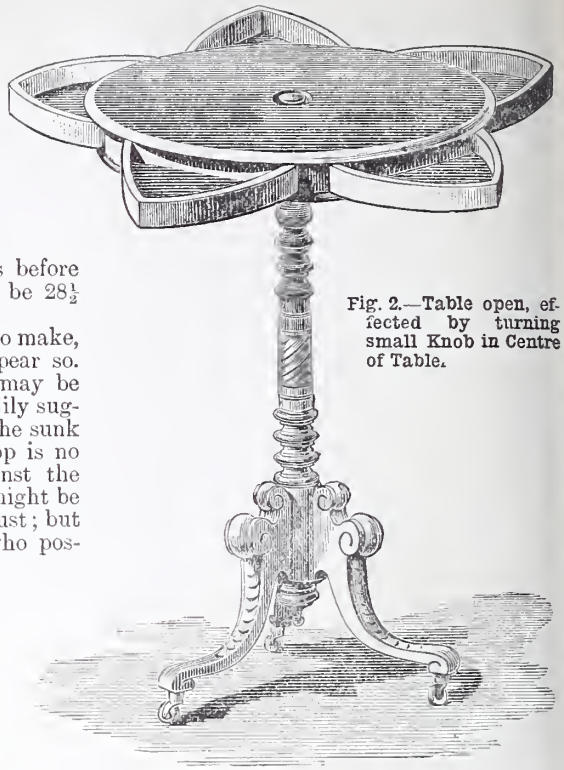


Fig. 2.—Table open, effected by turning small Knob in Centre of Table.

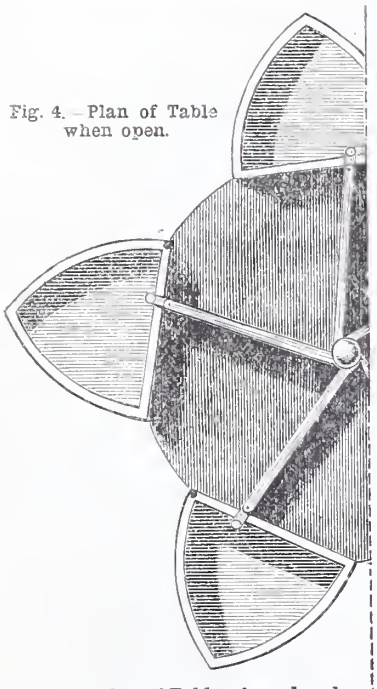


Fig. 4.—Plan of Table when open.

Fig. 3.—Plan of Table when closed.

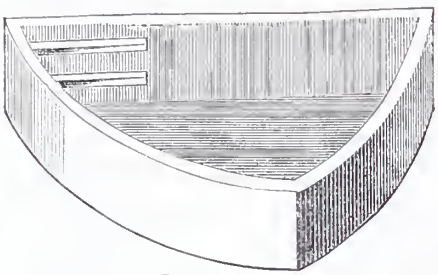


Fig. 8.—One of the Boxes.

Fig. 12.—Centre Spindle shown to receive Rails.

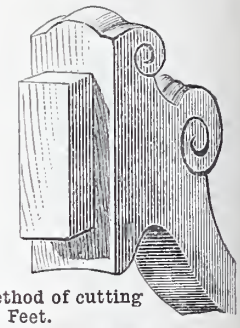


Fig. 5.—Method of cutting Feet.

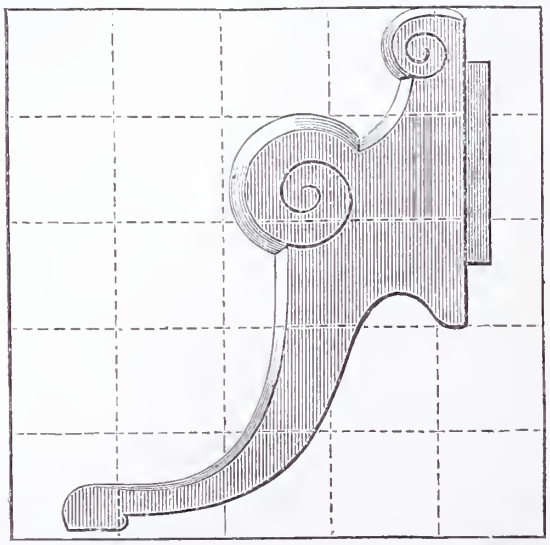


Fig. 9.—View of one of the Feet drawn three times smaller than actual size.

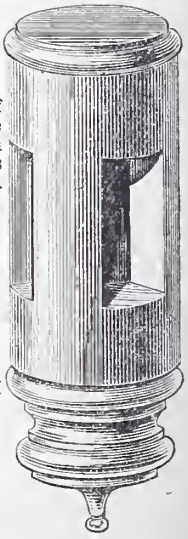


Fig. 6.—Method of cutting Pillar Block.

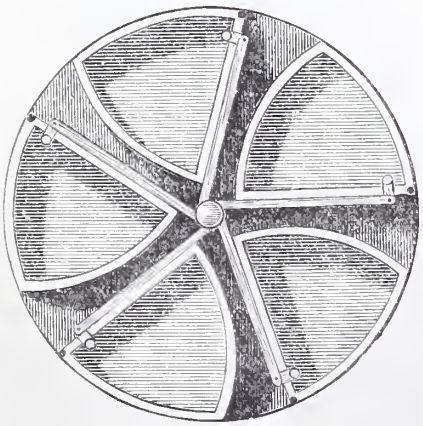
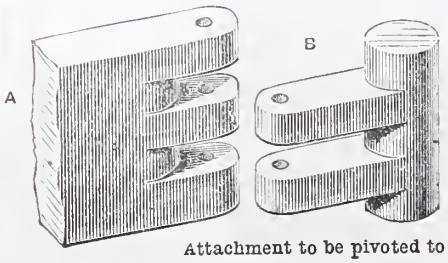


Fig. 7.—End of Rails to open Boxes (A) and



Attachment to be pivoted to Ends of Rails (B).

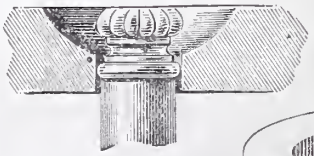


Fig. 10.—Section showing how to bring Knob flush with Table.

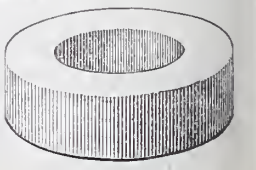


Fig. 11.—Block to secure Top of Centre Pillar.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

Queen Excluder—Sections—Section Racks—Planing Trough—Comb Box—Comb Stand.

Ascending from the brood-nest, the first piece of apparatus we meet is the queen excluder. This differs from that which I formerly described in that its object is to prevent the queen from getting up and laying in the super, where the surplus honey is to be stored. Many bee-masters never use the excluder over the frames, asserting that the queen seldom ascends to those elevated regions; and, if there is plenty of room underneath, I believe she seldom does. My object, however, is to describe not alone the appliances which may be managed with, but everything which the amateur is likely ever to require. It certainly would not pay to make one's own perforated zinc, and so I will suppose that it is purchased, which it can be for about eightpence per square foot, or in sheets 8 ft. by 3 for ten shillings. The two things to remember in making an excluder diaphragm, are that space should be left for the bees to run over the frames, and that it should fit exactly over the brood-nest. It is evident that, if a larger space than the holes in the excluder is left, the queen will soon find it out, and the object we have in view will be defeated.

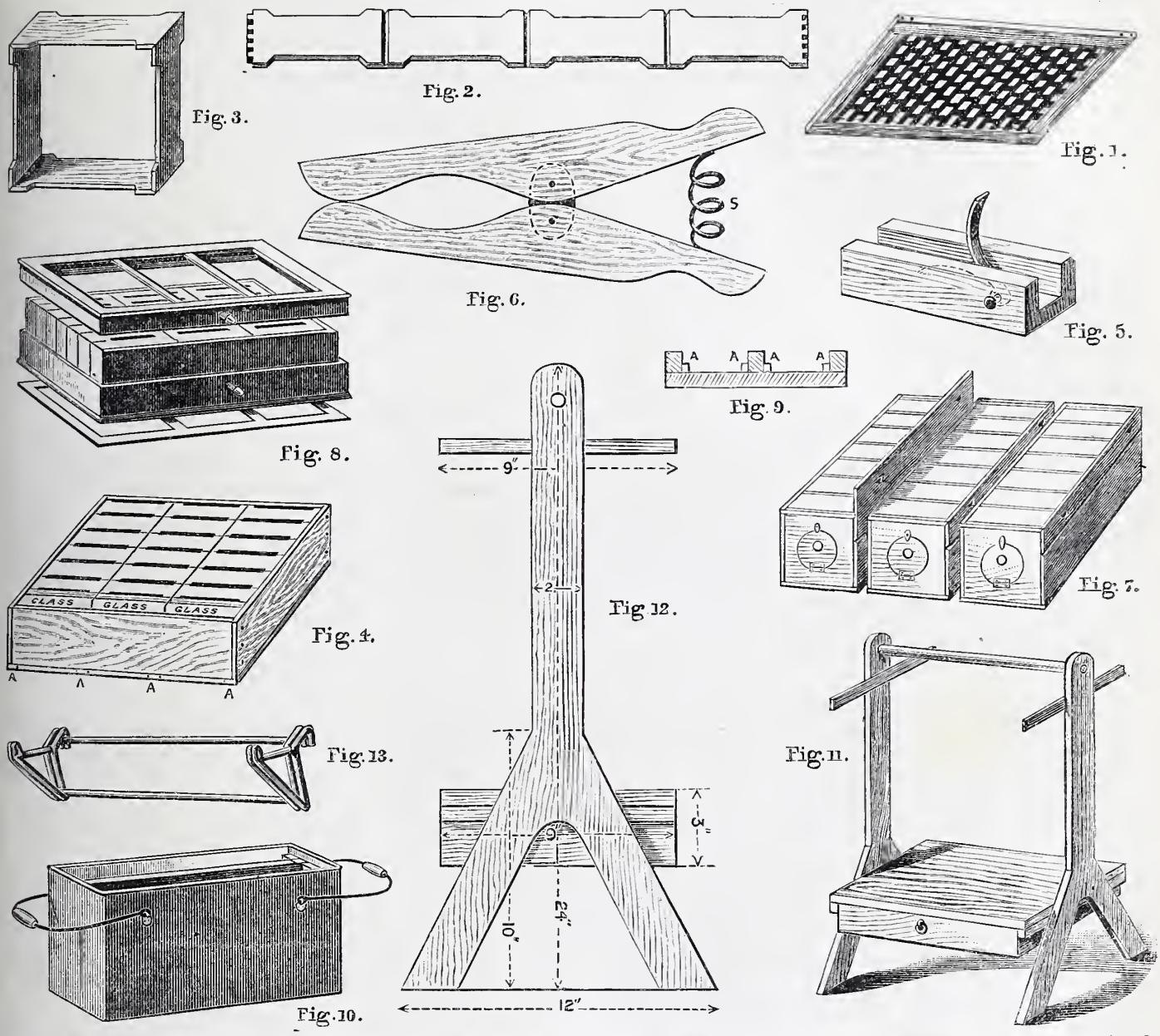


Fig. 1.—Queen Excluder for use over Brood-Nest. Fig. 2.—Section in Flat. Fig. 3.—Section made up. Fig. 4.—Section Rack. Fig. 5.—Spring for Section Rack. Fig. 6.—Clothes Peg Substitute. Fig. 7.—Raynor Section Rack (Divisional). Fig. 8.—Neighbour's Invertible Crate. Fig. 9.—Section of Planing Trough—A A, Gauges. Fig. 10.—Frame Box. Fig. 11.—Comb Stand. Fig. 12.—End View of Comb Stand. Fig. 13.—Comb Holder to hang on Hive.

We should make a frame of ⅜ in. wood which is just 17 in. square outside measurement, and 13 in. by 15 in. or thereabouts inside. On one side of this the piece of perforated zinc is to be tacked with gimp pins, and the job is done. If the hive is of a different size, the external dimensions will be varied to fit it so closely as to prevent any bees ascending except through the perforations. If necessary, one or two little slips of wood may be tacked across to prevent the zinc sagging in the middle. In Fig. 1, I give a diagram of such an excluder. It would be laid on the frames zinc uppermost, which will give the ⅜ of an inch bee-way over the frames.

The only difficulty in making it arises from the weakness of the woodwork, which should not be thicker than ⅜, but I never find it a very hard job to make it pretty firm with two nails at each corner and glue. Fortunately it does not require to be very strong.

The next thing in order is the section crates, and here let me say a few words about sections. They are the little boxes which are filled with comb honey and look so charming on the tea table. It certainly would not pay to try to make them, as they can be bought for half-a-crown a hundred, most perfect in every way. In Figs. 2 and 3, I show them in the flat and folded. A touch of thin glue along the V-cuts before folding would make them very much stronger, and prevent their being pulled asunder as they sometimes are.

As the dimensions of the crates will

depend upon those of the sections, the class of sections to be used should be decided on before the crates are made.

For sections $4\frac{1}{2}$ in. × $4\frac{1}{4}$ in. × 2 in., the crates I shall describe are intended, but by varying the dimensions to suit, any other sizes may be used.

Fig. 4 shows one of the simplest and best section crates that can well be designed. It is a plain box of wood without top or bottom, nailed—or, better still, dovetailed together. Its internal width is just sufficient to accommodate three sections—that is, $12\frac{3}{4}$ in.; the depth of the sides is $4\frac{1}{4}$ in., and in length it will hold seven 2 in. sections plus thin wood separators between each, plus a bit of glass at the end, plus a space for a spring to jamb the glass, about $15\frac{3}{4}$ in. in all. The wood for its construction may be $\frac{1}{2}$ in. or $\frac{5}{8}$ in. stuff, but the latter is to be preferred. Four slips are to be nailed to the base, one at each side, and two between in such a position as to cover the line made by the juncture of the sections, and at the same time to support them. These slips are to be $\frac{3}{4}$ in. wide and $\frac{3}{8}$ in. thick, so as to form a bee-way over the excluder, or, if it is not used, over the frames.

If the crate at this stage be filled with twenty-one sections together with separators, it will be found that a space about 1 in. wide remains between the glass, which is usually put at the end of each row, and the end of the crate. This would afford too convenient a passage for prospecting bees to visit the roof of the hive; and so it must be stopped up with three pieces long enough to fit between the slips already nailed on, and $\frac{3}{8}$ in. thick. At the other end similar pieces will be nailed on, but they need not be so wide.

The class of springs usually used to press the glass against the sections and keep all tight is shown in Fig. 5; but I find clothes pins (Fig. 6), at sixpence a dozen, do just as well as anything—in fact, a cork cut to length and pushed down has served my turn more than once.

One end of this section crate is sometimes cut in two, and the upper half can then be turned back on a couple of nails which act as hinges. A piece of glass is inserted between the sections and this end; and when it is desired to see whether the sections are full, the end may be turned down and a peep obtained through the glass. The top of this crate should be flush with the sections, so that another similar one would fit over it, and thus have only the bee space resulting from the slips nailed to its underside. Open racks are sometimes used to hold the sections, but they have nothing to recommend them except that they spare a little wood. Their sides are $2\frac{1}{4}$ in. the short way, and $1\frac{1}{8}$ in. the long way, in depth. The sections, of course, stand well over them, and are cold and comfortless for the bees.

The late Rev. G. Raynor invented the divisional rack, which is extensively used and very handy. Its advantage is that seven sections can be taken off at a time, and, if the outside row is not as advanced as the centre, they can be changed.

Fig. 7 shows three of these racks as they would be placed on the hive, with the exception that one of them has its wedge raised.

A plain box $14\frac{1}{2}$ in. long, $4\frac{5}{8}$ in. wide, and $4\frac{1}{4}$ in. high, inside measurements, is nailed together, having one of its sides only 2 in. high. Another piece is prepared $\frac{3}{8}$ in. thick, and the length of the box to wedge the sections tightly in place.

Strips are nailed on the under side to provide bee-way as in the other rack, the one at the wedge side being much wider than the other, at least wide enough to support the sections; and the job is done—at least, it only requires to have finger holds cut with a gouge in the wedge to assist in disengaging it. I always make what I call the wedge, a wedge in reality, having it thinner at one edge than at the other; this assists in putting it in place as well as in clamping the sections tight.

Before the crate is nailed together it is usual to cut a peephole at one end. This can best be done with a fret saw, and if it were cut smaller inside than out, as a person would do for inlaying, the same piece could be attached to the crate with a small hinge and act as door or shutter; a little button would be necessary to keep it closed, and a ring as a handle to open it with.

Invertible supers are now very often experimented with. In Fig. 8 I give a view of Mr. George Neighbour's invertible crate. It is in two parts, having slips, half a bee space in depth, nailed to the outside of each; a couple of thumbscrews force the follower, or loose wooden end, against the sections, and keep them tight while the inverting is going on. When another similar crate is placed over one of these, the two half bee spaces coming together form an entire bee space; but when one is placed over the frames, only half a bee space will intervene: a light frame, half a bee space in depth, must, accordingly, be provided to be laid over the frame under the rack—this is clearly shown in the figure. It is not difficult to make this piece of apparatus: two boxes are made of the dimensions given for Fig. 4, but only half the height; the slips, $\frac{3}{16}$ in. thick, are nailed to the top and bottom, as shown, and the ends are provided with thumbscrews. The kind used for fastening window frames, which can be bought at a cheap rate from ironmongers, would do excellently.

A useful tool for getting these thicknesses accurately is a planing trough; this consists of a piece of inch pine planed quite true and flat. Slips of the same wood, $1\frac{1}{2}$ in. high and 1 in. wide, are screwed along its entire length, which may be 2 ft., more or less, and so far apart as to let the trying-plane slip between them, say $3\frac{1}{2}$ in.; thus, in a 10 in. board, there would be two troughs $1\frac{1}{2}$ in. deep and as wide as the sole of the trying-plane. Fig. 9 is a section of such a trough. Slips of wood A A are placed in the corners, and these are planed truly parallel, and just slightly higher than the thickness which they are required to gauge. Its action is evident. The pieces which require thicknessing are packed in the trough between the gauges, and the latter will prevent the plane from going too deep; a stop tacked across one end prevents the pieces from slipping forward. The two troughs are for different thicknesses, but the gauges could be made removable, when one would do for all. We shall require gauges $\frac{3}{8}$ in. for full bee-way, and perhaps $\frac{3}{16}$ in. for half bee-way; also, if it is desired to plane the frames, gauges to accommodate them.

Another very useful piece of apparatus is a set of blocks for removing full sections from the crate. If they are pulled out with the fingers, the bottom and a good deal of the honey are sometimes left behind sticking to the bars of the crate. To avoid this, the sections should be pushed up from underneath, and this can be done by laying three pieces of wood 2 in. square and $13\frac{1}{2}$ in. long on the table, $4\frac{1}{4}$ in. apart centre to centre, and putting the crate full of sections on them, the middles of the sections resting on the square blocks. A firm pressure on the crate will push it down and make its contents stand up most convenient for handling. As it is not very easy to place these blocks exactly in the proper position by rule of thumb, I nailed them therefore to two strips of wood, so that they are a permanency and always correctly placed. It will scarcely require a figure to explain this.

I have now concluded the description of the hive and its appendages, but my task is far from complete. There are many other tools to be found in an apiary which I must not neglect to mention; one which is almost entirely made of wood and very useful is a frame box (Fig. 10). Its object is to hold combs while extracting, and to carry them to and from the hives in. It can easily be made of deal, $\frac{1}{2}$ in. thick, and of internal dimensions 17 in. × 9 in. × 9 in. It may have a bottom and, if preferred, a lid, but a cloth thrown over it does very well for the latter. The handles seen are of wire, $\frac{1}{8}$ in. thick, and are attached to the box with four staples; we must not forget to nail a ledge inside upon which the ends of the frames are to rest.

A somewhat similar piece of apparatus is the comb stand. I give a view of mine, which was made from the diagram in Cowan's book, in Fig. 11; and an end view with dimensions in Fig. 12.

It is made of inch stuff, the pillar and one leg being cut from the same piece of wood, and the second leg attached with glue and a couple of nails. The entire height is 2 ft., and the width between the pillars $15\frac{1}{2}$ in. The drawer, which may be omitted, is 9 in. wide by 2 in. deep, and the slips of $\frac{1}{2}$ in. wood nailed inside the pillars to support the combs are 9 in. long. This will be found very useful to hang combs on while examining a hive.

A simple arrangement, however, is shown in Fig. 13. As there illustrated it is made of wire, but it could also be easily made in wood, triangular pieces forming the ends, which should be attached to a flat back and hooks of hoop iron screwed on to hang it to the hive with. A nail in the front corners would prevent the frames from slipping off by any mischance.

I have confined myself, in the present paper, as much as possible to those pieces of apparatus which entail in their construction only woodwork. In my next I hope to treat of Parker's machine, Woiblet imbedder, smokers, etc., all of which will entail more or less of metal work. In the meantime, if any one finds a difficulty in following my instructions, I shall always be most happy to give further assistance in "Shop."

SHEET METAL WORK.

BY R. ALEXANDER.

THE WORKSHOP—THE WORK BENCH—MATERIAL, POSITION, AND HEIGHT OF SAME—TOOLS AND MACHINES USED IN THE TRADE.

The Workshop.—In the preceding papers on "Soldering," etc., no mention has been made of the workshop, as none of the operations were such as to require anything more than is usually within the reach of those who do a little work for themselves, either in an amateur or professional way. Most amateurs manage to rig up a bench of some sort on which to perform their various manipulations, and I think that most people who have the room like to have a workshop

of their very own in the back garden or somewhere where they will be out of the way of all interference, and where they also will be out of other people's way. This latter condition is perhaps very desirable in the trade of which I am writing, some of the operations that have been already described being not altogether suited for being carried on in the house, notably the brazing and tinning, though, excepting these, I think anything else mentioned could have been done in a room or washhouse by those possessing no better accommodation. For real work, however, a properly arranged workshop is desirable. My ideas on the subject are as follows :—The workshop should be roomy—18 feet by 12 feet is not too large for a tinman's shop, even if only one man is employed ; and I have had even larger workshops than this, and also some much smaller, one that I worked in in Oxford Street, London, being not more than 12 feet by 8 feet, and underground at that, with some big machines in it, so you may guess there was not much surplus room ; but such small shops as that are not very desirable, as, besides being unhealthy, only small work can be produced in them with any degree of comfort or facility. It is also important that the workshop should be well lighted, the bright work and the fine lines employed in marking out being very trying to the eyes in a bad light ; skylights are very desirable in a workshop, as by them a light is shown direct on to the floor where a large portion of the marking and setting out has to be done, and if the light is wholly from the side of the shop a shade is cast on the floor close to the bench, thus rendering marking out a tiresome job, especially on dark, gloomy days ; so by all means go in for plenty of light in your workshop. It should also be of a fair height, not only for health considerations, but in order that wire, patterns, etc., may be kept on hooks fixed to the joists, this being, in my opinion, the best position for such accessories, though in many places they have to be hung on the walls ; but this is inconvenient in many ways, and if the patterns and bundles of wire are hung systematically from the ceiling or joists, what is wanted can be seen at once and reached down without trouble by means of a "long arm" which can be easily made by fitting a ferrule on a broom handle and driving in a piece of ¼ in. rod and bending it to the required shape, Fig. 1 ; this is a humble tool, but, like many other apparently insignificant things, it is very useful, saving a lot of jumping up and down on the bench, etc.

The floor of the shop should be boarded, as there is not the danger of fire as there is in a smiths' shop ; and as there is a great deal of work done standing comparatively still, a brick or earth floor would be cold and uncomfortable.

The Work Bench.—This is one of the most important items in the shop, and special care should be taken both with regard to its material and fixing. No better material can be used than good sound beech, though, of course, any tough, hard wood will answer the purpose, but beech is my choice. The softer woods—such as deal or pine—are no use at all for this kind of work, as they will not stand the pulling and straining that the bench gets at times when used for heavy work, so by all means go in for a good piece of stuff for your bench. Its thickness for general work should be 3 in. (thicker will not matter, but less than 3 in. is not desirable) ; the width from 2 ft. to 2 ft. 6 in., the latter preferable. In the length you will, of course, have to be guided by circumstances, but by all means have it as long as your shop will allow or your purse will permit, as the longer your bench is, the better and more convenient for working on. I have mentioned the width of the bench as being 2 ft. 6 in., but this need not mean that the whole of the bench is to be of the thickness of 3 in. It is usually the plan to have the front half (in which are cut the holes or mortises for the tools, and on which all the hammering, etc., is done) of the thickness I have mentioned, and the back half much lighter, to avoid unnecessary expense—say, 1 in. or 1¼ in. board for the back part. This makes a very good bench, though if any one likes to have it solid right through, so much the better, but get the price first.

I remember, in my early days, a fellow apprentice telling the master that his bench was worn out, and receiving permission to go to the timber merchant and select another, thinking, no doubt, that he simply wanted to replace the front half. He availed himself of the permission, and selected a slab of beech 10 ft. long, 2 ft. 3 in. wide, and 4 in. thick. It was fixed and the holes cut in it, and made a splendid bench, the admiration of all beholders ; but didn't he catch it when the "governor" saw it. I think, if memory serves me rightly, that bench cost, without fixing, £2 10s.

Height of the Bench.—This will vary a little with the height of the workman. Thus, if you are a tall man, you require a bench to be higher than a very short man, or a stoop in the shoulders would be the result ; and, on the other hand, a short man would not like a high bench, as it would be arm-aching work to use the tools ; but the average and usual height of the bench is 30 in. For a tall man, one inch higher will be enough ; and for a short man, one inch lower will be sufficient.

Mode of Fixing.—If the bench is a short one, it will only require to be supported at each end ; but if over 8 ft., it will want support in the centre. It must be fixed very strongly, or it will soon be loose and shaky with the knocking and pulling about of the heavy stakes and tools. Stout posts fixed to the floor, with pieces running from the posts to the wall, and let into and fixed to the same, is as good a way as I know of. The bench is then laid on, and nailed or screwed down. A short return end is very useful on the right-hand end of the bench. The folding machine is often fixed here, and it comes handy to lay tools down on, or to put work aside temporarily. It need not be so thick as the other bench, or so strongly supported.

From 4 ft. to 6 ft. is a useful side bench. A couple of drawers are a useful accessory to the bench, one to keep odd fittings and materials and the odds and ends that rapidly accumulate in a workshop, and one for small tools, etc., that require to be kept with more care than others. Some square holes have to be cut in the bench for the stakes, etc., to fit in, and I would advise that they be as few as possible. Four ought to be enough if judgment is exercised in cutting them. Do not cut them till you have the tools to fit to them. Cut your first hole to the size of the foot of your largest stake but one ; this hole will then do for, perhaps, three different stakes. Then proceed the same with another hole, making that do for several stakes. Then one for the smaller stakes, and one for the stock shears alone will be quite enough ; and if you ever want more, they can be cut : but, in my opinion, a bench full of holes is a bench spoilt, as small tools, etc., drop through and get lost in the cuttings under the bench. These holes should not come nearer the edge of the bench than 1½ in., nor should they be further back than 2 in. Some, after the holes are cut, put plates of iron on the bench with square holes cut in, the same size as the holes in the wood, in order to prevent the tools wearing away the bench. It is, doubtless, effective for this purpose, but I dislike iron on my bench, and prefer to leave the holes as they are. I mention the plan, however, so that those who care to adopt it can do so. I may as well say here, as I forgot it before, that the way to cut the holes is to mark them out square on the bench, find the centre by drawing diagonal lines from corner to corner, and bore a hole with a Jennings' or Gedge's bit a shade smaller than the square is to be, and then cut out the corners with a joiner's chisel. Let the holes be 6 in. apart from each other.

Having disposed of the question of the bench, the next thing to consider is the selection of tools and machines. I will mention here those most in general use ; others will be noticed as we proceed farther with the subject, or I will give any information I can on special tools through the medium of "Shop."

The Burring Machine or Jenny (Fig. 2).—This is one of the most useful machines in a tinsmith's shop. It is used to "edge" bottoms and bodies, round or oval, to "crease" and edge covers, funnels, etc., put in wires, and many other things. Fig. 3 shows the same machine in a different form. This kind is used in a machine standard (Fig. 4, A, B, C, D, shows several forms of them). It can then be used in any part of the bench without the necessity of there being a hole there, which is at times desirable. The ordinary shape (Fig. 2) is made in three sizes, known as small size, regular size, and for iron work ; the two former are the same price, £1 12s. 6d. The diameter of their top rolls are 1½ in. and 2 in. The large size, for iron work, is 3½ in. diameter, and the price is £4 10s. The particulars and prices of these, and other machines and tools that I shall mention, I am kindly favoured with by Messrs. Rhodes & Sons, Wakefield, Yorks ; and having proved their goods, I can testify as to their quality.

Bending Rollers.—These also are almost indispensable. Before their introduction the work had to be turned on a tool called a former ; and in old-established shops they may still be seen lying about under the bench, or in some out-of-the-way corner. I expect some of the young hands of to-day hardly know their use. Fig. 5 illustrates them. They were made in various sizes, and though good work has undoubtedly been done with them, the rollers have knocked them out of time. Fig. 6 shows a pair of tinman's rollers, for tin goods, stove pipe, etc.

It consists of two cast-iron standards held together by two tie rods, and three rollers : two in front one over the other, and one at the back. At the left-hand end of the two front rollers are two cog pinions which communicate the motion. The top roller works on a bearing that is lifted up or pressed down by means of the thumbscrews, A A. This roller regulates the pressure.

The back roller lifts up and down in a somewhat similar way, except that, instead of having thumbscrews, it has two cranked screws, B B. The reason of this is that the

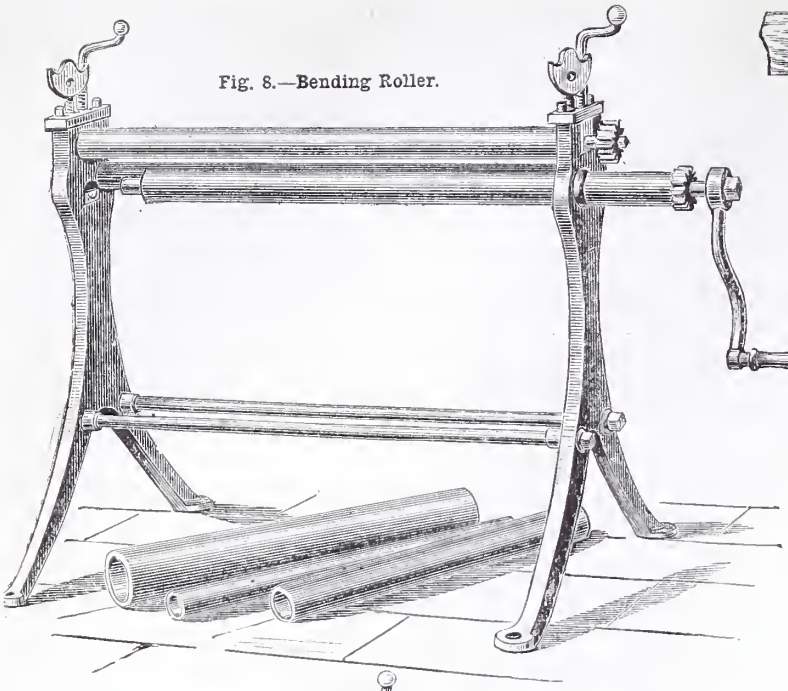


Fig. 8.—Bending Roller.

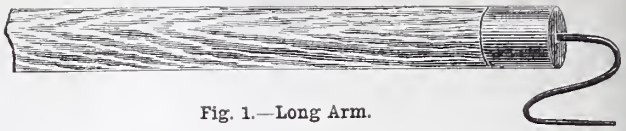


Fig. 1.—Long Arm.

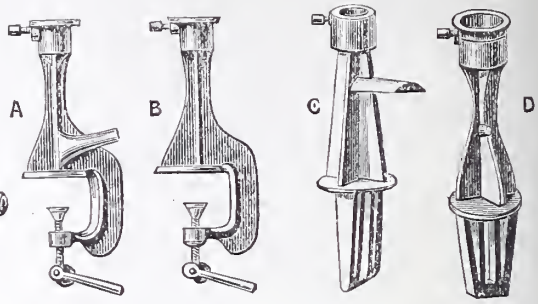


Fig. 4.—Bench Standards.

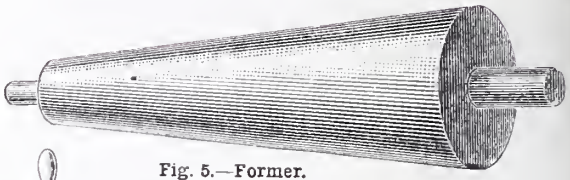


Fig. 5.—Former.

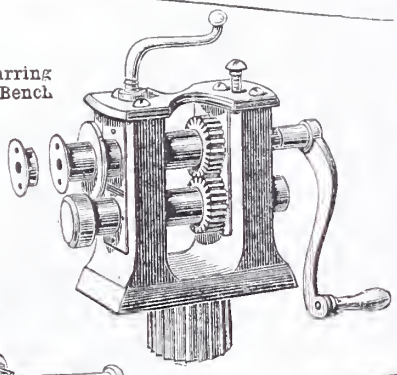


Fig. 3.—Small Burring Machine for Bench Standard.

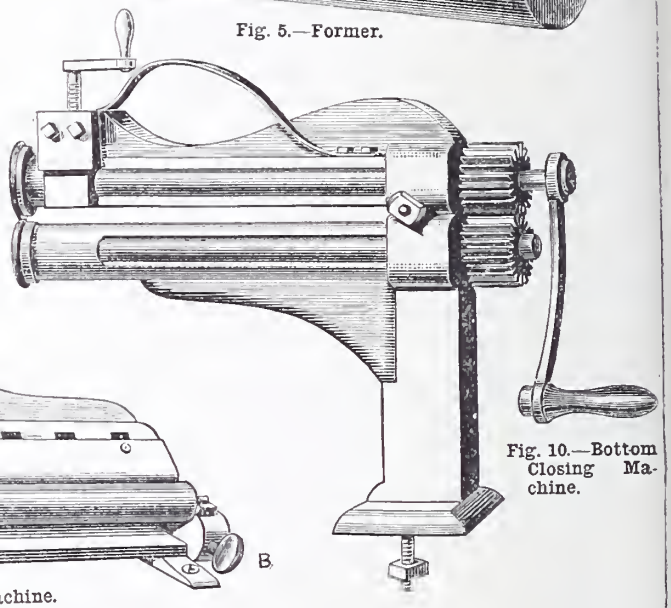


Fig. 10.—Bottom Closing Machine.

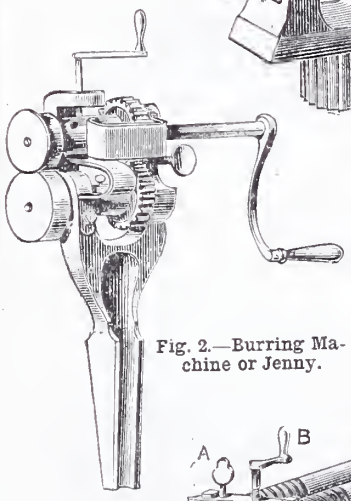


Fig. 2.—Burring Machine or Jenny.

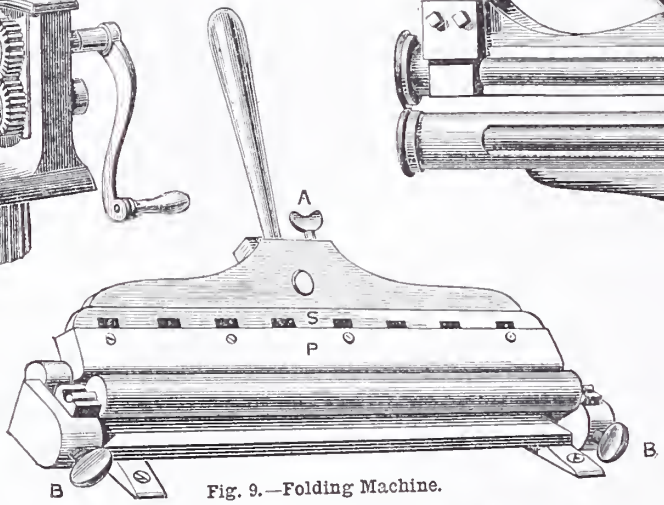


Fig. 9.—Folding Machine.

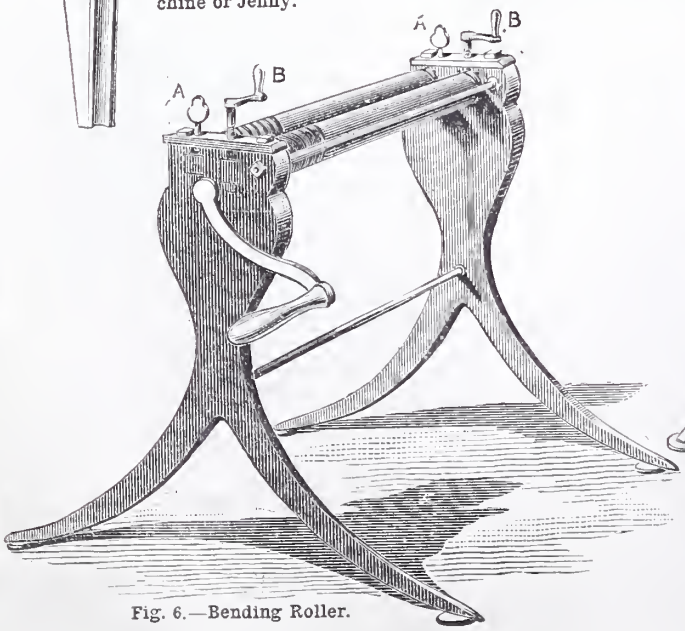


Fig. 6.—Bending Roller.

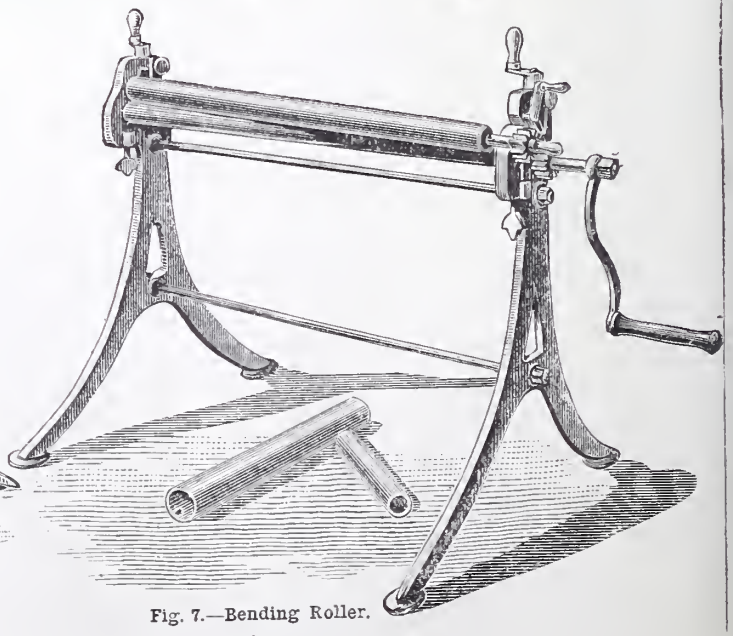


Fig. 7.—Bending Roller.

back roller is the one most in use, and requires to be moved up and down far more than the front top one; and the cranked form of screw admits of more rapid movement than the thumbscrew. This back roller is the one that principally regulates the size of the cylinder to be rolled. The smaller the article, the lower it is let down, and *vice versâ*. This form of roller is made in various sizes: the most useful are subjoined.

DIMENSIONS.

	In. long.	*In. dia.*
No. 1 ...	$25\frac{3}{8}$ ...	$1\frac{3}{4}$
No. 2 ...	$30\frac{3}{8}$ ...	$1\frac{3}{4}$
No. 3 ...	$36\frac{1}{2}$ ...	2
No. 4 ...	$36\frac{1}{2}$ ...	$2\frac{3}{4}$

PRICES.

	With iron rolls.	*Steel do.*
No. 1...	£3 5 0 ...	£3 15 0
No. 2..	4 5 0 ...	5 0 0
No. 3...	6 0 0 ...	7 0 0
No. 4...	8 10 9 ...	9 15 0

Larger sizes are made, but these are sufficiently large for all ordinary work. Mine is a No. 4, and turns 14 in. gauge iron as small as 10 in. cylinders, such as engine funnels, though I must say it is tough work, and takes two to pull it round.

Two very useful forms of rollers are shown (Figs. 7 and 8) for this class of work, —very heavy pipe. No doubt many others with myself have found a difficulty when rolling thick pipe of getting it out of the rollers; for instance: say a piece of pipe 9 in. in diameter, 16 in. gauge iron. If this is rolled round till the edges meet, it is a difficult matter to spring them open enough to clear the $2\frac{1}{2}$ or 3 in. diameter of the rollers. In Fig. 7 it will be seen that this difficulty is met. The top right-hand bearing swings back, and allows the roller to be lifted partly forward, so that the length of pipe can be drawn off. In Fig. 8 the same result is obtained by drawing out the bottom roller. The reader will notice that in Fig. 7 the work will be rolled upwards, and in Fig. 8 downwards. The price of these rollers is £9 10s., either kind, fitted with steel rolls, 2 in. diameter, $36\frac{1}{2}$ in. long. I have not restricted myself to the illustration of one form only, but have given three in order to meet the requirements of all professionals.

Fig. 9 shows the folding machine, another valuable labour-saving appliance. It is used for turning or folding the edges of tin goods that have to be joined together by the process of groving or grooving. This machine is screwed down to the bench by means of four lugs. The pieces to be folded are slipped over the front roller under the steel plate, P; the distance they are to be bent is regulated by the notched brass slide, S, which is moved by turning the regulating screw, A. By raising or lowering the front roller, a sharp or rounding fold is obtained respectively. These machines are made in various sizes:—

		£	s.	d.
No. 1 ...	$17\frac{3}{4}$ in. long ...	2	2	0
No. $1\frac{1}{2}$ ...	$20\frac{1}{4}$,, ...	2	7	6
No. 2 ...	$26\frac{3}{8}$,, ...	3	10	0

Of these No. $1\frac{1}{2}$ is the most useful size for most ordinary work.

Fig. 10 is a bottom-closing or "knocking-up" machine. It is used for turning up the bottoms of saucepans, water-pots, camp kettles, boilers, and such goods, and it is a valuable accessory to the workshop. This machine is made in three sizes.

U. No. 1 to take articles up to 10 in. deep.
U. No. $1\frac{1}{2}$,, ,, $12\frac{1}{2}$,,
U. No. 2 ,, ,, 15 ,,
Price £2 15s., £3 10s., and £4 5s. respectively.

There are several other machines that I wish to describe; but I must reserve them, and also the hand and bench tools, for my next paper.

ADJUSTING HAMMOCK CHAIR, SUITABLE FOR IN-DOOR OR OUT-DOOR USE.

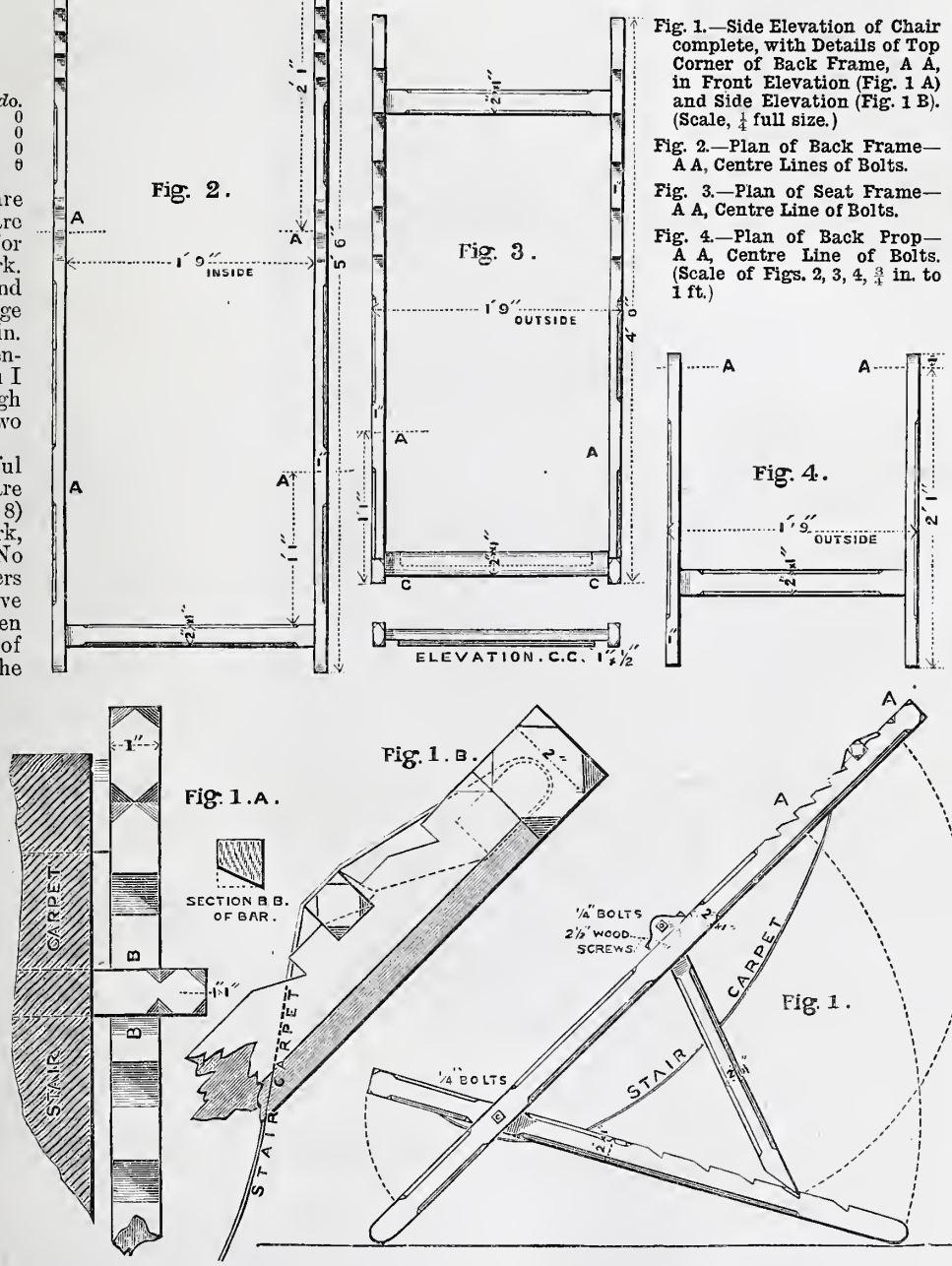


Fig. 1.—Side Elevation of Chair complete, with Details of Top Corner of Back Frame, A A, in Front Elevation (Fig. 1 A) and Side Elevation (Fig. 1 B). (Scale, $\frac{1}{4}$ full size.)

Fig. 2.—Plan of Back Frame—A A, Centre Lines of Bolts.

Fig. 3.—Plan of Seat Frame—A A, Centre Line of Bolts.

Fig. 4.—Plan of Back Prop—A A, Centre Line of Bolts. (Scale of Figs. 2, 3, 4, $\frac{3}{4}$ in. to 1 ft.)

ADJUSTING HAMMOCK CHAIR.

BY J. BROX.

THE advantages of the chair shown in the drawing are—its simplicity of construction, its compact way of folding, and the adjustment of both the hammock seat as well as the angle of the back frame, to say nothing of the comfort obtained by its use.

There is a slight divergence from the more usual drawings in WORK on this occasion, for this one is a simple mechanical drawing, with no perspective view at all, done on the same principle as practised in an engineer's office. The cause for this is, that it has been observed that there are some in "Shop" who would like to be able to read (as it is called) a drawing, and there is nothing like beginning with something simple. There was also a little bit of advice given, not so long ago, that it is better to hammer out any little difficulty in reading drawings than to write right off to "Shop." This is confirmed here; and any of the younger subscribers might do well in making a model of this to scale, first for the good it will do them in drawing reading; and secondly, if they have no better use for it when done, to give it to some little lady who keeps dolls.

But as regards the chair itself, it is all cut out of English ash, 2 in. by 1 in., except the two pieces, one for the adjusting bar for the hammock seat, which is 1 in. square, and one for the strengthening piece, 1 in. by $\frac{1}{2}$ in., under the bottom bar of the seat frame (shown at C C, Fig. 3). This bottom bar is rounded on the top both sides. All the bars are tenoned into the side pieces,

and the top bar of the back frame is rounded back and front on the top. It may at first sight be asked why there are blocks to carry the back prop, which are made fast by two good wood screws each, but this is to cause the prop to fold up out of the way of the seat frame when shut up, as by the dotted lines in Fig. 1, so that the whole may be as compact as possible. There are also one or two dimensions which must be regarded with care. The width of the frame, Fig. 2, encloses both the other two. Its width is 1 ft. 9 in. inside, and the other two are 1 ft. 9 in. outside, so that they fit inside Fig. 2 without any play. Then the distance from the bolt-hole in Fig. 3 to C is 1 ft. 1 in. This must be made slack, so that the bottom of the seat frame will pass the bottom bar in the back frame, whose inside measurement to the bolt-hole is also 1 ft. 1 in. The same thing applies to the prop and the top bar of the back frame.

The seat is simply a strip of stair carpet as near 1 ft. 7 in. in width as possible, and is well tacked under the bottom bar of the seat frame, C C, and brought round over it. The other end is sewn on to the adjusting bar, as shown in the enlarged details, as you sew the lath at the bottom of a window blind. This end, when the chair is finished, is thrown over the top bar of the back frame, brought round in front again, and the ends of the adjusting bar fixed into the nicks made for it. The weight of the person sitting in the chair prevents any chance of its coming out. The number of nicks, both for the adjusting bar and for the back prop, can be left to taste. The bolts and nuts used are the ordinary ¼ in.

As to decoration, that can be as you like. The one made from the above working drawing was in ash, chamfered as shown, the chamfers picked out with black, and the whole varnished. Of course, knobs and spikes, etc., can be added, but made as shown, and picked out with black, it looks wonderfully light, more so than in the drawing. Although it has no arms, there are some very comfortable corners inside it, and that is a great thing in any chair. Arms might be put on like those in use in railway carriages, but it must not be forgotten that they must be fixed on the upper sides of the back frame, so that they will not interfere with the closing of the chair. They should be slung with one eyelet hole each and a large-headed screw, so that they will always hang perpendicular to whatever angle the back frame may be set. Anything else about the subject can be got from the drawing, as it is all to scale with dimensions.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

33.—Metal Screw Button.

The metal screw button shown in Fig. 1 in its separate pieces, A, B, C, D, and E, and then combined so as to form the two parts of which each button is composed, was once a patent article, but is so no longer, the time over which the rights of the patentee extended having expired. A correspondent (Mr. H. Reed, 5, Lovell's Court, Paternoster Row) has told me this, and thinks it as well that the readers of WORK should know that they are free to make these buttons for their own use if they are inclined to do so. The button is of a kind that, in an emergency, can be fixed quickly to cloth or any other textile fabric. A is an oval or other shaped washer, designed to allow the button to roll or revolve when in use; and B is a piece of wire cut with a screw thread. These two parts are soldered together to form X. Similarly, C is a round or other shaped washer, D a piece of tubing with an inner screw thread, and E an ordinary button head. These three parts are fastened together as shown at Y. To fix the button, a small hole is made in the fabric, B is pressed through, and C is screwed on to B, gripping the material on both sides, thus obviating the necessity of sewing where strength and rapidity in fixing are required. In any emergency it is fixed instantaneously, and can be taken off and replaced at pleasure.

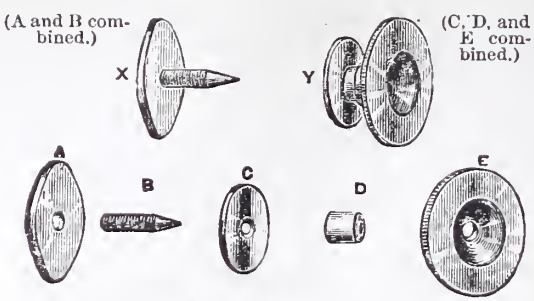


Fig. 1.—Metal Screw Button and its Parts.

34.—Bruce's Patent Hat Shaper.

Mr. George H. Bruce, Iverley Works, Helena Street, Smethwick, near Birmingham, the patentee and manufacturer of the "John Bull" Pocket Gauge, which was noticed in Vol. I., page 363, of WORK, has sent me a specimen of a new invention of his, which he calls a Hat Shaper, and whose form is illustrated and construction shown in Fig. 2. To use the shaper, turn the back of the hat towards you and hold the shaper in the left hand, placing the back wing in the back of the hat with the ledge resting on the rim; then place the two front wings to their required positions in length or width, and let the ledges of these also rest on the rim. Screw up with the coupling nut in the centre as may be required, and then hold the hat before the fire for one minute, and rub the rim, while warm, where the wings of the shaper are operating gently with the fingers, letting the shaper rest in that position till the hat is required for use. When the hat has been out in the rain, and is wet, the same treatment with the shaper will prevent it from contracting. The price of the shaper in brass is 5s., but when made in this material, it is intended for hat manufacturers and dealers. For ordinary household use it is made in bronzed malleable iron, and sold at 1s., or 1s. 3d., post free.

35.—Pike's Patent Bow-Guide, Music-Holder, and Mute.

Mr. W. H. Pike, of 212, West Fourteenth Street, New York, and of 19, Greek Street, Soho, London, W., calls attention to a patented contrivance of his for use with the violin, violoncello, etc., which acts as a music-holder, a guide for the bow, and a mute. Two forms of the music-holder are shown in Figs. 3 and 4, of which the latter is fixed, but the former is mounted on a rod, so that the music can be brought nearer to, or farther from, the eyes of the violinist as may be needful. This music-holder obviates the use of the ordinary music-stand, which causes the performer to resort to ungraceful bendings and contortions of the body at times in order to gain a position in which he may most readily read the music before him. The mode of fixing it is clearly shown in the engravings, and needs no description. When in this position it also acts as a bow-guide, by preventing the bow of the performer from going over the strings at any point below that part of it which rises at right angles to the surface of the instrument. The projecting points of the music-holder are divided transversely for the reception of the sheet of music, and it is thus made available for placing over the bridge, as shown in Fig. 3, in which position it acts as a mute. For price, etc., application must be made to the patentee. THE EDITOR.

Fig. 3.—Pike's Patent Bow-Guide and Music-Holder.

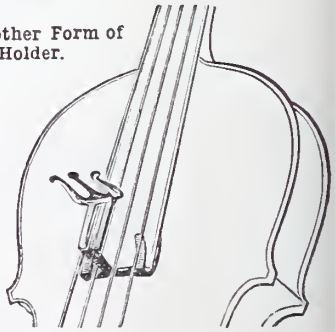


Fig. 4.—Another Form of Music-Holder.

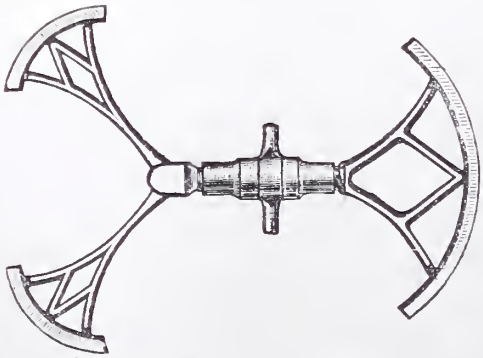


Fig. 2.—Bruce's Patent Hat Shaper.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

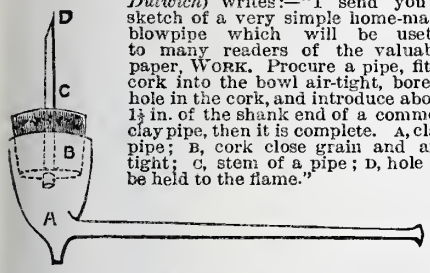
NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

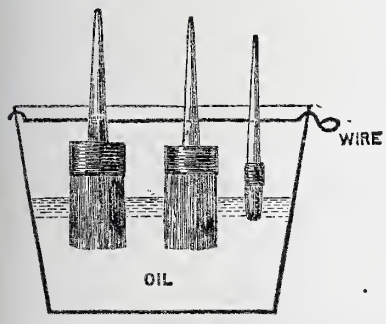
I.—LETTERS FROM CORRESPONDENTS.

Home-Made Blowpipe.—T. W. A. (*East Dulwich*) writes:—"I send you a sketch of a very simple home-made blowpipe which will be useful to many readers of the valuable paper, WORK. Procure a pipe, fit a cork into the bowl air-tight, bore a hole in the cork, and introduce about 1½ in. of the shank end of a common clay pipe, then it is complete. A, clay pipe; B, cork close grain and air-tight; C, stem of a pipe; D, hole to be held to the flame."



Home-Made Blowpipe.

Preserving Brushes.—T. W. A. (*East Dulwich*) writes:—"I send you another good recipe which I hope will be of some value to our readers of WORK. It is to preserve tools and brushes when not in use. Clean out the brushes well and make a hole in the handles to let the wire pass through,



Preserving Brushes.

and to let them hang from the wire without touching the bottom; put them in paraffin oil or linseed."

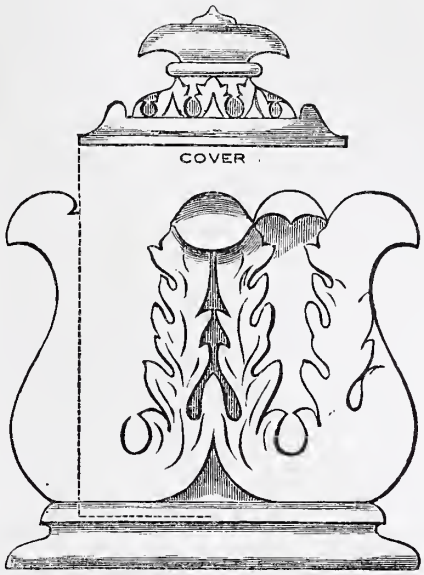
Glasses of Telescopes.—E. A. F. writes:—"In my reply to A. C. (*Edinburgh*) (see page 92, Vol. II.), in line 6 of reply, please read for double concave' 'double convex.'"

Cigarette Maker.—C. W. B. (*Plymouth*) writes:—"In my reply as to Cigarette Maker (see page 94, Vol. II.), I forgot to point out that the sketch on page 670, Vol. I., *must be* incorrectly drawn, as it shows domed end. Dotted line at A explains error."

Piano Tuning.—In reply to B. A. B. (*Hampstead*) T. E. writes:—"I think you have made an error in criticising my remarks on page 803, Vol. I., I did not attempt to show what a fifth or a fourth was, but I put in the simplest manner I could the remarks on tuning, so that the amateur to whom I was addressing my observations might be able to grasp the ideas."

Mandrel for Lathes.—W. D. P. (*Newnham*) writes:—"Some time ago I applied to one of our large firms for a small part of a machine, and was frightened at the price, but being recommended to an engineer, Mr. E. Leach, 52, Southampton Street, Camberwell, London, I obtained the articles at *just half the price*. Since then Mr. Leach has done many little jobs for me, and always satisfactorily." [This information should be regularly advertised by Mr. Leach and similar men in our cheap "Sale and Exchange" column.]

Carved Wood Tobacco Jar.—C. C. H. (*Northallerton*) writes:—"The accompanying sketches show a tobacco jar, to be made in any hard wood. The turning will be easy to any one who has had any practice at the lathe. It would do without the little carving, but it requires it to make the thing look really effective. The jar must be got out of wood that will finish 4½ in. long by 5 in. across. It must be securely fixed to a taper screw



Carved Wood Tobacco Jar.

chuck, or other chuck that will drive it without the aid of the back centre, as the inside can then be hollowed out at the time of turning. The dotted lines at the left side of the sketch show the inside dimensions. The cover should also be turned on a taper screw chuck, and should be made to fit moderately tight. When all is finished and polished, the inside of jar must be lined with tin foil, and the bottom (outside) covered with cloth, to prevent it scratching the table."

Combined Side Tools.—F. McC. (*Birmingham*) writes:—"I enclose sketch of combined side tools, with explanation. Fig. 1 is an end view; Fig. 2, top view as left-hand side tool; and Fig. 3, top view as right-hand side tool. The advantage this tool has over ordinary side tools is that one piece of steel will do for the two tools, and instead of having to take your side tool out and look for the other handed tool, you simply slack off and turn over

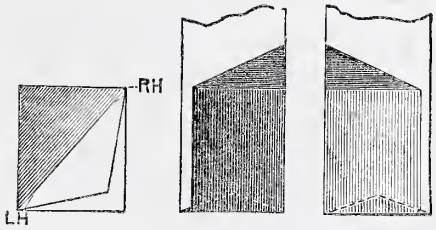
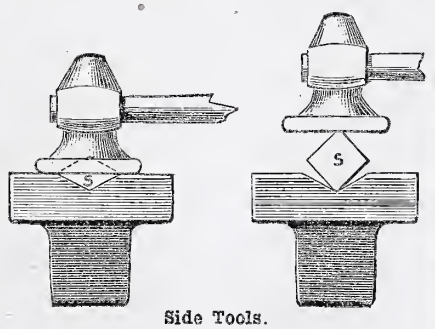


Fig. 1. Fig. 2. Fig. 3.



Side Tools.

the tool. These tools are stronger than the ordinary knife tool, but cannot be used in such narrow grooves. Here are instructions for making these tools. To forge them, take a piece of square steel and drive it with a flat swage into a bottom tool (Fig. 2) until it assumes the form shown at Fig. 3. The angle of the bottom tool should be a right angle plus the angle of relief doubled—that is, if the L of relief is 5 degrees, then L of block should be 55 degrees."

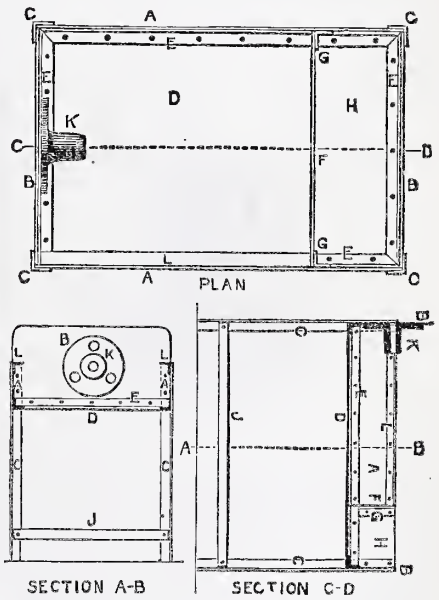
II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Future Subjects.—EMIGRANT.—I am obliged to you for your suggestions. Papers on all the subjects you mention will appear in due course.

Polishing Paste for Hot Brass.—E. B. (*South Shields*) may try Joseph Pickering & Sons' metal polishing paste for polishing hot brass and copper, using a dry flannel, and rub firmly, and polish off with a soft dry cloth. If E. B. does not succeed with the above, and if the articles have been polished previously, he may try crocus and oil, applied with a coarse flannel or the leg of an old worsted sock, and finish with a leather and finely-powdered lime.—N. M.

Thinning Printing Ink.—J. E. (*Ebbw Vale*).—From the card you send as a specimen of your printing, the ink you used wants no thinning, but is far too thin. It is sold of the right consistency by the makers, in various qualities for various purposes. You would do well to get a good solid letterpress ink at about 2s. 6d. or 3s. per lb., and use as little as you possibly can on the face of the type (you have got six times as much on your card as you should have). Any colour can be had ready for use, but unless for machine printing it is rarely thinned. If you do require it not quite so stiff, mix a very little oil and printers' varnish with it, well mixing with a palette knife and afterwards with your roller. I think your roller is not in good order; it should be cleaned with turpentine and then slightly wiped with a damp sponge till it is softened a little; then let it hang for a few minutes to dry, when it will be found to have recovered its suction or "bite." Messrs. Stanbury and Co., of West Harding Street, E.C., will supply you with small samples in tins of any of their inks or varnish, if you write enclosing remittance.—J. W. H.

Small Forge.—MONTE.—Drawings of a forge are given below. It is made of sheets of iron, ⅛ in. thick, and angle irons about 1½ in. by 1½ in. A, A, are two sides; B, B, two ends; C, C, C, C, are four angle irons, to which these sides and ends are riveted, and which support the forge. D is the forge bottom, which is united to the sides and ends by the angles E, E, E, E. F is a partition secured with angles G, G, to part off the coal bunk H. J, J, are stretchers of flat bar-iron that keep the vertical angles, C, rigid, and at their proper distances apart below the forge.

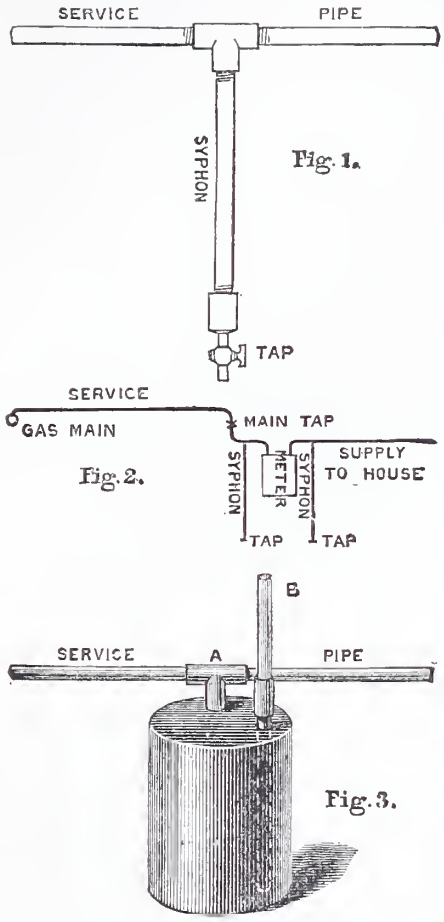


Small Forge Parts.

K is the tuyere, a casting bolted to the back plate B. L, L, are angles bolted along the top edges of the forge, to act as stiffeners. I cannot go into the weight of these parts and consequent cost; you can easily reckon out the former, and the cost will probably be larger than trade prices, because you will want small quantities and will have to get them through a general ironmonger. I have drawn this to scale, making it 3 ft. by 2 ft., and you can scale the minor details, whose dimensions are not of much importance. A fan is preferable to bellows, and a blower is better than a fan, and is also the most expensive.—J.

Converting Brass Bushes.—J. S. (*Coschoe*).—No; you had better sell your brass bushes and buy sheet brass. Expensive plant is required for rolling. Small castings are easily made if you understand moulding, and if not, it would take a long time to describe properly. The subject will, however, be treated in a series of articles on moulding, now preparing. The best book is Spretson's "Casting and Founding," price 18s.—J.

Piping.—W. B. (*Highgate Hill*).—I append a sketch of the usual mode of forming a syphon in gas-fitting. A piece of barrel screwed into a T piece or other approved connection is all that is required, with a tap at the end to let out any moisture that may accumulate from time to time. The length of the syphon in your case should not be less than 2 ft. 6 in. Try to get a rise ever so slight in your service from the main; even if the meter is below it you might rise gently all along until you reach the meter and then drop down, and just before you connect up, insert a deep syphon as in Fig. 2. Always insert a syphon where the pipe goes from one temperature to another. Of course you can insert one anywhere along the length of your service. If your service is buried in the ground, and it is found necessary to insert syphons in it, I should advise you to use what are called "syphon boxes," Fig. 3. These boxes are made to hold from about one quart upwards, and to connect to any size barrel at A.



Gas-Fitting Syphon.

The pipe B, which goes nearly to the bottom of the box, can be carried up to the ground level, and plugged off, and covered with an iron flap and frame. The method of emptying the syphon is to lift up the iron flap, take out the plug, and connect the end of a suction pump to the pipe B; this will enable you to draw off all the water that may have accumulated. The question of how many boxes to use and how large to have them, as well as the chances of your service being under the public road, of course must be determined by circumstances.—E. D.

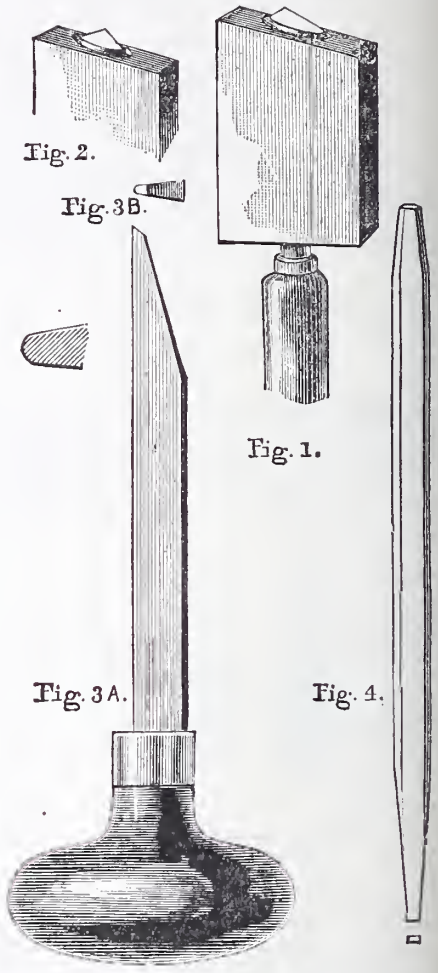
Tableaux.—BAILIE.—BAILIE asks for a few hints in "Shop" that will enable him to work the above at a little amateur concert without great expense. I am afraid the space in "Shop" is far too small for me to give full directions for this interesting amusement. It would take a fairly long article. What the Editor would say were I to commit myself so far I dare not contemplate. The best advice I can give BAILIE is to read an article on the subject which appeared in *Scribner's Monthly*, Vol. 21; it will give him all he needs in the way of information. But supposing the volume is not come-at-able, I will give a few hints. First, the stage. This must be raised above the audience; 3 ft. will not be too high for most subjects. Many houses in and about London have the two principal rooms separated by folding doors. Such rooms suit admirably for our purpose. The opening will form a convenient proscenium: one room for the stage; the other for the audience.—Atmospheric Effect: To make a tableaux effective we must avail ourselves of *black gauze*. If of tulle, two thicknesses will be required; if of tarletan, one may be sufficient. This must be stretched over the opening with the foot and head lights behind it or *on the stage side*. This produces a soft, mysterious haze over the subject, and being placed between the eye and the light will not be perceived by the audience. Wonderful effects can be produced by the arrangement of lights, above, below, and behind. Background and sky effects can be made with gauze of different colours stretched over frames with a different light shining through them.—Subjects and Make Up: In selecting a subject for representation, choose a person of typical face and pay no heed to complexion. For example: a person with a delicate complexion might have a decided Roman cast of countenance, yet might not strike an unobservant person because of his complexion. Paint and powder will easily give the requisite tone and produce a splendid Roman. Or again: a girl with a devout face would make a splendid nun, in spite of her plump rosy cheeks, by the aid of the same process. The three points to remember are, first, atmospheric effects to be procured alone by gauze; second, disposition of lights to give the request shadows; and, third, paint and powder and wigs. To give a list and description of set pieces would occupy too much room. If the hints given are acted upon, BAILIE will find his exhibition a wonderful improvement on the "living waxwork" exhibitions, which, as a rule, from an artistic point of view, constitute a "chamber of horrors."—O. B.

Broken Telescope Lens.—THETA must furnish more particulars. The diameter of the object lens in question should be stated and its focal length. This last can be roughly ascertained by drawing out the telescope to its full length and then measuring the distance between the object glass and the lense of the eyepiece nearest to it. At the same time the whole length of the telescope had better be given. As the broken glass formed part of an achromatic combination, the cheapest way for him to proceed, most probably, will be to put the remaining convex lens on one side, and purchase a new achromatic lens of the proper diameter and focal length. Most likely the optician who demanded ten shillings to repair it would have adopted this course. Achromatic lenses in ordinary telescopes are manufactured in quantity, and the finished lens could be purchased, in the right quarter, for much less than the sum which would be required to pay for the grinding and polishing of a special concave to replace the broken one. Is it absolutely broken, or only cracked into two or three pieces? I have assumed that the telescope is one used for ordinary sight-seeing and is not an astronomical telescope.—E. A. F.

Clock Materials.—HEXHAM.—When giving my advice or help to correspondents, I make it a point to give addresses, as far as I am able, where the materials may be got. The reason you have received no reply from Grimshaw & Co., of course I do not know; I have always found them ready to reply to me. Did you enclose stamps for reply, or send cash or card? if not, try again, enclosing stamped addressed envelope. Or try Haswell and Sons, 49, Spencer Street, Clerkenwell; a very good house for repairs, tools, and materials, as I have found many times.—A. B. C.

Wood Waste.—P. P. (*Withington*).—If P. P. is only an amateur, as his letter suggests, the best thing he can do with his waste is to light his fire with it; but if he is in the trade, and his waste of wood and dust is considerable, he may be able to turn it to profit by machinery. For instance, he could get a machine for making wood wool, and I am given to understand that a machine will turn out two tons to one h.p. per week, and as wood wool is worth about £4 per ton, this sounds all right; or if his waste is only sawdust and chips, he could mix it with resin and compress it for fire-lighters, which sell at two and three a penny. But unless P. P. can produce a large quantity, he had better use his waste for his own domestic purposes.—A. J. H.

Setting Glazier's Diamonds.—GLAZIER (*Edinburgh*) asks, 1st, How to find the point of a glazier's diamond, and to keep it (the point) until it is set in the brass? Secondly, How it is fixed. As to the edge, not the point, that is to be selected from the other edges. Much time in writing and in attempted explanation will be well saved if GLAZIER studies and compares the position the diamond is set in all those he can get to look at. It is so much a matter of experience and judgment, that it is found to be much the easier way generally to send it to a good maker of these articles. But here is the principle on which they are set, viz., the proper position of the exposed or cutting part of the diamond. This will be best understood by reference to Fig. 1, where the point is right at the further end. On no account is the stone to be set with the point in the centre, like Fig. 2. Besides this a good straight edge of the diamond should be selected, and great care must be taken to get this edge parallel with the long sides of the steel part. If after this you can decide on the edge that you will use to cut with, I think I can tell you how to fix it in the brass. There are two or three things we have to arrange for. 1st. We must have a hole in the brass deep enough. 2nd. It must be made as near as can be to the shape of the stone. 3rd. It has to be held in by hammering or pinching the edge of the brass over the diamond, or as some seem to do by soldering it in. If the former, see that you have the brass annealed before pinching or punching the metal over the stone. The first is not a difficult matter, this merely drilling a hole to the requisite depth. You are sure to be able to buy some drilling arrangement or other, that is, if you cannot get a jeweller or metal worker to do it for you. But what is the requisite depth? It would average ¾ of the entire depth of the diamond. The second thing is to make the hole the exact shape and size of the under part, so that it will fit well and support itself in the exact position it has to be fixed in. The best single tool for cutting out the metal after drilling will be a medium size round scorper, about the size in section of Fig. 3 B, and ground and sharpened into the form of Fig. 3 A. Now comes a bit of a difficulty, and that is how are you to be continually trying it in the hole, in order to fit it well. You must have some means of picking it up, placing it in the hole, and removing the means of doing so, in order to look at your work. Now the best thing to use is what is called a wax-stick—that is, a piece of modelling wax (artist's, not dentist's) pinched into a point, and soft enough to

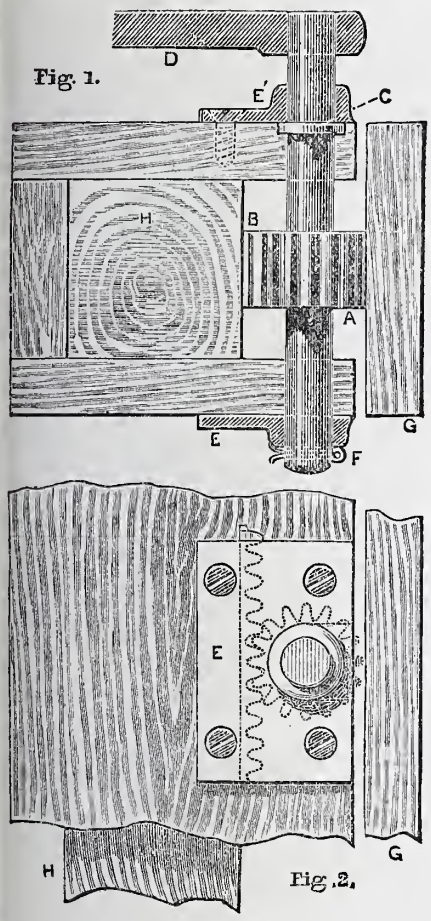


Glazier's Diamond.

pick a stone up with, but not so soft as to leave any portion of itself on the stone. If this cannot be obtained, try a piece of cobbler's wax, mixed with plaster of Paris. With this you can take up your diamond as often as you like—but you understand clearly that you must be sure of the front of the stone you have selected, else you will be trying to fit the wrong edges. Shortly, the foregoing is—make a hole to fit the diamond, and get the largest part under the top edge of the brass. If that is arranged all right we can proceed to fix it, either by solder (if spelter or silver, see WORK, No. 37, page 588, jeweller's soldering; but if lead, or pewter solder, then you know how to do it I expect) or by pressing the brass over the edge of the stone. This can be done either by pinching the metal or, as I recommend, by punching it in. For this method you will require a small steel punch, something like Fig. 4, and an assistant just to give you one or two smart, but not heavy, taps with the hammer (a chaser's hammer is best) until the stone is fixed, for you will most probably have to steady the stone with your nail. Once it is steady you can go on by yourself, and you will have to judge whether you should drive the brass down on to the stone or sideways, or both ways—it will depend on the way you have opened the hole. But, as I said at starting, it is a matter of judgment, practice, and experience.—H. S. G.

Book on Social Questions.—L. B. (*Upper Sydenham*).—Some of these are treated in "Subjects of Social Welfare," by Sir Lyon Playfair, price 7s. 6d., published by Cassell & Co.—F. J. C.

Cog Wheels.—J. F. K. (*Doncaster*).—I am glad to find that you made one of the lathes described by me in No. 17 of WORK, and that it has proved useful to you. Although I am not the "old hand" who wrote the description of tripods in No 29, yet, as your query was sent to me, I will endeavour to set you right about the cog wheels and racks. Amateurs, and professionals likewise, might well take note that beautiful cog and bevel wheel castings and racks are supplied by Richard Lloyd & Co., Steelhouse Lane, Birmingham, at very moderate rates. A rack 14 or 12 pitch, length, 15 and 18 in., and costing 1s. and 1s. 4d. respectively, would probably suit you. Cog wheels can be got to match; 14 pitch, from 15 to 24 teeth; any one for 4d.; the diameter will range from $1\frac{1}{16}$ in. to $1\frac{5}{8}$ in. 12 pitch, the wheels any size containing from 15 to 24 teeth, varying in diameter from $1\frac{1}{4}$ in. to 2 in., will cost 5d. If I were making the studio stand referred to, I would order a rack 12 pitch, 18 in. long, and a wheel containing 18 teeth; total cost, 1s. 9d. I would bore a hole centrally in the wheel for a $\frac{3}{8}$ in. piece of Bessemer steel to



Cog Wheels.

pass through tightly, and key it on; the steel axle may be 5 or 6 in. long, and could also be procured from Lloyd. The casing for the pillar I would make $2\frac{1}{2}$ in. by $3\frac{3}{4}$ in., internal dimensions, having one of the sides loose, as seen in Fig. 1. The loose side could be fastened on with brass screws, and would always afford a ready means of examination in case the rack or pinion got out of order. Holes might be bored through the sides to let the axle through, but this would mean taking the wheel off every time it was taken out. I would therefore prefer to cut a way for it to go in, as is seen in the dotted line (Fig. 2). Stout brass plates should be screwed at each side for the axle to work in. If they were cast $\frac{1}{8}$ in. thick, with bosses another $\frac{1}{4}$ in. thicker, and the surfaces turned, it would be a good job. Some means must be adopted to prevent the axle moving endways. Pins passed through it at each end would do, but the most workmanlike plan would be to have shoulders inside the plates; I show a shoulder at one end and a pin at the other end in Fig. 1. I think J. F. K. can manage the rest himself, and I wish him all success. Beech, I should say, would be an excellent wood for the work, but mahogany would look better. Thanks for your kind words relative to WORK.—SELF-HELPER.

Back Numbers of WORK.—R. M. (*Bolton*).—Back numbers can be had from any bookseller or the publishers. Vol. I. bound is 7s. 6d.

WORK Volume.—H. W. (*Newcastle-on-Tyne*).—Each volume of WORK will contain fifty-two numbers.

Gilding.—LOWERFOLD (*Rochdale*).—The subject of covering surfaces with gold and silver leaf, and other imitations of metal, will in time be fully explained and illustrated in WORK. In the meantime the subjoined will materially aid you. Note also the answer to gilding in "Shop," No. 38, Vol. I., and reply to GOLD LEAF in recent issue. I know of no existing manual on all gilding processes, as the branch known as "water gilding" is seldom practised outside the ranks of professed gilders and carvers, and the majority of them are "society" men, and would hardly favour such a proceeding. In answer to your direct inquiry, you will require a little oil gold size, ready for use, which is spread upon the surface one day and gilded the next, applying the gold leaf with gilders' tip, or brush. The surface must, however, be non-absorbent ere rubbing on the size very barely. If the grain of the wood is to be preserved, coat with three applications of French polish or spirit varnish; otherwise, quick-drying paint is the best for stopping the suction of either wood or fabric. Gilders' brushes and cushion can be bought at any dealer in painters' brushes. The recently-published answer on steel bronzing will probably be useful to you respecting the urn. If gilded with freshly-procured silver leaf, quite free from discolouration, and then coated with the white shellac solution, I am sure it would answer every purpose as an ornament, and would not discolour. See index of Vol. I. for several other replies bearing on gilding.—F. P.

Mandrel for Lathe.—F. P. (*Heywood*) and a large number of other correspondents who offer to undertake the execution of small jobs in fitting, turning, and pattern-making, are informed that they cannot do better than advertise in the "Sale and Exchange" column of WORK.—ED.

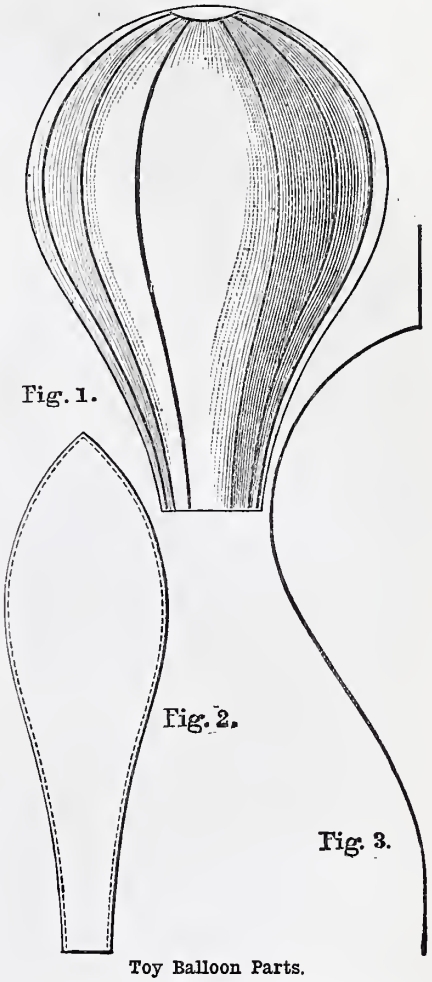
Making Accumulators.—SEMPER PARARE (*Edina*).—Illustrated information on making accumulators will be forthcoming in the series of articles on "Model Electric Lights."

Rubber Stamp Thermometer.—J. P. (*Belfast*).—I regret that I cannot specify any particular shop where thermometers such as that described in my article on "Rubber Stamp Making" are sold. A spare one which I have was purchased at a shop in Leeds (Frank's, optician, Briggate), the price, I believe, being 5s. I would suggest that inquiry be made at some scientific apparatus dealer in your town. If you find any difficulty in getting the pattern recommended, you might use an ordinary chemical thermometer, so long as the graduations extend to about 300° F.; the only drawback to this form being the length of tube projecting from the apparatus; such thermometers cost from 2s. to 4s. each.—QUI VIVE.

Lenses.—W. R. (*Oswestry*).—Any double convex lens *may* be used for the purpose. The object glass of the telescope would be the preferable one; but, as in all probability the visual and actinic foci are not coincident, it will require adjustment in this particular before satisfactory results can be obtained. In all probability the focal length of the lens would require a camera very much longer than usual, for the size of image produced.—E. D.

Backs of Books.—G. H. (*Congleton*).—In binding books in cloth or leather limp, it is usual to use stiff paper for the backs. The method of procedure is as follows:—When the book has been sewn, end papers are pasted on. For end papers it is usual to get four sheets of paper twice the size of the book, and, after having folded them, they are pasted along the fold about $\frac{1}{4}$ in.; one of the sheets is now lifted and carefully laid on the book with the fold evenly flush with the back of the book. This sheet is now opened and another sheet placed inside, the folds in the two sheets coming close together. The outside sheet is closed and the other side of the book treated in the same way. The stiff paper to be used for the back is now pasted all over one side and laid evenly upon the end paper about $\frac{1}{4}$ in. from the back. This is done so that the book may have a joint and open freely at the back. The book, when both sides have been treated alike, is placed in the press and considerable pressure applied; this causes the backs to adhere perfectly all over. When dry, the book can be taken out and the cloth or leather cover put on. Cut the cover a little larger than the book to allow for turning in. If the cover is of cloth, it must be glued all over very carefully. The book is laid upon the glued cover with the front or fore-edge towards the operator; the other part of the cover is drawn tightly on to the book and the cloth rubbed briskly with the open hand. The edges of the cover are now turned in, and both sides of the book rubbed very carefully to ensure the cloth sticking perfectly in every part. If this is done in the manner described, there will be no danger of cracks. When the cover is perfectly dry, the first leaf of the end papers is pasted all over with the brush, first one side of the book and then the other, and the book is again placed in the press and allowed to dry. I trust you will be able to understand the above description. Some articles on bookbinding have appeared, so do not cease to continue taking in WORK. In regard to your second question about staining new oak to make it look old, I should think that Stephens's stains for wood would suit your purpose. But you can also use vandyke brown, mixed with glue and water. It should be applied hot. You could experiment upon a piece of wood until you have obtained the desired tint.—G. C.

Toy Balloons.—J. T. J. (*Manchester*).—I hope I am right in supposing that you refer to miniature balloons made of tissue paper, and rendered buoyant by inflation with heated air. They are the only "toy balloons" I know of, except the indiarubber bladders so common as advertisements, which are not, I assume, alluded to by you. The toy balloon to which I refer is made of tissue paper, and is of the shape suggested by Fig. 1. The size may vary from about 18 in. and upwards in height; but as the buoyancy of the heated air, with which the balloon is filled, must exceed or overcome the force of gravity in the materials of which it is composed, any smaller size than that just mentioned will not prove satisfactory. The balloon is composed of a number of sections shaped something like Fig. 2. In fact, if you can imagine an *orange shaped* like a pear, it will help you greatly to understand the construction. In such a case, Fig. 2 would represent the portion of rind covering each section of the orange. The dotted lines show the narrow margin on each side of the sections which overlap each other, and which are to be gummed together in



Toy Balloon Parts.

their entire length. This is the most difficult part of the work, and calls for great patience and neat fingering. Good strong gum should be used, and as one side of each section is gummed to the depth of about $\frac{1}{8}$ in., it is applied to the ungummed edge of another. The difficulty lies in getting the curved edges together so that they shall lap evenly, and without wrinkles or puckers; to overcome this, bend a piece of ribbon iron to the shape shown at Fig. 3, which will form a sufficiently solid support for the edges. This template should be, as nearly as possible, of the shape of half the *contour* of the balloon; and if an inch or so at the top end of the sections be left ungummed, so that the template may pass through, it will expedite matters, and the opening may be closed by gumming a circular piece of tissue paper on the apex of the balloon when all the sections are closed. As to the number of sections, there is no limit; but eight sections, 24 in. long and 6 in. wide at the widest part, will make a fair-sized balloon. The lower end should be, for this size, from 4 in. to 6 in. in diameter, and should be finished by turning the ends of the sections round a piece of thin wire, and securing with gum. Now fix two wires in the form of a cross in the mouth of the balloon; and in the centre fix a piece of cotton-wool or sponge, also attached with a piece of very thin wire. Saturate this with methylated spirits; and holding the balloons perfectly upright, set fire to the spirit, and in a few seconds you will have the satisfaction of seeing your balloon mount upwards either to the ceiling or the skies.—OPIFEX.

Transmitter. — A WOULD-BE ELECTRICIAN.—The drawing of the transmitter given on page 572, Vol. I., of WORK would not do to communicate between the two points mentioned by you; nor, in point of fact, between any two points. But a transmitter made like the drawing on that page would do very well if you had a receiver at the other end. The carbon pencil does not fit tightly into the carbon blocks; it must have room to shake, making only a feeble contact by its own weight, so that it will take up the vibrations of the diaphragm and set up a disturbance in the electrical circuit. You will require, if you are going to set up two telephone stations, besides the two transmitters, two receivers, two call bells, and two batteries, and a little more electrical knowledge than you seem to have. The Morse key is of little use in telephone work. If your wire is insulated with gutta-percha, you can run it under the floor. I am sorry to have to tell you that you cannot set up two telephone stations for business purposes or convenience without making yourself liable to prosecution for infringement of patent rights. You may, of course, set them up for experimental purposes, and there would be no harm in having them made against the good time coming, when we can make and use any form of telephone we choose. Your drawing is all wrong, but if you watch the pages of WORK you will get the proper method of connections, as I have already given them. I have no idea what a phonograph would cost; they used to be sold long ago for 20s. each, but now they are only let out on hire. So if you are dying to have one, I suppose there is no help for it, you must just die, but choose an easy way; do not attempt to hang yourself, for you might break your neck. I expect that shortly there will be an article on the phonograph in WORK, so if you are not in a hurry to die you might wait. —W. D.

Winding Gramme Dynamo.—J. KENNEDY.—As you altered the armature and made it 1¼ in. larger than the size specified in Mr. S. R. Bottone's book, you should also have made the carcase proportionately larger. Your F. M.'s are now proportionally too small to allow you to balance fully so large an armature. You do not say the exact amount of No. 18 wire you have got on the armature, but Mr. Bottono thinks you have probably something between 4 lbs. and 6 lbs. Had you made the armature the right size, 25 lbs. of No. 24 would about balance it as a shunt machine; now, 35 lbs. to 40 lbs. would be nearer the mark. But you will now be obliged to do with less, and probably 20 lbs. of No. 24 is as much as you will get on the F. M.'s. If you read carefully at page 113 of Mr. Bottone's book on "Electrical Instrument Making," you will see that tho ratio between the armature and the F. M. wire resistanco should be as 1 to 400. A 6 in. armature should have a coarser wire than one of 4⅞ in. You must now run the armature at a lower speed to avoid injurious heating. The F. M.'s must not be insulated from the standards. The machine will not work if the cores do not hold a little residual magnetism. Mr. S. R. Bottone, Carshalton, supplies all parts of dynamos.—G. E. B.

Gesso Work.—N. W. (*Clapham*).—You have not seen the first article on "Gesso Work" which appeared in WORK, No. 25. Gesso composition is sold by the Society of Artists, 53, New Bond Street, W. This composition is easy to use, as it is prepared in a manner that prevents its hardening before ample time has been allowed for modelling the subject in hand. In using plaster of Paris and glue, or whiting and parchment size, there is always the difficulty to contend with of the mixture hardening too quickly. It needs experience to get the right consistency. For this reason alone I recommended beginners to employ the ready prepared composition mentioned above. If you make your own gesso, the finest plaster of Paris must be used, and glue made from parchment. Warm the glue in a jar or pipkin; add the plaster of Paris. Stand the jar in a saucepan of hot water so that the gesso will get warm without boiling. Or warm some parchment size and scrape into it with a knife sufficient whiting to make a batter; warm as before. If required very hard, a little powdered resin is added. One part linseed oil to six of size is used for fibrous gesso. The cotton-wool is dipped into the composition, being first pulled into little pieces, then it is laid on the design where high relief is required, and modelled. This has already been explained in the articles in WORK. Fibrous gesso is also used for statuettes, as I may perhaps call them, to distinguish them from figures in high relief on a background.—E. C.

Air Gas Mixtures.—J. H. C. (*Stockton-on-Tees*).—The ratio of air to gas in gas engines is commonly obtained from a measurement of the gas consumption alone, the air being reckoned as the volume of the piston displacement, less the measured amount of gas. In engines of the Otto type it is about seven to one when the engine is working most energetically, but it varies with each engine, and, besides this, the gas supply is generally so arranged that more or less gas can be consumed as required. —F. B. C.

Magnetic Belts. — W. C. (*Dukinfield*).—Magnetic belts in themselves alone are useless as agents for the cure of dyspepsia. This complaint is caused in most cases by wrong food, or bad habits of living. A complete reform of these will effect a cure in time. I shall hope to give illustrated descriptions of these apparatus in my article on "Coils."—G. E. B.

Hard Wood Merchants.—AN OLD SOLDIER.—There are plenty of hard wood merchants in and around Old Street, E.C., who could supply you with all you require. For names of firms, please refer to back numbers, as similar replies to your inquiry have been given several times. If you do not live in London, write to me, through the Editor, stating exactly what you require, and I will try to get it for you.—A. J. H.

Heating a Bath.—S. A. R. (*South Shields*).—I am afraid you would find it quite impossible to heat the bath by means of a heater placed in the water, but if (as your letter seems to imply) you have any idea of your own you wish to work out, I shall be pleased to assist you. If you will send a rough sketch, showing relative positions of bath and wash-house, and also say if the bath is on a higher or lower level than the pot or boiler you speak of, I may be able to advise you. Have you gas laid on that would be available?—T. W.

Carrier for Lathe. — J. T. (*Northampton*) wants to be told how to make a carrier for the lathe, described in No. 17 of WORK. The simplest form of carrier that he could well use would consist of two pieces of tough wood about 1 in. square and 4 in. long, coupled together with a pair of ¼ in. bolts of a suitable length. This is a form of carrier that I frequently use for wood-turning. I give a side view of it in Fig. 1. The bolts there shown

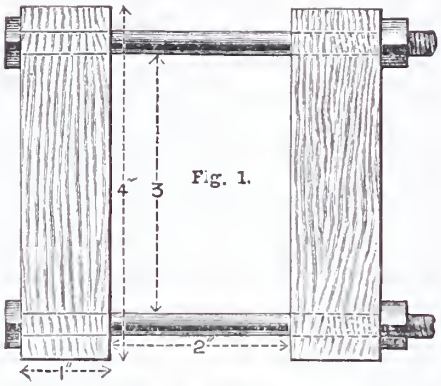


Fig. 1.

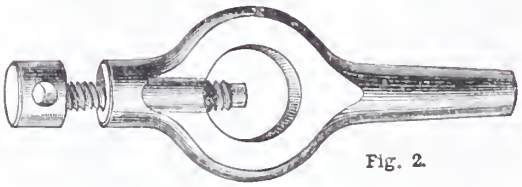


Fig. 2.

Carrier for Lathe.

are 4½ in. long, and would embrace a piece of wood from 2½ in. to 1½ in. thick. If it is required to turn a smaller piece, shorter bolts could be substituted, or a pair could be screwed for a long distance. As they can be bought for sixpence a dozen, I usually keep a good number on hand. I also prefer to have various carriers rather than trouble about changing the bolts. So will J. T. soon, if he uses the lathe much. For metal turning, this plan is sometimes used, but iron must be substituted for the wood at the sides. Stronger bolts too should be used; ⅜ in. or even ½ in. thick. The sides would not usually require to be more than ¾ in. square iron. The usual form of carrier for metal work, however, is shown in Fig. 2. The body of this may be forged, but malleable cast iron is now largely employed. The screw, which is proportional to the size of tho carrier, is steel with the point hardened. Castings may be obtained from Richard Lloyd & Co., Steelhouse Lane, Birmingham, at the following prices:—½ in., 3d.; ¾ in., 4d.; 1 in., 6d.; 1¼ in., 9d.; 1½ in., 1s.; 1¾ in., 1s. 4d.; 2 in., 1s. 9d. The finished carriers will cost for the same sizes:—1s. 3d., 1s. 6d., 2s., 2s. 6d., 3s., 3s. 9d., and 4s. 9d., respectively. The sizes above are those of the rod which the carrier will take. I wish J. T. all success.—SELF HELPER.

Ivory. — C. W. (*Ilfracombe*). — Apply to any worker in ivory, but if you do not know of any, Grew & Bridge, Summer Row, Birmingham, will probably be willing to supply you. As ivory is costly, I may recommend xylonite as a very good substitute in most cases.—D. D.

Silkworm Keeping.—H. M. (*Wolverhampton*).—When in the silk districts of Spain I have watched winding from the cocoons. They were placed in a shallow tub of warm water and stirred with a bundle of twigs to loosen the ends of the silk. A single thread, as spun by the worm, being too fine to wind off alone, several ends were twisted together so as to form a thread of moderate strength. This was passed through a hole in a piece of agate, and the silk of the several cocoons then reeled off together. Passing the thread through the hole in the agate is, of course, to remove impurities. I believe that sometimes a metal hoop is used for the purpose. The "Silk Supply Association," of which the address is, or was, Castle Street, Holborn, London, furnishes eggs, though for the quantity H. M. would require he would probably get them better through the medium of our advertising columns. I question whether he will be able to make silkworm keeping a "profitable pastime." English-grown silk, so far as I am aware, has little or no commercial value. The food on which the worms are fed in this country does not appear to contain a sufficient quantity of that glutinous material in which the mulberry leaves of warmer countries are rich. In England it is not probable that silkworm culture will ever be anything more than an interesting amusement for schoolgirls.—S.W.

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Lathe Mandrels.—NUTRIX writes (see page 159, Vol. II.):—"If J. T. (*Walworth*) will send me his address and a sketch of what he requires, I will make him any ordinary foot-lathe size mandrel of manganese steel for 12s."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. G. B. (*London, N.E.*); E. L. H. (*Liverpool*); CONSTANT READER; D. U. J. (*Portsmouth*); H. S. (*Stoke Newington*); L. G. U. (*Islington*); J. J. D. (*Carnarvon*); J. W. H. (*Sharrow*); TELEPHONE; J. R. M. (*Walton*); AMATEUR; CLOG IRONS; THOMASO; W. B. (*Wigan*); BETA (*Derby*); A WORKING MAN; IN DOUBT; A. T. (*Blackburn*); R. M. (*Glasgow*); J. O. (*Huddersfield*); STUFFER; J. S. (*Crieff*); J. P.; W. A. B. (*Salford*); A GLASGOW BOY; A WELL WISHER; C. H. C. (*Pimlico*); D. B.; U. C. W.; P. C. N. (*Shrewsbury*); EXILE; PHILIPPA; CHEMIST; PENKNIFE; B. BROS. (*Dublin*); A YOUNG ENGINEER; J. W. (*Homerton*).

Trade Note.

THE project for a railway from Jaffa to Jerusalem seems at last likely to be realised. The concession has been acquired by a French company, and the engineers have already proceeded to Jaffa to begin operations. The line is expected to be very acceptable to tourists and pilgrims, but as regards goods traffic it is a matter of little importance. Meanwhile a Constantinople paper states that the convention with M. Moutran for the construction of the Damascus tramways, and of the steam tramway from that city to the Hauran, has been signed, the concessionary having presented to the Porte a Franco-Belgian Company of sufficient financial competence. The centre of the tramway system of the town will be the square in which stands the residence of the Governor-General, and five lines will radiate from that point to serve the principal traffic routes thence to the outskirts of the city. The tramway to the Hauran will be worked by locomotive engines, and covers a distance of fifty English miles. The capital for this undertaking being ready, formalities fulfilled, and documents exchanged, there is apparently nothing to prevent the works from being pushed forward.

WORK

is published at La Belle Sauvage Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [24 R

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured.—ETHELBERT HENRY, Alvaston, Derby. [22 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [26 R

Patterns and Models to order. Castings, for Novelties, Model engines, Lathes, and Electric work.—F. CHARLTON, Starkey Street, Stockton. [27 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [28 R

For Sale.—Press and plough, sewing press, and strong (home-made) standing press. By letter (or after 6 p.m.) STEPHENSON, 31, Cranswick Road, South Bermondsey. [18

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

FOURTH EDITION. Price ***7s. 6d.***

Practical Electricity: A Laboratory and Lecture Course, for First Year Students of Electrical Engineering, based on the Practical Definitions of the Electrical Units. By Prof. W. E. AYRTON, F.R.S., Assoc. Mem. Inst. C.E. With Numerous Illustrations.

"In Prof. Ayrton's 'Practical Electricity' the student will find far more useful information upon instruments used by practical men than in any other work in this or any other language."—*Electrician.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

CASSELL'S CLASSIFIED CATALOGUE, containing particulars of upwards of **One Thousand Volumes** published by Messrs. CASSELL AND COMPANY, ranging in price from

THREEPENCE to FIFTY GUINEAS,

will be sent on request *post free to any address.*

CASSELL & COMPANY, Limited *Ludgate Hill, London.*

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

TO INVENTORS.

If you have an idea for an invention PATENT it for a trifling cost. Particulars and Pamphlet free.

RAYNOR & CASSELL, Patent Agents, 37, CHANCERY LANE, LONDON, E.C.

The Polytechnic Series.

Consisting of Practical Illustrated Manuals specially prepared for Students of the Polytechnic Institute, Regent's Street, London, and suitable for the use of all Students.

FIRST LIST OF VOLUMES.

Elementary Chemistry for Science Schools and Classes. By ROBERT AVEY WARD. 128 pp., crown 8vo, cloth, **1s. 6d.**

Forty Lessons in Carpentry Workshop Practice. By CHARLES F. MITCHELL. Revised by GEORGE CAMPION POPE. **1s.**

Practical Plane and Solid Geometry, including Graphic Arithmetic. Vol. I. ELEMENTARY STAGE. By Prof. HENRY J. SPOONER, C.E., F.G.S. **3s.**

Forty Lessons in Engineering Workshop Practice. By C. F. MITCHELL and E. G. DAVEY. Revised by J. ROGERS, M.A.S.E. Price **1s. 6d.**

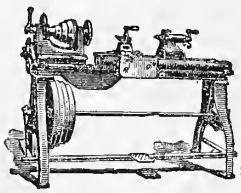
The Polytechnic Technical Scales. Ten Scales printed on card, in Case, **1s.**

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

JOHN AARON,

Engineers' Tool Merchant,

GAOL LANE, HALIFAX, YORKS.



Lathes, Pillar and Bench Drills.

SAWBENCHES.

SHAPING AND PLANING MACHINES.

All kinds of Tools, Chucks, &c.

SPECIALITIES IN AMATEURS' LATHES.

Catalogues free on application.

All inquiries have prompt attention.

TOOLS TOOLS

MOSELEY & SON.

323 HIGH HOLBORN.

200 PAGE-CATALOGUE BY POST 6P

ORDERS OF 10/- CARRIAGE PAID

CASSELL'S

TECHNICAL MANUALS.

Illustrated throughout with Drawings and Working Diagrams, bound in cloth.

Applied Mechanics. By Sir R. S. BALL, LL.D., F.R.S. Cloth, 2s.

Bricklayers, Drawing for. 3s.

Building Construction. 2s.

Cabinet Makers, Drawing for. 3s.

Carpenters and Joiners, Drawing for. 3s. 6d.

Gothic Stonework. 3s.

Handrailing and Staircasing. 3s. 6d.

Linear Drawing and Practical Geometry. 2s.

Linear Drawing and Projection. The Two Vols. in One, 3s. 6d.

Machinists and Engineers, Drawing for. 4s. 6d.

Metal-Plate Workers, Drawing for. 3s.

Model Drawing. 3s.

Orthographical and Isometrical Projection. 2s.

Practical Perspective. 3s.

Stonemasons, Drawing for. Cloth, 3s.

Systematic Drawing and Shading. 2s.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NOTICE!!

WE are *bonâ-fide* Makers of 300 Varieties of Lathes and other Engineers' TOOLS, many of which were designed for the British Government. Six Varieties of Fret Saws. Numerous Prize Medals. Our New Fret Machine, No. 8, cuts metals or ¾-in. wood: it is having a capital sale. Send 6d. for Catalogue; 2d. for List of Second-hand Tools. New and Valuable Book on Turning, 3s., post free. Cash or Hire Purchase. You are invited to call and inspect a Large Stock of above at

BRITANNIA CO., 100, Houndsditch, London.

ALL LETTERS TO BRITANNIA WORKS, COLCHESTER (ENGLAND).

Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

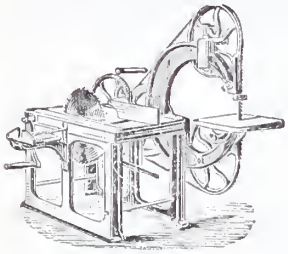
SOLD EVERYWHERE.

LEWIS & LEWIS,

ENGINEERS,

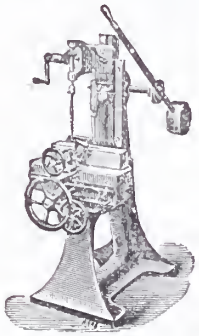
CAMBRIDGE HEATH,

LONDON, N.E.



THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,

For Hand or Power, will take in 22 in. Circular Saw, and will cut by hand-power up to 5 in. deep.



THE "HACKNEY" MORTISING & BORING MACHINE,

With 8 Chisels, 1 Coredriver, Key, 3 Augers, and 3 Drills.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic **WEAKNESS** speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place).

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

NOW READY, No. 350, price 1d., of

Cassell's Saturday Journal,

Containing the commencement of a NEW SERIAL ADVENTURE STORY OF LIFE IN THE FAR WEST, entitled *"CALAMITY JANE."*

Each Number of "CASSELL'S SATURDAY JOURNAL" contains 24 pages, illustrated, for One Penny.

The *Times* says:—

"'CASSELL'S SATURDAY JOURNAL' is the best and cheapest pennyworth of popular literature ever produced."

Public Opinion says:—

"'CASSELL'S SATURDAY JOURNAL.'—The success which this publication has attained is due entirely to its undoubted merits. The proprietors of the 'Saturday Journal' have never stooped to meretricious means—such as guessing competitions, which the Treasury threaten to pronounce illegal—to gain a circulation; but instead have given good sterling stories by authors of repute. The illustrations form a special feature, and well deserve praise for their excellent drawing."

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 68.] SATURDAY, JULY 5, 1890. [PRICE ONE PENNY.

THE GARDEN BARROW: HOW TO MAKE IT.

BY WHEELER.

IN making the body of a garden barrow we shall be able to buy our stuff ready sawn but to commence work with from any English timber dealer—*i.e.*, one who deals in nothing but English-grown wood. I have both bought planking and sawn up the stuff, and also bought it ready sawn from the dealers, and I find from experience that it is cheaper in the end to buy the stuff ready sawn. A list of the pieces which will be required in making the barrow body are enumerated below, namely, one pair of ash shafts, one pair of elm legs, one oak or ash top piece, one pair of front standards, one pair of oak slots, two pairs of ash side standards; also boarding for the barrow. This can be of birch or elm, or, failing these, we can get a spruce deal board, 11 in. wide, 1 in. thick.

When picking your stuff, be sure that it is well seasoned. As is usually the case, the pieces will be a little longer than required. This is on account of the different lengths of different barrows. In planing the above-mentioned pieces, always get two sides of a piece true, to work from. The squared sides should be marked, to enable us to see it at a glance; and, when setting the work out, to always have the true sides at the top and outer side. In wheelwrighting this is the general rule. Before we commence to plane our shafts or strines we saw them to the required length, which will be 56 in. or 60 in. long, 3 in. by 2 in. thick when planed. We next get our slots or swords. These will be $2\frac{1}{2}$ in., $1\frac{1}{4}$ in. thick, 22 in. long. Of course, these will be too long, but we do not saw them off now, but after they have been fitted. After these have been planed, we set our shafts upon a pair of joiner's trestles, and set them out with a long straightedge.

Now, this setting the framework out right is very tedious work, but it has to be done, and done properly, or, if not, the barrow will be, when finished, askew. The most effectual and easiest way I know of is to place the shafts upon a fairly level floor, letting one end of the shafts touch the skirting board or the wall. Now the shafts have two ends; one is called the wheel end and the other the handle end. It is the wheel end which will touch the wall. Get hold of the handle ends and draw them apart until you can measure $26\frac{1}{2}$ in. across the shafts at the handle ends, outside measurement. At the wheel end measure across the top $12\frac{1}{2}$ in., the measurements in both cases to be from outside to outside top edge of the shafts. We now place our slots upon the top. Measure from the front of the slot to the end

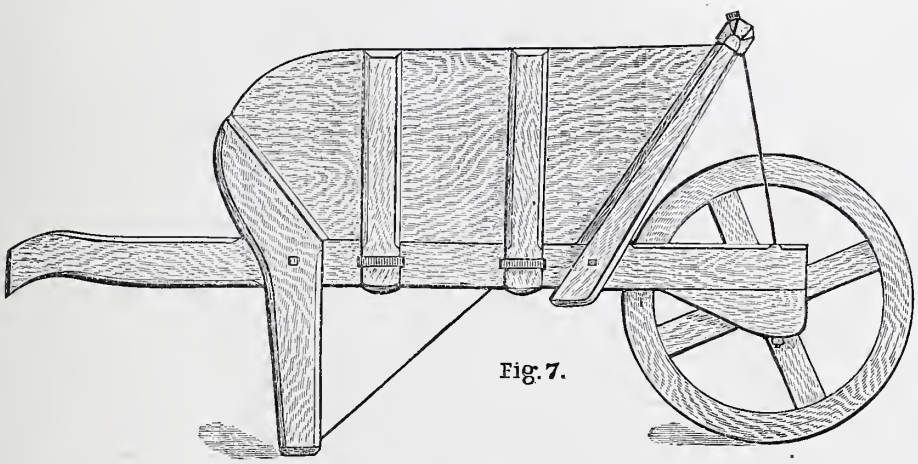


Fig. 7.

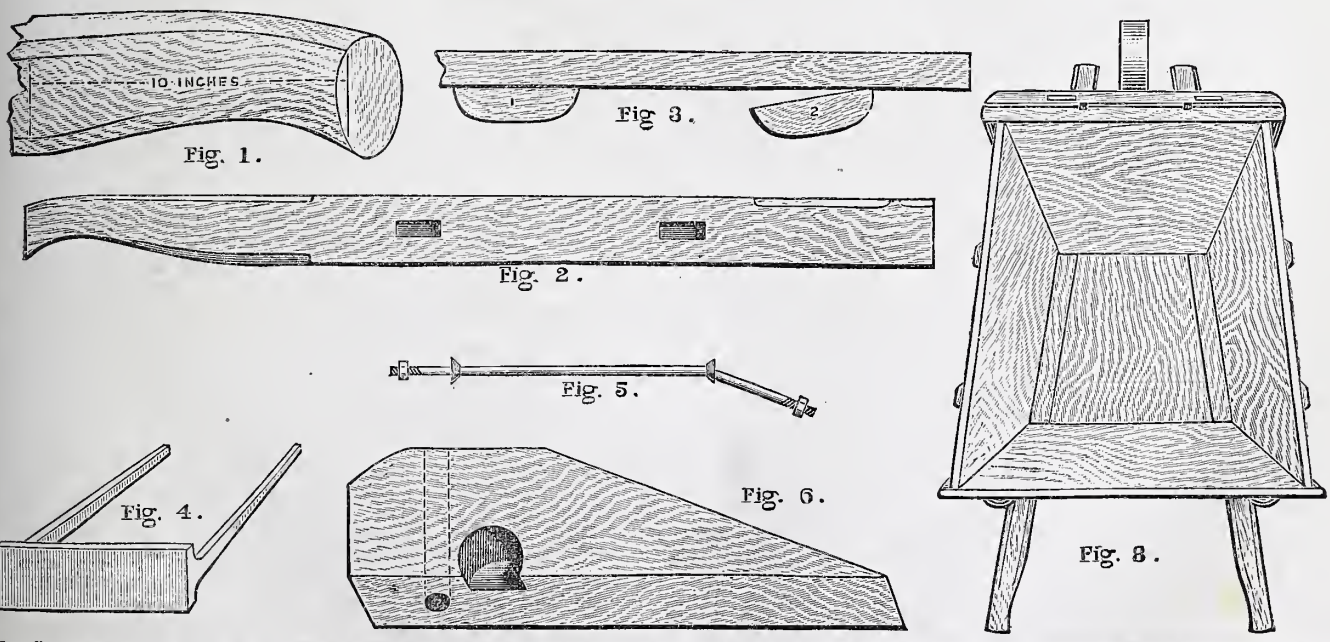


Fig. 1. Fig. 3. Fig. 2. Fig. 5. Fig. 4. Fig. 6. Fig. 8.

Fig. 1.—Curve of Handle. Fig. 2.—Shaft dressed off. Fig. 3.—Straightedge on Face of the Legs, showing Method of getting Legs set right. Fig. 4.—Square Staple. Fig. 5.—Front Iron Stay. Fig. 6.—Axle Bracket in Position as when put on Barrow upside down. Fig. 7.—Side Elevation of Barrow. Fig. 8.—Plan of Barrow seen from above.

of the shaft at the wheel end 18½ in. Measure and place the other slot 25 in. from the handle ends. When right, place your left hand upon the slot to steady it whilst you mark it with a sharp pencil. First mark the shafts, by running your pencil by the side of the slot, thus marking the shaft on the top. Also mark underneath the slot by running your pencil along the inside of the shaft. When each have been marked, number the end of slot and shaft to correspond when fitting them together again.

We now get hold of a shaft, and you will observe that, although the slot was placed upon the shafts straight, yet the lines which we have marked do not go straight across the top, but traverse it slanting upon the top, 2 in. squared. We now get our square and mark down the 3 in. sides from the top. Get your gauge and set it to mark out an inch mortise, this to be in the centre of the side between the two pencil lines. When we have marked all our mortises out we bore with a bit and pare the mortise out with a sharp paring chisel. In boring and paring always meet half way, and try each tang, or tenon of slot, in its respective mortise. These tenons should fit in their places to a nicety. Of course, when we knock the slots in the mortise, we see that they only go in up to the pencil line previously marked upon the slot.

After we have put the framework together and found it right, we knock it asunder, and commence to dress the shafts off. In the first place, we chop some of the wood away from the inner side at the handle end. We next get our pencil and draw a curve underneath the handle end, or, better still, make a drawing on stiff paper, then cut it out with the scissors. Place the drawing, when cut out, upon the handle, and mark out with the pencil from the end of the handle to the curve, which runs into the full thickness of the shaft, the length of which is 10 in. (Fig. 1). This can be sawn out or chopped with the adze. After the curve of the handle has been chopped out, we commence to dress the shafts off. This is merely chamfering the edge in the same way as an Oxford frame. The chamfer is ½ in. wide in dressing the barrow throughout, so we, therefore, set our gauge a quarter of an inch to mark both sides of the shaft. In dressing out the shafts, we only dress the top off at the front, or wheel end, but at the back we dress off all the edges. Measure from the handle end 17½ in. From this measurement we commence to take the average off up to the handle end. Use your spokeshave round the handle, and leave it full at the end, so that the hands, when grasping the handles, will not slip off. Use the smoothing plane on the straight dressing off.

We now mark the front measure, 12½ in. This must be on the top of the shaft only. From the end we again measure 2½ in. in the centre and on the top. Get your square and mark across the top, down the side, and underneath the shaft again. Next get your brace and bit, and bore a ½ in. hole. This is to receive the front iron stay, which holds the head, or top piece, up in its place. We now dress the top edges off as in Fig. 2, which shows the shaft ready dressed off. We now fix our slots in the mortises, and knock the framework together. Before sawing the tenons off level with the outside of the shafts, measure across the wheel end to see that it is 12½ in., and the handle ends across the top of shafts 26½ in. We next knock a nail through the centre of the tenon and mortise, afterwards sawing the tenon off level with the outside of the shaft. Also insert two wedges in the tenon, to keep it tight in the mortise. Saw the ends off, and afterwards plane the outside of the shafts up a little to smooth it.

We now fix the bottom in its place. This can be of birch, oak, or any hard wood, 1 in. thick. This will be all in a piece, or, failing a piece, we can use two pieces, joining them. We do not plane the piece up, except at the sides, to ensure it fitting close up to the inside of the shafts. If we cannot get any hard wood, we shall have to use spruce deal. This bottom, when fitted in its place, should come over the ends of the slots just an inch. In nailing, use the 2 in. round wire nails, and, as the points come through, clinch them with the hammer.

We now get our barrow legs. These are generally of elm. If you have bought the legs ready sawn, you will have nothing to do but dress them off. In the first place, plane the legs up. The top part, where the back boarding is nailed to, has been, or should be, sawn to a bevel of 45°. Place one of the legs upon the shaft, letting the bottom of the bevel come in a line with the top of the shaft. This leg should cover the tenon in the mortise, say, about 1 in. from the back of the leg to the handle, and about 18½ in. or so, according to the length of the shafts. Whilst the leg is in this position, get your pencil and mark the leg by running the pencil along the top of the shaft and underneath. From these two lines we mark at the back with the square, then set our gauge ½ in., and mark from the side which rested against the shaft. We get our saw and saw this bevelled rebate out, afterwards paring it out with the chisel. When one leg is rebated and fitted to the shaft, get the other leg and fit it to the other shaft, exactly as we did the first.

We now get a long stay bolt, screwed at each end, and fitted with an iron washer and nut, the stay 27 in. long, ½ in. round iron. Bore a ½ in. hole through the centre of the leg and shaft, and see that both the holes are bored in a straight line with each other across the shafts. Screw a nut upon the end of the stay, and drive through a leg into and through both the shafts; then place the other leg on the end of stay, knock the leg on the shaft, put your washer and nut on, and screw the legs up in their places. We now place our straightedge across the face of the bevel. If you can move the straightedge, and, at the same time, let it touch the bevelled front of the legs, then they are set right; if it is as Fig. 3, it shows that the bevel requires a little more paring out in the rebate which fits upon the shafts. When we have got the legs fitted right, we take them off, and commence to dress them. The bevelled part, where the back is nailed to, is not touched, but all the other edges are.

We now get a pair of front standards. These are of ash or oak, 20 in. long, 2 in. thick, 3 in. wide at the bottom, and at the other end 1½ in. Plane two sides of this front standard true. After it has been planed, we place the standard against the shaft, letting the 3 in. bottom end of standard lie against the outside of the shaft, and 13 in. from the front of the standard to the end of the shaft. Let the standard slope at the top end towards the wheel end at an angle of 55°. Next, get your pencil, and mark the inside of the standard, by running the pencil on the top of the shaft. The face side of the standards at the 2 in. side looks towards the inside of the barrow. From this side we mark half an inch down from the pencil line which we have just marked on the standard. We saw this bevel out, and fix upon shaft. We next get the other standard and serve it exactly the same, always taking care to fit each standard to its shaft in marking out. We test the standards in exactly the same way as we did the legs. When right, we dress the front of the standards off. We also place a stay bolt through the standards and shafts same as we did the legs; but, of course, the front stay bolt is not so long as the back one.

We now get our top piece. This is a piece of ash or oak 28 in. long, 2¾ in. by 2½ in. thick; we also plane this piece true. Before proceeding further, measure 12½ in. from the top of the shaft up the front of the standard. When you have marked both standards, lay your straightedge across the front of both standards and mark across them both with the pencil; from this pencil line we square each side of the standard. Then set our gauge 1 in. and mark all round from the true side; we saw the superfluous away with the tenon saw, thus leaving a 1 in. tenon, the ½ in. shoulder which we have just sawn away being at the front. Having planed our top piece, which will now be 2½ in. by 2 in., we place the 2½ in. side upon the shoulder of the standard, measure from the end of the top piece to the side of the standard, and see that they are at an equal distance at both sides. Next, run your pencil up each side of the tenon, thus marking the head piece; get the top piece off, and setting your gauge 1 in., mark from the top and bottom (after the pencil lines have also been squared from the lines previously marked on each side of the tenon). After we have marked our 1 in. mortise out, we bore and pare it out nicely; let the tenon slip in easy in the mortise. We next plane the two top edges off, the underneath edge at the front; we dress out between the standards, and from each standard to the end.

We next get four side standards, or brackets; these are generally of ash. The smallest length which fits against the side of the shaft is straight; it then runs up to a bevel of 65°. These side standards are 17 in. long, 2 in. wide, 1½ in. thick; place one near the front standard, and the other near the leg, mark each side of the side standard, bore a hole each side where marked, and drive in your square staple (Fig. 4), to hold the side standards in their places. We now get the side standards out, and take the average off the outer edge a little; do not dress the front part off which comes against the square staple, but leave it as strong as you can.

We now board the front, and this boarding throughout must be 1 in. thick. If we have not got a piece which will fit between the top piece and the bottom of the barrow, we shall have to get and joint two pieces together. Bevel the bottom of the board first, so that it rests upon the bottom of the barrow; next, plane the boards up and nail to the front standards; get your staff and pencil and mark from the head piece end down the bottom of the boarding up to the bottom of standard. Get your saw and saw down this line; serve the other side the same; we now get our board nailed to the level of the legs. This back will be 9½ in. high; plane the board up and bevel the bottom, to ensure it fitting—it should come over the outside of the legs a few inches at the top, then sawn down slanting, until it touches the side of the leg.

We now nail the back to the legs, then afterwards, saw and fit the sides in their

places. Get your piece and mark it out at an angle of 55°; this is for the front; measure the distance between the front board and the back, then mark again a bevel at an angle of 45°; saw these sides out larger than required, as a great deal will come off in fitting them in their places. If we have not got a piece which will do for a side we shall have to use two pieces, putting the smaller piece at the bottom. After the sides are in—the height of which will be 14 in.—and when the sides are nailed on to the side standards, get your saw and saw the top of the legs and side standards off level. We now round the sides down to the top of the back.

Next, get your front iron stay (Fig. 5). This is a piece of ½ in. round iron, screwed at each end, and fitted with a washer and nut, and is 20 in. long; bore a hole through the top piece just over the hole in the shaft, take the top piece off, place your stays in the shafts, then knock the top piece on to the top of the stays. Then insert the tenons in the mortise, knock the top piece in its place, and screw up the stays; next, get a couple of wedges put in each tenon on the top piece, then saw the tenons off level with the top piece; next, round the ends off, first by sawing, then finish off with the spokeshave.

We now get a pair of axle or wheel brackets (Fig. 6). First, bore a hole through the bracket and fit it on the stay. Bore an inch hole in the bracket for the axle to revolve in; do not bore the hole too deep or the wheel will work itself out—about ½ an inch or so will be plenty. You will find that fitting the wheel in its place right is a very troublesome job; the general way to do it is place the wheel in its place, letting the axle rest upon the shafts; of course, the barrow is now upside down. Measure from the rim of the wheel to the side of the shaft; if right at the other side, give the wheel half a turn and measure again. We do this until the measurements are alike, or nearly so; get your pencil and mark round the axle, then mark the side of the wheel which comes to the right- or left-hand side of shaft, so that the axle will get back to its right place. Get your chisel and take a very little out of the shaft where we have just marked it, put the wheel in its place again, then put the brackets on. If you will now hit the bracket just over the axle, it will cause the axle to mark the bracket; this will have to be pared out with the gouge until the brackets fit nicely upon the shafts; rub a little oil upon the axle, and screw the brackets on their respective places.

We now require an iron leg stay for each leg; these are also of ½ in. round iron; the hoop which encircles the leg is 2 in. diameter round the leg. Knock the stay on, then get some very small iron wedges or nail stumps and knock in the wood next to the iron, to swell the bottom of the leg to keep it tight within the stay. We have now to nail four ribs in the corners of the inside of the barrow, and also four at the outside; these are so simple to make and fit that they call for no explanation.

We can now give the barrow a coat of priming colour; when dry, which will be in the course of a day or so, fill all the nail holes, cracks, etc., up with putty, then give it a couple of coats of red lead, or Brunswick green paint, ground in oil with driers, or whatever colour you may fancy. As I have only this article on the body of the barrow, I leave it to my readers to buy their wheel, which will cost them, including strong iron axle, about six or seven shillings, or perhaps you may have an old wheel, thus making a new barrow body for it.

BRICKLAYERS' WORK.

BY MUNIO.

Setting Out.

There are various methods employed in setting out a building. One is to stretch a line along the front, and fix another line at right angles to it, on the end or gable; another method is by centre lines at right angles through the centre of the building. In either case the lines should be squared by a large square set level, and the lines should be kept parallel to the blades of the square. From the two lines thus obtained, the remaining walls should be gauged. The walls should not be gauged from wall to wall, as an error in one would be carried through the whole. These lines can be checked by gauging the full length; the square should, of course, be perfectly true. An approximate method of squaring, which is sometimes used in setting out excavations, is as follows:—Fix one line and set the other as near at right angles as you can; then measure 6 feet on one line and mark it, and 8 feet on the other line, also marking it. If the lines are square, the distance between the two marks will be 10 feet.

When commencing the walls, a fixed mark or level should be set to work from. This may be the ground floor level; a post is driven in, or a fixed mark set, and from this all measurements should be taken. Should there be any addition to or deduction from the plan, it can be ascertained from this mark, and the dimensions of any additional work should be taken when built, as it will save the trouble of digging holes after the building is up. After the footings are brought up to the net size, the bond should be set out, marking off all openings for windows, doors, etc., and should there be broken bond, it should be worked under an opening, if possible. Broken bond occurs when the space between two quoins requires a closer less than a header or stretcher. If the broken bond is in a pier, it must be carried up from the bottom, in order to keep the perpends, that is, all the vertical joints to be exactly plumb over each other. The ingenuity of the bricklayer will be exercised in setting out the broken bond. Thus, for a stretcher and a quarter brick closer, he would substitute a header and a three-quarter closer, or, in Flemish bond, three headers in one course, and two stretchers above them in the next course.

Joints.

In carrying up the building, the joints should be kept as near of one thickness as possible, or the work will get out of level. After the first course is levelled round the building, a mark should be made at each quoin, and the plumbings, or "settings up," should be gauged from this mark. A rod or lath should be provided, the height of one story, with the level of sills and heads marked on it. This is a much better plan than using a two-foot rule, which is often done.

The joints of brickwork should not be made too thick, but the thickness will depend to a great extent on the quality of the brick used. Thus, a pressed brick, with an even, straight surface, will require a much thinner joint than a hand-made brick, the surface of which is rough, and a machine-made brick would require a joint somewhere between the two. The bricks for facing should be selected as near the same length and thickness as they can be got, selecting those with good square ends, for the quoins and reveals. In dry weather the bricks require sprinkling with water, as there is generally dust on the beds, which prevents them adhering properly to the mortar. Some qualities of bricks will require more water than others, being more porous. In wet weather the bricks should be stacked, or they will be saturated, and unfit for use till dry.

In walling a long length of brickwork, the line is apt to sag or droop in the middle. A brick should then be bedded in the middle of the course, and sighted from the quoins till straight; the line is then fixed to it by a small loop of cord, which is held by a piece of mortar, and a brick laid upon it. This is called a "tingle" brick. When building curved or circular work, plumbings are set up at various points, and the wall between these points worked by a curved rule; the plumbings should always be made at one place, a mark being carried up the face of the wall. In setting window sills and door thresholds, they should be bedded at the ends only, leaving the middle of the joint clear, or they are almost certain to be broken by the settlement of the brickwork. When three or four sills are in one range, the two outermost should be set first, and the others set to them by a line.

Damp Course.

As soon as the walls have been brought up to the level of the ground, a damp proof course should be laid on them to prevent damp being drawn up from the foundations. Different materials are used for this, sometimes slates bedded in Portland cement with the joints overlapping are used; sometimes a coating of asphalte, laid on hot, is used. In either case, they should be set hard, before being built on. A material, called fibrous asphalte, is also used. It is made in sheets, the width of the walls, and 32 in. long. It is laid with the joints overlapping each other 2 in., and appears to answer its purpose very well.

Air Bricks.

When the ground floors of a house are wood, air flues should be formed through the walls under such floors to admit of the circulation of air under them, or they will soon rot. Air bricks or grates are fixed in the face of the walls outside these flues. These should be galvanised, if of cast iron; they are also made in glazed stoneware.

The ground floor joists are supported on walls built under them, called sleeper walls. The hearths also have solid foundations built under them to rest on.

Inverts.

When a large building, such as a mill or warehouse, containing a great number of openings, is built, it is usual to form inverts, or inverted arches, on the top of the footings across the openings, in order to distribute the weight over the whole of the foundations. Fig. 28 shows an invert. The bottom of flue openings in tall furnace chimneys are formed with inverts. The lower half of barrel arches, culverts, and drains, are inverted arches.

Wood Bricks, Bond Timber, and Iron Bonding.

Wood bricks are walled into the quoins or angles of windows, doorways, and other openings for fixing the casings and linings. These should not be more than ¾ in. thick, as when made thicker they often get loose from the shrinking of the wood.

Bond timber was formerly much used in brick walls, and across openings to keep the

work in line while being built, but as the wood was found to shrink after being built in, thus causing settlement, it is now nearly superseded by hoop iron bond, which is laid in the joints; the iron is generally coated with tar.

Relieving Arches.

Relieving arches are built over wood lintels, and sometimes over stone heads. They should spring from the ends of the lintel, as shown in Fig. 29; they are generally turned on a core or centre formed of brickwork, which should always be taken out as soon as the arch is backed up, and filled in again after the building has had time to settle. When large beams or girders for carrying floors, etc., are to be laid on the walls, a piece of hard flagstone, not less than 18 in. long, should be laid under them to give a larger bearing surface. These are called templates.

In carrying up the walls of a building, no portion should be carried more than one scaffold height, or about four feet above another, and in setting up the quoins they should be returned and sloped back, not set over, or toothed, as they are often done. The cross joints of the bricks should be well filled right through with mortar, and each course, as it is levelled up, flushed with mortar. This is better than "grouting," which consists of mortar mixed thin with water, and run into the joints, as after the water has evaporated the joints are left only about half full, and have to be gone over again. When the wall is very thick, a little water may be put in the mortar to make it work better, but each brick should be jointed right through with the trowel and flushed in at the top when levelled up.

Flues.

Great care should be used in building the flues. They should be carefully smoothed and plastered inside with lime and hair mortar, and should be made about 14 in. by 10 in. inside. Sometimes they are formed with fire brick tubes or pipes, called flue linings. The opening over fireplace is arched over, as shown in Fig. 30, the arch being turned on an iron bar turned

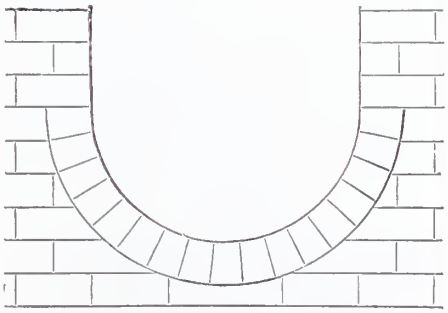


Fig. 28.—Invert.

up at the ends as shown by the dark line. As soon as the arch is turned, the flue should be set in to the size, flag stones or iron bars being used to support the bricks. If gathered over, or sloped, a cavity is formed just above the grate which is almost certain to cause a smoky chimney. The flue should be sloped to one side of the breast to allow room for the fireplace on the next floor, and no sharp angles or bends should be formed in it. When the flues from two rooms have to be gathered into one stack, an arch is turned between them to carry the flues; when the flues are brought through the roof, they sometimes require sloping in, and if a dressed stone is

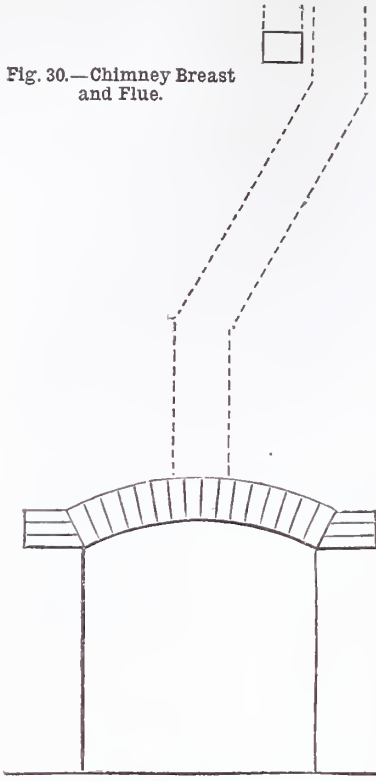


Fig. 30.—Chimney Breast and Flue.

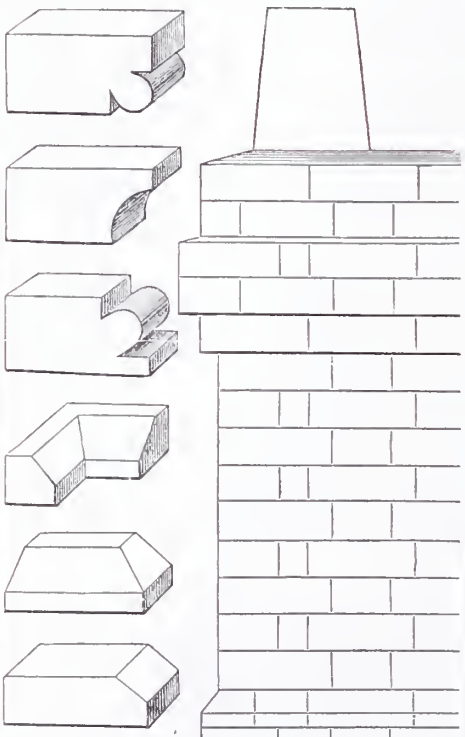


Fig. 32.—Moulded Bricks.

Fig. 31.—Chimney Stack.

not used, the bricks are walled as shown at A (Fig. 31). A plinth course is generally put on above the ridge, the bricks for which are moulded. The top of the chimney stack is finished by projecting courses called oversailing courses, as shown in Fig. 31. Sometimes moulded bricks are used as a cornice; these are shown in Fig. 32. The top of chimney stack and oversail courses should be pointed with Portland cement, sloped to throw the wet off. Chimney pots should also be well pointed round with Portland cement. When a ventilating flue is carried from a room, it should be formed 9 in. by 4½ in. inside, and carried from just below the ceiling level, as shown in Fig. 30.

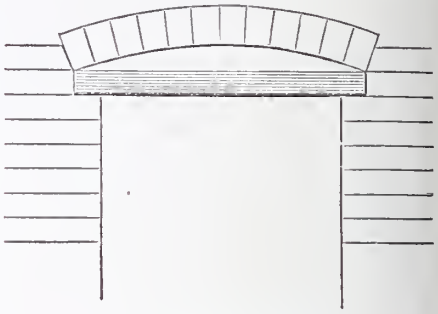


Fig. 29.—Relieving Arch.

The grates are set with fire bricks, neatly cut to shape and set with thin joints. The chimney pieces are fixed with fine mortar, mixed with plaster of Paris, and the tops of jambs fixed by brass cramps, let into the brickwork.

MILLING CUTTERS.

BY DAMON.

Such a large variety of work may be accomplished by the use of milling cutters, either in the lathe or in a special milling machine, that there is no doubt they would have a much more extended use if they could only be procured cheaply. In many of our modern workshops milling machines have almost entirely superseded shaping and small planing machines, as they will turn out more work in the same time. The price of the cutters is, however, prohibitive to many amateurs and small mechanics who have only a limited amount of work to do with them, and who are not overburdened with capital. I propose in the present paper to describe the method of making, hardening, and sharpening these cutters, for the benefit of such readers.

A handy little machine for the manufacture of the cutters is shown in the accompanying sketches. The same letters apply to all the views. Fig. 1 is a front elevation; Fig. 2 a side elevation; and Fig. 3 a plan. The machine is easy and cheap to make, and may be easily made by any one having only a moderate amount of skill as a "fitter." It consists of a table A on which slides the carriage B, which is moved forward or backward by means of the hand wheel and screw C. The spindle S of the machine is carried by the frame D, one side of which is extended to form the handle *d*. The frame D is mounted on the shaft E. By means of the handle *d* the spindle may be made to describe an arc, as shown by the arrow (*see* Fig. 2). The dead-centre S can be taken out by unscrewing the nut N to allow the different cutters to be put on the spindle, on which they are fastened by the little nut and washer shown. E also

Fig. 7.—Grinding Apparatus.

Fig. 6.—Cutter Blanks.

Fig. 4.—Mandrel. [*a*, *a* are turned to fit Bush on which Dividing Wheel H is keyed.]

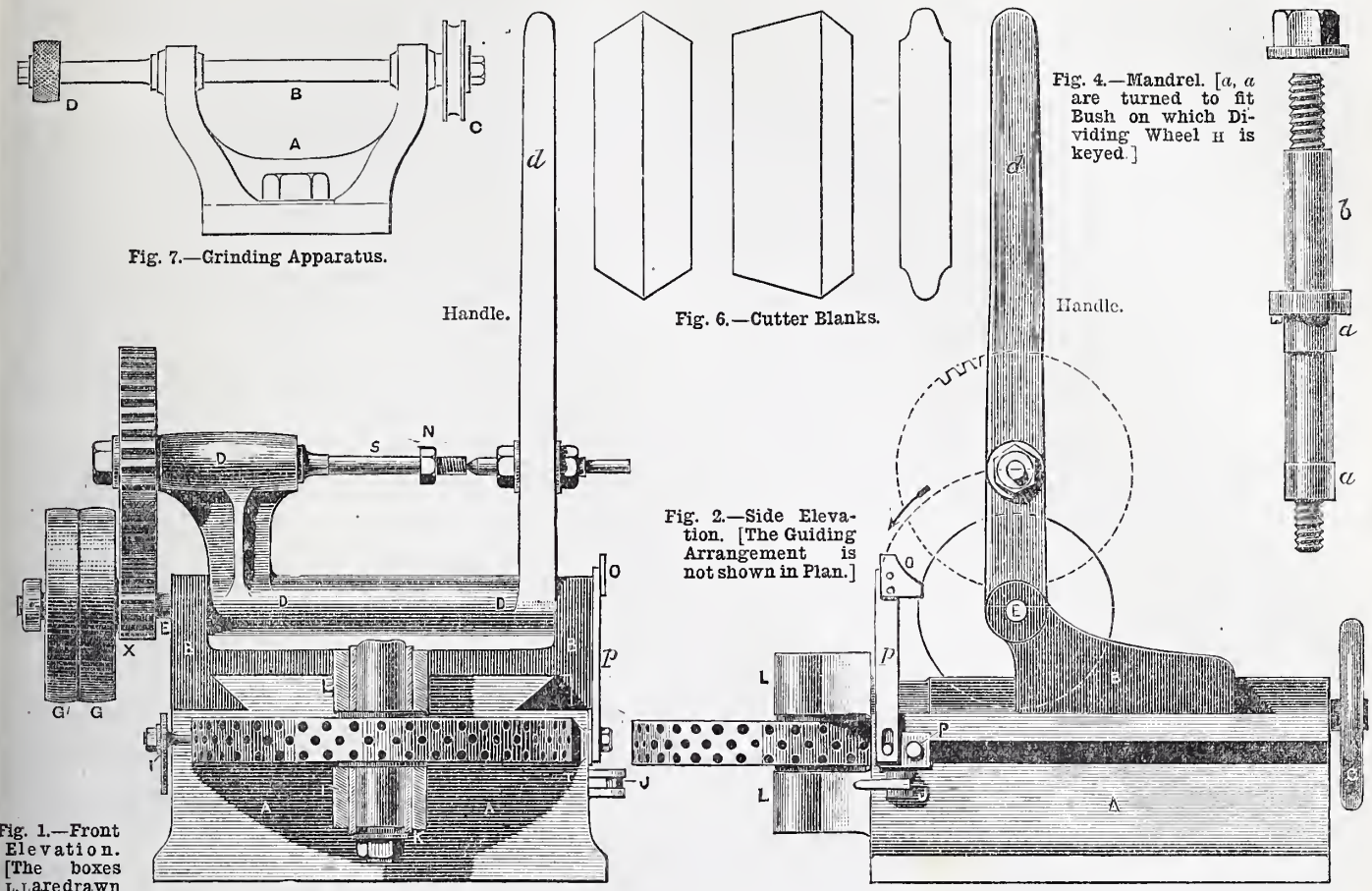


Fig. 2.—Side Elevation. [The Guiding Arrangement is not shown in Plan.]

Fig. 1.—Front Elevation. [The boxes L, L are drawn in section to show how Mandrel is fastened in.]

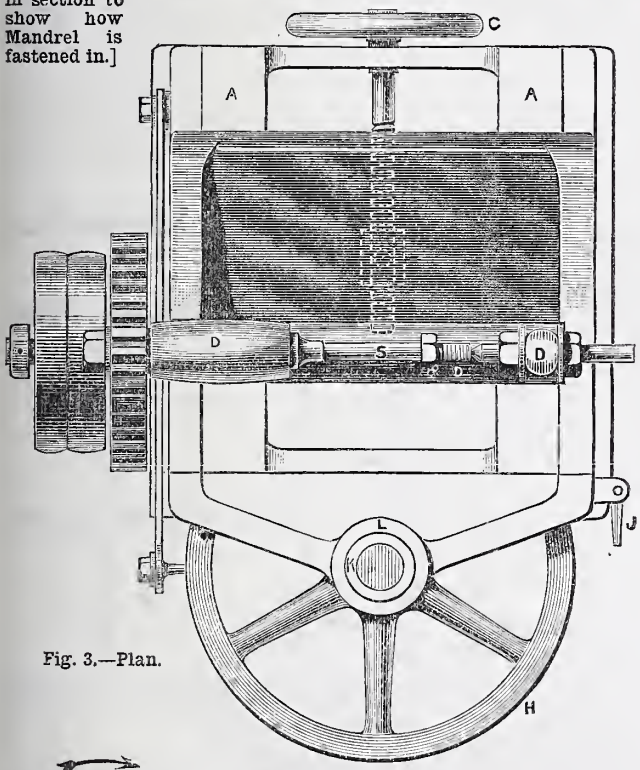


Fig. 3.—Plan.

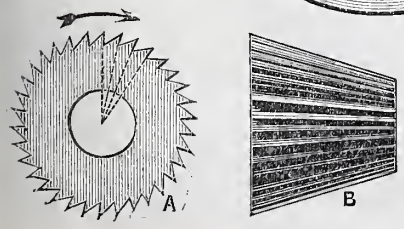


Fig. 5.—Cutter for use in Machine—A, Plan at Larger End; B, Side View. (Figs. 1, 2, and 3 are about quarter size.)

carries the two pulleys G, G′. The outside one runs loose on the stud. On the boss of the inside one (G) is keyed a pinion (X) which gears with the wheel on the end of the spindle, thus transmitting the power to the cutter. H is a dividing wheel, the periphery of which is drilled with any suitable number of holes. Three rows, having respectively 32, 30, and 25 holes, will be found as suitable as any. They may easily be drilled in the lathe by means of the dividing plate. I is a pointer, which may be thrown out clear of the wheel H by the eccentric handle J. The dividing wheel H is keyed on a bush K, which turns freely in the bosses L, L. Various mandrels are made, as shown in Fig. 4, to hold the cutter blanks while they are being operated on in the machine. The part *a* (Fig. 4) is turned to fit the hole in the bush K. A small peg is inserted in the side which fits a notch in the bush, and prevents the mandrel turning round when it is being screwed up. The part *b* of the mandrel is turned to fit the hole in the cutter blank, which is fastened on by the nut and washer shown in the sketch. The small cutters which are used in this machine can have the teeth filed in by hand. They need only be from an inch downwards in diameter. A piece of steel rod is taken the required length, and drilled to fit the spindle, which may be $\frac{3}{8}$ of an inch in diameter. It is then driven on a mandrel, faced up on the ends in the lathe, and turned to the required size and taper. The amount of taper is determined by the amount of clearance it is desired to give to the teeth of the cutter we are going to make. It also varies with the diameter of this cutter. Taking two cutter blanks, one say two inches and the other three inches in diameter, the cutter used in forming the teeth in the first case would require less taper than in the second, to give the same pitch of teeth. As you are rather limited in choice as to the number of teeth, it is best to set out the shape of the teeth on a piece of tin, and file it up as a template to turn the little cutter blank up to.

Having the little blank turned up we proceed to file the teeth. The cutting face should be in a plane radial from the centre of the spindle, as shown in Fig. 5. Having filed the teeth as evenly as possible, the little cutter will require hardening and tempering. It should be heated to a "cherry" red and cooled in water; then polished on the ends, and carefully let down to a "nut-brown" or "dark straw" colour. If the profile of the cutter is angular or symmetrical like those shown in Fig. 6, we shall require two small cutters such as have just been described, one right-handed and one left-handed. When cutting, the spindle of the machine must be guided to form the outline of the cutter. The guiding arrangement of the machine in question is shown in Figs. 1 and 2 but not in Fig. 3. It

consists of a slot T planed in the side of the table A. A plate P slides along this slot and may be fastened in any position by the bolt shown. To this plate is screwed another plate *p*, which stands vertically. The screw which fastens this plate passes through a slot, to allow of vertical adjustment (*see* Fig. 2). To the top of plate *p* is screwed the template O which is carefully filed up out of a piece of sheet steel about $\frac{3}{32}$ in. thick. The tail end of the dead-centre is extended beyond the handle *d*, and rests on this template. It is held down upon it by the pressure of the hand, when the machine is working, and may be lifted up clear of it when it is desired to examine the progress of the work.

The cutter blank, having been carefully turned to shape and polished, is slipped on the vertical mandrel and fastened by the nut. The number of teeth having been settled on, the pointer I is set to that row of holes in the dividing wheel H, a suitable cutter is put on the spindle S, and the proper template screwed to the plate *p*. The larger face of the cutter on S must be carefully set in a line with the centre of the vertical mandrel. This may be done by packing it with suitable washers. The reason is, of course, to make the cutting faces of our cutter radial. We are now ready to start. In starting the first tooth care must be taken not to cut the full depth, a mere mark which will show the cutting edge only being required. The blank must then be moved round to the next tooth, and the template O adjusted till the spindle is following the right shape. We may now cut all the teeth, going the full depth with each one as we proceed, just leaving the "turning marks" in. If the shape of the blank requires it (*see* Fig. 6), it must now be turned over and a little cutter of the other hand used to cut that side. The blank is now ready for filing up. If it is intended to grind it before use this filing up may be omitted. If the teeth are filed, care should be taken not to make one smaller than another or the cutter will "run out," and not leave so good a finish on the work. Besides, the largest tooth getting an undue share of the work will soon wear dull, and greater power will be required to drive the cutter, and if it is being used in a foot lathe the workman will soon appreciate the fact. If the outline of the cutting face is curved, as in the case of a cutter forming the teeth of wheels, it cannot be filed, nor yet ground without special apparatus for guiding the emery wheel, which it would not pay the occasional user to obtain. A scraper made out of a square or triangular file, used endways, may be used in these cases.

The cutter is now ready for hardening, though if a key-way is required it must be cut first. If it is required to stamp or mark it, of course it must be done while the cutter is soft. For hardening, a good fire must be made, and the cutter heated to a dull red, then "potashed," to make up for the carbon burnt in heating, and further heated to a cherry red, care being taken to heat it equally all over, or it will probably crack in hardening. When sufficiently heated, it should be taken from the fire and plunged steadily, with the flat side downwards, into a trough of water. When cold, the sides of the cutter and the backs of some of the teeth should be polished with emery cloth, so that we can accurately observe the colour in tempering. An iron rod, rather less in diameter than the hole in the cutter, is now heated. It is better, by the way, to have two such rods, so that as one cools the other may be heating.

The cutter, having been oiled all over, is slipped on the hot rod, and turned round so as to apply the heat evenly. The change of colour must be carefully watched. A "dark straw" or "nut brown" is about right. When the change of colour has reached this stage the cutter must be plunged in cold water. When wiped and oiled it is ready for use, or grinding, as the case may be. If the hole in the cutter was bored a good fit on the mandrel, it may possibly be found to be too small now. If this is the case, a "lead lap" and emery powder will soon rectify matters.

The machine which has just been described is not suitable for making cutters the cutting faces of which are parallel with their axis. The reason may easily be seen by looking at Figs. 1, 2, and 3. The axis of the blank is vertical, and the spindle S of the machine cannot be made to describe a vertical line, and cut properly. This class of cutter may, however, be easily cut in the lathe, by first making a cutter which will give the proper shaped tooth. Use this cutter in a horizontal cutting frame in the slide rest, having the blank on a mandrel between the centres.

For any other class of cutter, however, the machine is perfectly suitable. Where there is only a small face parallel with the axis, the slight concavity which the cutter gives to the tooth is easily removed with a file.

For surfacing large areas, the teeth of the milling cutter should be in a helical or "screw twist" form. These are best cut in the lathe. The slide rest is arranged as for screw cutting, so that it moves sideways while the blank is turning round the right distance. The pitch should be such that as one tooth is leaving the work, the next is just starting. By so arranging them, the cutting of the teeth is smoother, and they are not so liable to break off.

When a cutter becomes dull with use, it may be sharpened by grinding. A little grinding apparatus is shown in Fig. 7. It is adapted for fastening on top of the slide rest. It consists of a bracket A which carries the spindle B. At one end of the spindle (or in the middle, according to fancy) is a pulley C, and at the other end the little emery wheel D. The cutter which requires sharpening is put on a mandrel between the lathe centres. It is as well, if possible, to use the mandrel on which it is going to be used. By doing so we ensure its running true. The emery wheel must be at such a height that it will give the necessary amount of clearance to the teeth. It is driven by a cord from the overhead motion, and is traversed across the face of the cutter by means of the screw of the slide rest.

I do not recommend doing much grinding on a good lathe, because the emery dust gets into the bearings, and on the slides. A serviceable grinding machine can be improvised out of an old slide rest and a pair of centres. By taking the wheel off the end of the spindle S in the machine described above, and putting a small pulley in its place, with a small emery wheel on the spindle instead of a cutter, the machine may be used for grinding. I have done this with fairly satisfactory results, except in the case of wheel cutters, which I prefer to "scrape" to a cutting edge. I trust that the machine which I have endeavoured to describe will be found useful by many.

NOTES ON GLASS PAINTING.

BY FRED MILLER.

LEADING.

PROFESSIONAL glass painters do not have anything to do with the leading. All they do is to design and trace, the glass being cut by glaziers, who lead it together when it is painted and burnt.

The designer makes what is termed an outline, that is a kind of tracing of the window showing the shape of the various pieces of glass, and as a result of this where

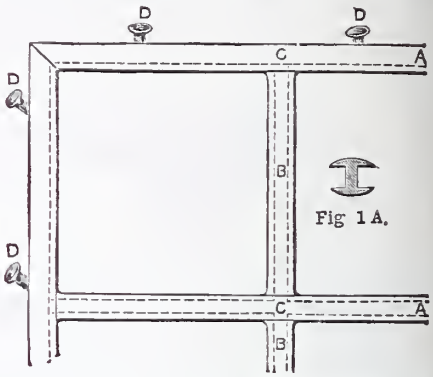


Fig. 1.—Arrangement of Leads—A, A, Leads running Length of Blind; B, B, Leads width of Squares when between Leads A, A; C, C, Corners at which Leads are soldered together Back and Front; D, D, Nails stuck into Glazing Board to keep Leads together before Soldering. Dotted Lines show size Glass has to be cut as Lead has to clip over Glass.

the leads come. We are dealing here with the simplest kind of leading, consisting of squares with lines outside and a circle inside. In making an outline for such a window it is merely a case of setting out the work geometrically exact. If you are desirous of trying your hand at leading you will have to procure leads and glass of some firm who make stained glass windows, and with a diamond cut the glass into the various

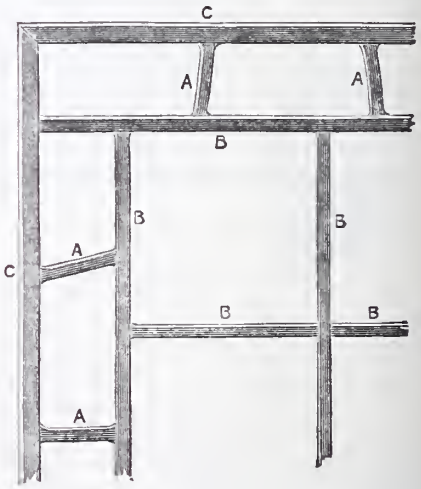


Fig. 2.—Arrangement of Short Leads, A, which come to right or left of Leads B; Outside Leads wider than other Leads.

shapes. Remember that allowance must be made for the thickness of the lead coming between each piece of glass; it is therefore necessary to cut each piece of glass a trifle under the size marked on outline, so that when the work is leaded together it does not spread beyond the outside of outline, as it would do if due allowance were not made for thickness of lead. Fig. 1 A is a section of a lead, and it is made in varying

widths and depths, the narrower being used for small pieces, and where the design is of a geometrical character, and the larger leads for important joins. For ordinary work, such as window blinds, a ¼ in. lead will do. We will imagine the blind consists of a series of 3 in. squares, with ruby and white "lines" outside (narrow strips of glass outside the work are termed "lines"). The leads A, A running the length of the window can be in strips, and as each square is slipped between the long leads, sections, B, B, the width of the space between the lengths, must be put in as at Fig. 1. The leading should be done on a board as the glass is kept in its place by means of nails D, D. In leading lines on outside squares the short leads between the several pieces should come at irregular intervals, and not follow the direction of the leads between the squares (Fig. 2). This intentional irregularity gives character and quaintness to a window. I always like to see a white line about ½ in. wide around the outside of all work, as it frames it in, but a ruby line next to the white also looks well. The short leads in both cases should come at irregular intervals (Fig. 3), and the corners should come "under and over." In cutting the glass for lines cut long strips, and then piece them so that your joins come where you want them.

It looks a good deal better to vary the

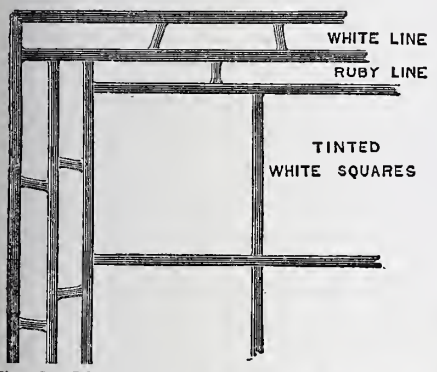


Fig. 3.—Diagram showing Leading of Outside Lines and treatment of Corners.

tints of glass, and instead of using glass of all one tint for the squares, to have, say, a white, yellow-white, green-white, warm-white, and so on, and put them together indiscriminately. In this case the white line outside can be pure white. The makes of glass are numerous, but clear glass is rarely used for leaded windows unless it is desirable to see through the glass. Glass is made with a certain unevenness of surface as in "anbetti," which has a sparkling effect owing to the light catching the little excrescences; "sanded" white, so called from small portions of sand being rolled into the glass when it is soft; "antique," which is made in the mediæval way, by blowing a globe of glass and then cutting an opening at the side opposite the blowing rod or "punt," and whirling it until the globe opens and becomes a disc of glass, thicker in the centre where the punt is fixed, and thinner at the extremities. A good deal of the effect of a church window is obtained by using different makes of glass for the different parts of the window, and "antique," by its varying so much in thickness and surface, gives a sparkling look to a window. The flesh tints and white drapery in figure windows are usually cut out of "antique," but for ordinary squares it is not so generally employed, as it is much more expensive than other makes. "Cathedral" is another glass largely used. It is rolled while soft, and has a kind of wavy surface, which prevents it being seen through. It is made in a large number of tints and is much employed for church windows that are plain glazed, *i.e.*, not painted; but for small work such as window blinds it produces a harsh, cold effect, and I give the preference to anbetti. It is not a good plan to introduce two or more makes of glass into the same window (except in the case of figure windows), as you want to obtain variety without harshness, and this can only be accomplished when each piece blends with those around it. This remark does not apply to the outside white line, which can be of "Cathedral," while the squares are anbetti.

The coloured glasses, such as ruby, blue, green, etc., vary a great deal. The finest colours can only be had in "antique," and in this make of glass the colours are very beautiful. For the ruby line in the window blind you might be able to get some fragments of antique that you could cut into strips. A ruby line only looks well when the glass shades itself, *i.e.*, when it varies a good deal in tone, a dark piece coming against a light piece, and so on, and you only get this variety with antique; but it is expensive when used in any quantity.

When you have leaded your window, you must solder all the joins on one side and then turn it over and solder them on the other side. But the window is not yet finished, for the glass rattles about in the lead, and if placed outside, or to act as a window in a house, the weather would get through between the glass and lead. Cement, consisting of white lead, black lead, linseed oil, putty and driers made stiff, is brushed over the window and worked well into the leads on both sides until all gaps and spaces are filled out. When this gets quite hard it makes the leading quite stiff, and it is not so liable to bend, though in large windows it is necessary to have iron bars to help support the weight of the lead.

Leading and glazing is not difficult, and to those who can work exactly offers a good field for their labour. The cutting of glass is a little troublesome at first, especially when the glass has to be shaped to fit the various portions of a design, for the diamond must be held at one particular angle.

Leads and glass could be obtained at a moderate price from some good stained-glass firm, such as Pepper & Boyes, 174, Euston Road, N.W., and I don't see how you can dispense with the help of some firm of the kind, as the leads are turned through a vice, an instrument it would not be worth while for an amateur to purchase; and as you only require glass in small quantities, you could not go to a wholesale warehouse or a manufacturer's for what you wanted.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

Modelling in the Round.

Copying a Bust from the Antique—How to Support It—Sketching in the Round—Methods of Getting a Good Surface—Copying the Entire Figure—Frames for Statuettes, and Building Them Up.

Let us now see how the modeller would set about copying a bust from a cast from the antique. He will, in the first place, need a frame to support his work. In Figs. 14 and 15 are given an elevation and section of a good and simple frame for the purpose, which any one may make for himself, or readily get made. In both these diagrams A marks the flat bottom board, of sufficient size, say 15 in. by 11 in., which is braced together by two ledgers to prevent warping. B is an upright of sufficient height to reach to about the centre of the head; a tenon at the bottom of this upright passes through a mortise in the middle of A, where a peg C, removable at pleasure, tightens and secures it. Through a second mortise near the top of the upright passes the short cross-arm D, also removable at pleasure. On this arm will chiefly rest the weight of the head. The cross-arm and upright are made easy of removal from their places, to facilitate taking the clay from the mould in the process of casting, as we shall see when the moulding of busts comes to be spoken of. Wood has an advantage over iron, as forming the support of a bust, in this respect—that if through alterations in the model in course of the work any part of the frame should become exposed, that part may be easily cut away. Leaden piping is sometimes used for the upright, but this is rather for busts from the life, when flexibility may be required; wood is better for our present purpose when the position of the head is absolutely settled beforehand.

When copying a bust or other work in the round, it is well that both cast and model should be on turn-tables, that all sides of them may be readily brought under the eye, and that both should be on the same level.

These arrangements made, the frame is damped, and the clay built up around it. It may be thought that in putting together a comparatively large mass, it can matter little whether the clay is well tempered or otherwise, or that the building up should be done methodically. But the modeller should not be guided by such slipshod ideas. All clay shrinks as it becomes drier, and in badly-tempered clay the soft parts shrink more than the hard. A "lumpy" and irregular surface may result from negligence in this respect, as it may from air-holes in careless building up. So far as the experience of the writer goes, thorough workmanship is as desirable in modelling as it is in most other things.

Roughing-out a bust, though only from the antique, is highly interesting work. The modeller needs to discern clearly the characteristic points of his original, so as to get resemblance by the disposal of his great masses only. This he ought to be able to do quickly; and all the leading features may be expressed by a few effective touches. The thumbs pressed deeply into what will afterwards be the inner corners of the eyes, and then drawn outwards, marking the line of the eye-brows, at once give a human look to the upper part of the face. A deep, somewhat crescent-shaped indentation at the opening of the ear, and an oblique line drawn with the thumb-nail, marking its hinder limit, something more than indicate that organ. A few sharp incisions of the tool bespeak hair where it falls upon the flesh. The position of the mouth and something of its expression are given by a slight depression at each of its angles, and drawing the thumb downwards from them. In this stage an ingenious modeller throws a vast amount of resemblance into his copy with marvellously little labour; and it is well that the learner should practise the means of doing this. It at once gives interest to his work, and facilitates after-labour.

Although in some respects it is more

difficult to copy in the round than in relief, the worker has this advantage—he can now take measurements in all directions. This should be done freely, but in an intelligent manner—that is, the dimensions of each form should first be judged by the eye, and afterwards tested by the callipers. The eye is thus trained to accuracy, and will after a time become so exact that scarcely any measurements will be needed. It is well to acquire this habit before working from the life, for a frequent application of the callipers is not pleasing to sitters for portraits.

In working up the forms of the more intricate features—such as the eye and mouth—the main part of the work must needs be done with tools; but in life-sized work—such as we suppose the present to be—the eyeball is best formed by the thumb. But the upper eyelid cannot be completed without the tool, and it plays so important a part in the expression of the face that form should be given to it at a comparatively early stage. The lower eyelid is rarely put in till later. This, in an unfinished state, takes off from breadth of effect in a painful manner, and, to keep it from being offensive, needs a great deal of softening down. It may be well to see how this is done.

In large forms, where the thumbs can work freely, softness seems to come naturally; but in less accessible parts the harsh marks left by tools have to be removed in order to give finish. Working across any line—say, as this of the eyelid—with a fine tool and a light touch, will do much. Sometimes what painters call a hog-tool, with the bristles cut rather short, is used, it being first dipped in water. In delicate matters a sable brush, also cut short, may be used instead of, or after, the hog-tool; and a final dabbing with a fine, moist sponge blends all together and makes a good surface. For small work a scrap of sponge tied to a bit of stick as a handle is useful for parts which cannot be reached with the fingers.

Whilst discussing such matters, it may not be amiss to speak of the mechanical plan of producing a presentable surface on flesh, etc., to which allusion has already been made. The modeller gets a piece of that ribbed stuff of which cotton stockings are formed, more or less coarse, according to the nature of his work. This he wraps tightly and smoothly over his thumb, with the ribs running across it, and, having damped it, works it firmly but lightly over his surface. The ribs to a slight degree cut into the clay and reduce it to smoothness, and this, with an after-dabbing with the sponge, produces a great appearance of finish.

Those who are learning modelling, rarely undertake to copy a whole life-sized statue in the dimensions of the original. The great quantity of clay required, and the cost and difficulty of providing sufficient support, deter them from doing so. For the mere purposes of study, it is held sufficient to copy some of the antique statues on a smaller scale, or, in other words, to reproduce them as statuettes.

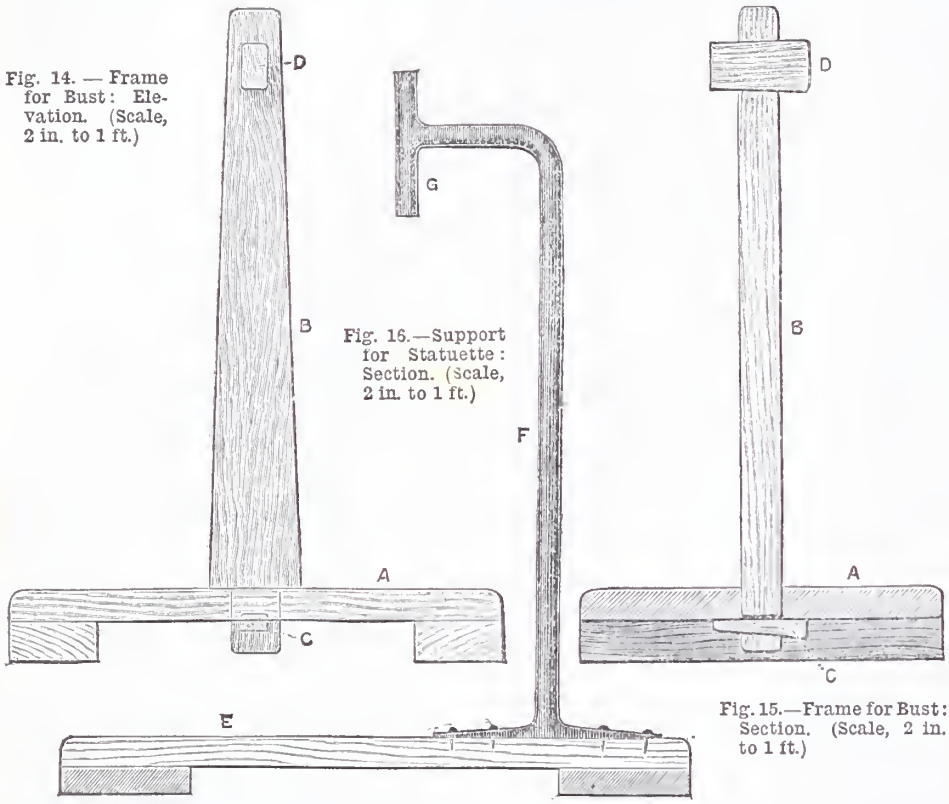


Fig. 14. — Frame for Bust: Elevation. (Scale, 2 in. to 1 ft.)

Fig. 16.—Support for Statuette: Section. (Scale, 2 in. to 1 ft.)

Fig. 15.—Frame for Bust: Section. (Scale, 2 in. to 1 ft.)

In Fig. 16 is shown a section of a frame for the support of a standing figure some two feet high. This will give a tolerable idea of the method of supporting these things; but to any unusual attitude the frame must, of course, be specially adapted. The board on which the figure stands is marked E; and strongly screwed to this, near one end, is the upright bar of iron F; this is bent near its upper end, that it may enter the figure at the small of the back. At its termination is the shank G, which will occupy the centre of the lower part of the body. When this frame is prepared for use, three pieces of gas-piping will be bound with copper wire to this shank. Two of these will descend to the board below, and will be arranged to run down the middles of the legs; their upper ends, after being carried straight upwards to the height of the shoulders, will branch off, to support the arms; and the third pipe, running up to the centre of the head, will carry the weight of that important member. This will be tightly bound to the arm-pipes for so far as it keeps company with them, and to its top some cross-bits of wood will be wired, for the better support of the clay forming the head. The clay will hold more firmly to the pipes generally if wires are wound spirally round them. For figures of moderate size, lead or "compo" gas-piping admirably serves the purpose of skeletons; for whilst strong enough to bear the weight of the clay, it admits of being freely bent in any direction.

It is no easy matter for an unpractised modeller to give the proper pose and action to a figure in the round; even making it so balance as to give the idea of standing securely may perplex him at first. He will have to make free use of his plummet, and to bend and re-bend his pieces of gas-piping many times. He will, however, be surprised to find with how little beyond a mere skeleton it is possible so well to express the action of his figure as to produce a decided resemblance.

If figures of this kind have to be kept long in the clay, it is desirable to have an oil-cloth covered frame to fit over and keep them moist.

Nothing more needs to be said with regard to copying from the antique. Such copying, though pleasant and interesting work, is, of course, but a means to an end. Those who do it, are generally only seeking to fit themselves for dealing with portraits, or for expressing the inventions of their own imaginations in ideal sculpture. Some there will be who read this who will have no such aspirations, but will look to modelling ornament only. To these we would say that, if they can spare time for some little studying from the antique, they will be no losers by it, even as ornamentalists. The antique statues teach lessons of just proportion and beauty which cannot fail to improve the taste. But if time does not serve, let them copy from casts of good examples of ornament. Such are easily to be got, whether classical, mediæval, or modern, and all necessary technical directions they will find in these articles, for these directions are equally applicable to decorative or figure modelling.

DRAWING BOARD FOR DRAUGHTSMEN ON WOOD AND IMPROVED INSTRUMENTS FOR CIRCLES.

BY JOHN W. WHITFIELD HARLAND.

A GREAT inconvenience arises in drawing upon wood blocks which are $\frac{15}{16}$ of an inch in thickness, owing to the absence of a rest for the hand and the difficulty in using squares (T or set) in drawing accurately perpendicular and horizontal lines, a difficulty still increased when drawing architectural or other subjects to perspective points where great care and accuracy are requisite.

To obviate these drawbacks and ensure ease, convenience, and extreme truth of drawing the writer designed, made, and used a board, which has stood the test of twenty years' use most satisfactorily, not only for wood but for drawings on paper, if to a very small scale, the paper of course mounted.

First make a $\frac{3}{4}$ in. drawing board A clamped at ends 24 in. by 15 in. over all, and plant upon it a 1 in. strip B, 4 in. wide, 24 in. long, glued and screwed from the back, with

groove ploughed in its face $\frac{1}{2}$ in. from edge, of a dovetail form (see *a* in section) and rebated $\frac{1}{2}$ in. by $\frac{1}{2}$ in. on its upper edge, next to A, so as to leave a soffit of $\frac{7}{16}$ overhanging $\frac{1}{2}$ in. beyond where the rebate is pointed on A, Fig. 1. To the right-hand side of drawing board A fit and plant on with glue and screws a strip of 1 in. stuff, 6 in. wide, $1\frac{1}{2}$ in. at back, rebated at one end to 11 in. long at face so as to fill the rebate in strip B. Note that this strip must be made absolutely

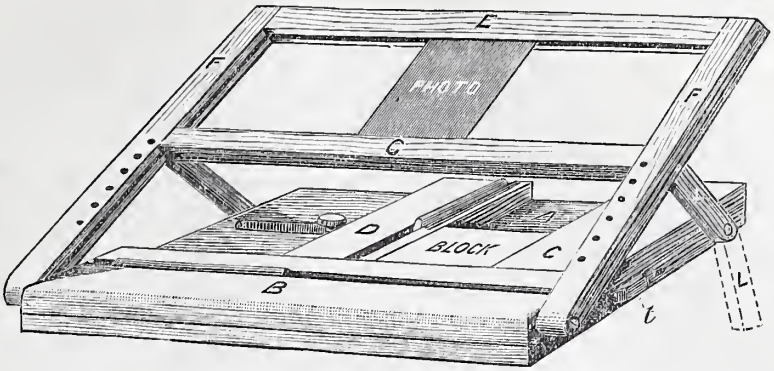


Fig. 6.—Perspective View of Drawing Board: open.

portion of A. At *e e* cut a groove through the drawing board as a slot $\frac{1}{4}$ in. at face and $\frac{1}{2}$ in. at back of a T shape, parallel to B, but 5 in. from it, to receive a stud and thumbscrew *f*, or what is called a camera-back screw, and on under side of the follower D let in and screw the plate *g* (see *f* in section also).

Now the board is so far complete that a block can be placed upon the uncovered part of A against B and C, and the follower D pressed against its side until it is firmly held; whilst the

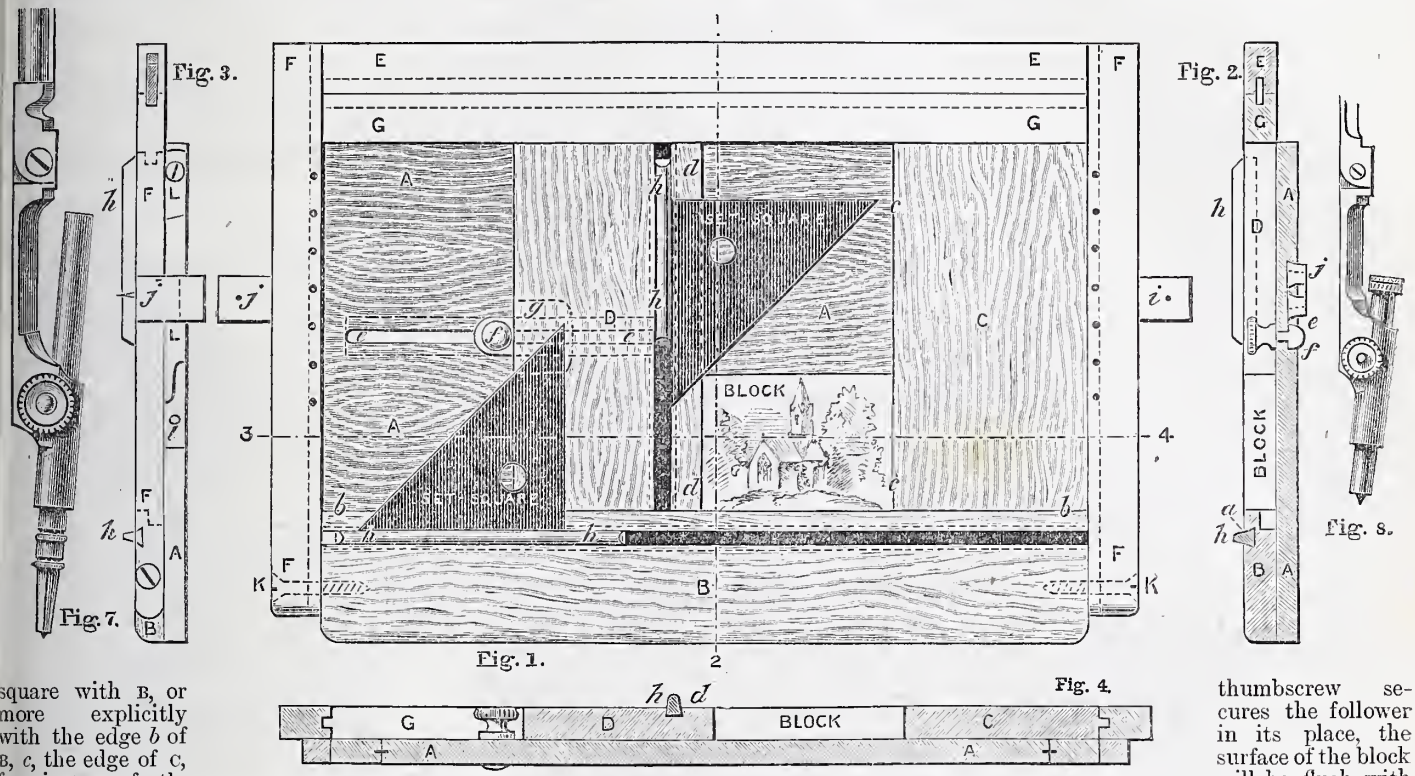


Fig. 1.—Plan of Drawing Board for Draughtsmen on Wood. Fig. 2.—Section of Drawing Board at Centre Line 1 2 in Fig. 1. Fig. 3.—End View. Fig. 4.—Section through Line 3 4. Fig. 7.—Propelling Pencil-Case for carrying Leads. Fig. 8.—Split Tube for Faber's Leads.

square with B, or more explicitly with the edge *b* of B, *c*, the edge of C, forming a perfectly true right angle with it.

Next fit a similar piece of 1 in. stuff of same dimensions D, henceforth called the "follower," so that it will correctly fit the rebate of B, and its edge *d* made perfectly square with *b*. Half an inch back from its edge *d* plough a groove parallel to *d* $\frac{1}{4}$ in. deep, $\frac{1}{4}$ in. wide at top by $\frac{3}{8}$ in. at bottom exactly as groove before mentioned (at *a* in sections). This strip must *not* be glued or screwed, but is utilised as its name, follower, implies to slide square with B all along from the edge of C, also square to the full extent of the uncovered

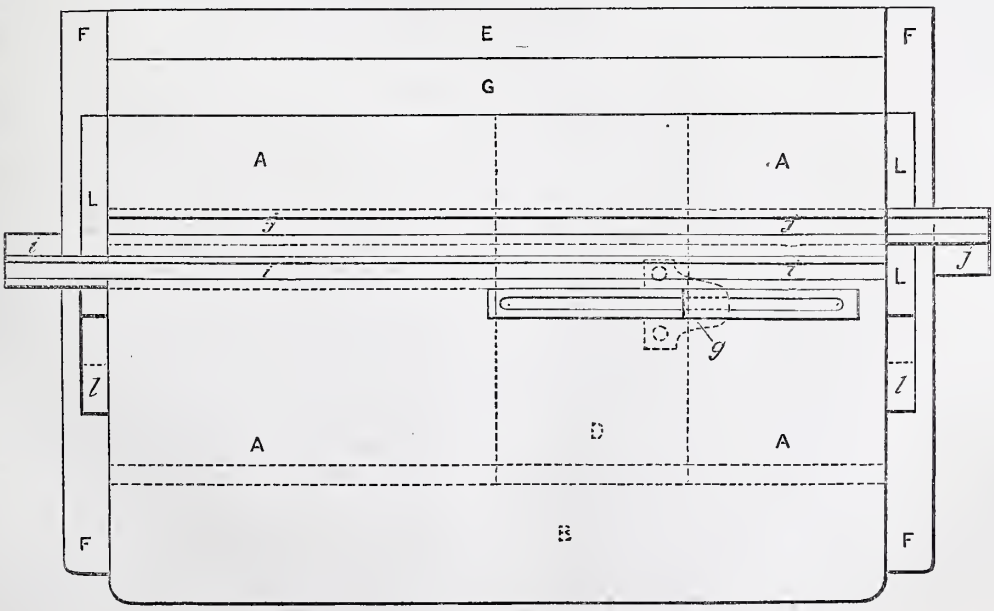


Fig. 5.—Plan of Drawing Board: looking up.

thumbscrew secures the follower in its place, the surface of the block will be flush with the surfaces of B, C, and D, thus fulfilling the first condition: convenience for the rest for the hand of same level as the block itself. Now fit exactly to the dovetail grooves strips of wood (boxwood for preference) of the section shown at *h*, Fig. 2, respectively 9 in. and 6 in. long, made so accurately as to slide readily but not loosely in the grooves (see *a* in section). Having fitted these slides *h*, *h*, which stand up $\frac{1}{8}$ in. above the level of the block, they can be slid along and used as *straightedges* for set squares to slide against, the longer one giving perpendiculars, in the

groove in B, and the other, horizontals in groove in D, with a right-angled set-square, but when not so required they may be pushed along their grooves out of the way of the hand when drawing.

At any point on the horizon of the required perspective where the vanishing points fall, a needle may be driven into the strip C and the follower D, and all vanishing lines can then be drawn with a straight-edge to these points with microscopic accuracy, the slides being pushed out of the way and pushed back again when vertical or horizontal lines are required; the width of strip and follower, 6 in. each, being ordinarily sufficiently distant for the vanishing points. In certain instances this is not the case, however; the writer, therefore, provided and fixed (see plan Fig. 5, "looking-up") two sliding strips, *i i*, *j j*, dovetailed into dovetail grooves in back of A (which can be taken out and hung up when not in use), having a thicknessing piece at their outward ends glued and screwed on with a fixed point or needle in each, so placed as to be in the same horizontal line.

As the horizontal line varies in various drawings, its distance should be first ascertained, and the block to be drawn should be pushed up to the fixed horizontal line of these sliders, and the vacuum, so to speak, between base line of block and the edge *b* should be filled with a strip of boxwood block of the exact size to maintain the block to be drawn in its right position with its perspective horizontal line coincident with the normal one of the board. The sliders being drawn out to the required distance on each edge, ought to remain in position through accuracy of fit, but as wood shrinks in time, and they may thus become looser, and thus be apt to slip, the sliders may be marked with inches and eighths like an English rule (or centimètres, dixièmes, etc., on the French decimal scale of lengths, which we like better), and when the point is found a note can be made of it, to check any subsequent shifting. By this means, before photography and process work came into vogue, the writer has produced for *The Builder* perspective architectural drawings which for accurate detail have not been surpassed, an accuracy due entirely to the means employed. A careful tracing put down on the wood gets obliterated in the shading-up in Indian ink and its exact angle is lost, but if the vanishing point is there it can be regained in the ruling up with mathematical precision.

But the draughtsmen on wood—artists, perhaps we ought to say nowadays—have not only to draw upon wood, they have very frequently to trace from very indifferent photographs, which is best done by light being transmitted through the print or glass photo on to the tracing paper. Our drawing board affords convenient means of doing this in the following manner. Make a frame of 1 in. stuff, $1\frac{1}{2}$ in. broad (see Figs. 1 and 4), 24 in. inside measurement, tenoning one piece of the side E into the two ends F, F, which are 15 in. long. Before gluing up into the mortises cut in ends, plough a $\frac{1}{4}$ in. by $\frac{1}{4}$ in. groove about $\frac{1}{8}$ in. from face in the four pieces of frame, and then make the fourth a sliding piece G, to fit the groove accurately, so that it will move therein to any desired position; then glue up and wedge the end pieces and the tenoned side E; when dry and finished off, slide the sliding piece G into it. At K, K, in F, F, bore screw holes countersunk and screw into the ends of B, so that when level with face of block, the strip C and follower D shall at their top ends be in contact with the inner edge of G when it is pushed close up to the tenoned side of frame E.

These screws form pivots, or hinges, on which the frame can be raised to any angle, or allowed to remain flush with top of block and board.

In the frame ends F, F, holes passing into the grooves in which the sliding piece G moves should be made every $\frac{1}{2}$ in. or so from $3\frac{1}{4}$ upwards, so as to maintain G in place with a photograph covered with tracing paper, or glass plate, with a paper print and tracing paper mounted upon it, put into the grooves of E and G (see section, Fig. 2), which will hold it whilst being traced, a mirror being put at the proper angle behind it to reflect the rays of light through it, the frame F E F G being inclined to a convenient angle to the plane of the board supported by the following means.

The top of the frame F E F G should be, when *down*, flush with the surface of the block, *i.e.*, with the surfaces of B, C, and D; when *up*, at a convenient angle, say, for instance, 45° or 50° to these surfaces or planes. By making two strips of wood L, L, with screw holes bored and countersunk at one end, and screwing them on to the sides of A below the frame which is screwed to B (see end view, Fig. 3), leaving them 9 in. long, and putting screws, in position shown, into A to form pivots—support for the frame F E F G is at once provided in the position shown in the perspective view, Fig. 6. But these pieces or levers, when not in use, would fall on their pivots; we halve them at their ends, as shown, and save the pieces so cut away—to plant on to A with a single screw each, in the same places they would have occupied had they *not* been cut off. The levers L, L, when not in use, are thus locked in their normal places by these "frogs" *l*, *l*, but they are capable of another use, namely, that of forming hind legs as it were to slope the drawing board to a suitable angle when blocks are being drawn (see dotted outlines in perspective, Fig. 4).

Having now completed the construction, we may add to its perfection as a "tool" by rounding the edges of B, so as not to fray the sleeves or irritate the wrist as shown in the drawings, and add to its appearance by polishing it with French polish or oiling it with raw linseed oil; or the parts where friction exists may be rubbed from time to time with powdered talc (pudding-stone), the French chalk of the oil shops, the bootmaker's, or the glover's.

Whilst on the subject of drawing to fine scales, probably we may usefully suggest simple means of keeping the radius of compasses always the same with pencil as it is with pen, the pen never wears away; the graphite gets shorter with every circle turned. Instead of using a lead-pencil cut to a diameter suitable for the holder in a pair of compasses, procure a propelling pencil-case (see Fig. 7) and break away the outer case; this costs but a few pence, and will save hours of time wasted in sharpening leads and altering the legs. You have only to propel the lead further out, by turning the nose-piece, to always keep the length of the leg of the compasses the same as the other leg. Another plan, useful principally for bow-pencils and spring pencil-bows, is to obtain, or make, split tubes to carry Faber's movable leads, which are made in all degrees of hardness (Fig. 8). As the lead wears it may be pushed further through the carrier and always kept to length, without altering the angle of the legs. Another alternative is to gum a strip of paper and roll it around a piece of Faber's lead until it is thicknessed out to fit the carrier of the compasses, and keep pushing it further and further through as the graphite wears away.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

36.—Harger Brothers' "Alpenstock" Camera Stand.

Messrs. Harger Brothers, of Settle, Yorkshire, have recently added to their large stock of specialities for the amateur's use a Camera Stand, which not only serves as an excellent and serviceable tripod for the support of the photographic

Harger Brothers' "Alpenstock" Camera Stand.

tourist's camera when taking sun pictures of the most noticeable views and objects in the country through which he may be passing, but also as a stout and strong, but not too heavy, staff or alpenstock to assist him in ascending hills and climbing mountain slopes. It may be regarded, indeed, as an assistance in walking generally, and will enable those who use it to dispense with the ordinary walking-stick. Its construction may be gathered from the accompanying illustration, in which it is represented as an alpenstock. When in this form it measures 4 ft. 8 in. in length, and varies in its diameter from $1\frac{3}{4}$ in. at the top to $1\frac{1}{4}$ in. at the bottom, weighing from 2 lbs. to 3 lbs., according to the size required. It is furnished with a strong spike at the bottom, and has a leather hand-rest at the top, which is useful in enabling the tourist to keep a firm grip on the staff when it is used as such. The legs of the tripod are held together by three leather braces, as shown in the illustration. When it is to be used as a camera stand, the braces, or collars, are removed, and when the brass top or tripod supplied with the alpenstock has been fixed on the brass pins in the top, the braces are slipped one on to each leg as far as is requisite to give the needful grip. In the hand-rest brace there is a space, the proper size for this purpose, left loose in the strap. The camera is then attached to the brass top. The price, complete, for a $\frac{1}{4}$ or $\frac{1}{2}$ plate camera is 10s. 6d.; and for a whole-plate size, 12s. 6d. The Editor

SHOP:

A Corner for Those who Want to Talk It.

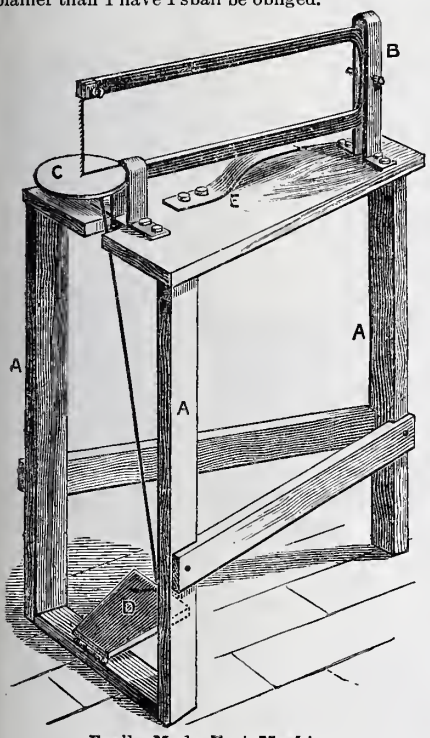
NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Easily-Made Fret Machine (see page 651, Vol. I.).—A. J. P. (*London, S.W.*) writes:—"When I said that I would send model, I did not mean that I would send one to every body, because it is so simple that I should have thought that any one could make it from the sketch. I send model for your approval because I have not the time to make models for all, so if you could make the instruction plainer than I have I shall be obliged."



Easily-Made Fret Machine.

[The above illustration has been drawn from A. J. P.'s model, and it is hoped it will prove useful to our readers.]

Mandrel for Lathe.—The Britannia Company write:—"In reply to J. T. (see page 159, Vol. II.), there must have been something special about the mandrel to cost 30s. We should like to hear again. Our charges are always based upon small profits. Such an article as a mandrel, if forged and made special size, and hardened, and then carefully trued after the usual slight warping, may very likely be cheap at 30s. There is no telling what else belonged to the estimate." [Such complaints as those of J. T. should not be lightly made. Whenever it is thought desirable to call the charges of any firm or any maker in question, full particulars should be given. As the Britannia Company gently and justly hints, there are mandrels and mandrels, and that which would be a fair price for a good and carefully made article would be too much for one that was less elaborated and required less labour.—Ed.]

Griffin's Fret Saws.—Messrs. Charles Churchill & Co., Limited, 21, Cross Street, Finsbury, E.C., write:—"We have had three applications to-day (June 2) from parties who state that they 'see by Work that we sell Griffin fret saws at 3d. per dozen.' Kindly make announcement in your next issue that your correspondent was misinformed. The price is 4d., and will not be reduced."

Mandrel for Lathe.—G. L. B. (*Bridport*) writes:—"I see in page 152, Vol. II., of Work, an amateur asks where he can get engineering work done well at a nominal price. I have had good work done at a very cheap rate by Mr. G. Hounsell, South Street, Bridport."

II.—Questions Answered by Editor and Staff.

Carving Patterns.—A Carver.—I am not aware that there is any one who makes a speciality of casts for carving from. Patterns are hired out by the School of Art Wood Carving, South Kensington, to the manager of which you might apply. Rogers does the same from his studio in Maddox Street, W. Look round the Italian plaster cast shops. Your fellow carvers might sell you copies of any casts they have or allow you to take them.—D. A.

Electric Light.—R. H. (*Birmingham*).—It has given me pleasure to help my fellow workers in making their own electric bells and time alarums. I feel equal pleasure in being able to warn you against wasting your money in electric lights. In my forthcoming series of articles on "Model Electric Lights," you will learn all you wish to know respecting the cost of a small installation. Money spent in this way for the sake of amusement, or to gain an insight into the mysteries of electrical science, is money well spent; but the value of the light thus obtained is very small indeed. To prevent disappointment, I have clearly told my readers what to expect, whilst showing them how to satisfy their desires at the least possible cost.—G. E. B.

Watches.—J. C.—A half chronometer is a combination of the lever and chronometer escapements; but there are so many combinations, that unless you know somewhat of the escapement you had better entrust the purchase to a friend who does. I am afraid by writing I could not make you understand the difference between them all, as there are plenty of watches advertised as such that are simply frauds; for instance, some have simply a compound balance, that is to say, an imitation of the chronometer balance with a few screws stuck in round the rim, and that is sold often as a half chronometer; then some go still a little farther and cut the balance: then, again, a little farther, and put a genuine compensated balance; others, still farther, with a compensated balance and free hairspring; still again, compensated balance and Breguet hairspring; so that you will see there are half chronometers *and* half chronometers in all their varieties in the balance and hairspring only, with touching the vital part, the escapement; and, therefore, I can only repeat be careful what you buy and *where*. If you do not know any one you can trust to buy for you, go to a good maker like Dent, Strand, tell him what you require, with the price you are prepared to give, and you cannot go far wrong. The price you name I do not think you could get a thorough genuine one for, but you certainly would have a thorough good lever watch which with care would give you every satisfaction. The difference in price of the lever watches is solely in the finish. The actual cost of a wheel is very little indeed, often a few pence only. For a thorough good gold lever give about £30 or £35 at Dent's, and you will have the time, say, to a minute, or at most two, in a year. A Kew certificate is given with those watches that have been sent to Kew Observatory to be rated, and have passed satisfactorily.—A. B. C.

Index and Bookcase.—G. M. (*Berlin*).—An Index to Vol. I. of Work can be had of any bookseller for 1d. Sketches and working drawings of a revolving bookcase have appeared in No. 48 of Work.

Boiler Deposit.—W. S. T. (*Edinburgh*).—Water contains carbonate of lime and sulphate of lime in more or less quantities; and according to whether there be much or little, the water is termed "hard" or "soft." When boiled, water distils off pure as steam, leaving the lime salts deposited in the boiler as an incrustation or "scales." The carbonate of lime can be removed before boiling by stirring up some lime with the water, when the lime causes the carbonate to separate out; and after standing at rest for some time, the water can be drawn off the sediment. This is termed Clarke's softening process; but although it removes the carbonate of lime, it does not affect the sulphate, of which there is no practical way of getting rid. The best plan is not to do as above, but to put a handful or so of common washing soda into the boiler, when you will find that, although scales are formed as usual, they are soft and very easily removed, not requiring the scraping so injurious to boilers. There are "boiler-fluids" sold for putting into boilers, but they chiefly consist of a solution of soda. Some add sugar or tannin with the soda, but no advantage is gained thereby. Lead and copper pipes would be affected in the same way as those of iron.—F. B. C.

Polishing Drawers.—W. (*Alyth*).—You must first clean off all the varnish and then repolish in the usual way, except that you will probably be able to dispense with filling. I think you will find that you can remove the varnish more easily by scraping than by papering. If you are very careful you might wash off the varnish with soda or potash and water, but I hesitate to recommend you to adopt this course, on account of the liability to injure the wood.—D. A.

Fret Machine Fixture.—F. N. M. (*Keighley*).—Of course, if you fasten up your arrangement so that it is legally a fixture, it would become the landlord's on your removal from the house. If you are in doubt, why not see the landlord about it? If he is a decent sort of fellow, he will probably not object to allow you to fix up the machine and take it away, as it is hardly likely to be of much value. Fasten it up with screw nails, and then you can easily take it down without saying anything about it.—D. A.

Reading Desk for Bed.—M. A. (*Nottingham*).—The ordinary bed table is so suitable for your needs that I shall describe it. Fig. 1 shows the article. It can be adjusted to any height, and, as it is longer from the pillar to one end of the table than it is from it to the other, one half is allowed to pass over the bed when it is pushed to its side. By having two loose flaps it matters not on which side of the bed it is placed, as it will afford the required use in either way. Convenient sizes will be as follows:—Height of pillar proper, 24 in.; length of top, 30 in.; width of top, 15 in. If the top consists of a bottom board framed to a top board, with the latter divided into three pieces, the space between them will form a handy place for an odd book or two, etc. The pillar might be 4 in. thick, and a thinner one, square in section, will work freely up and down it inside. The inner pillar might penetrate the bottom board and be joined to the top board; or else fastened to a stout block of wood, and then that block and it joined to the bottom board. In the latter case the afore-mentioned space will be of more service than it will if the former method is adopted. The shape of the bottom board is optional, but have a good stout piece of material on castors. The inner pillar is fixed at any height by means of a screw and rack, or ratchet. The table top-board is divided into three pieces; the two smaller ones each being about 12 in. long and 7½ in. wide. The

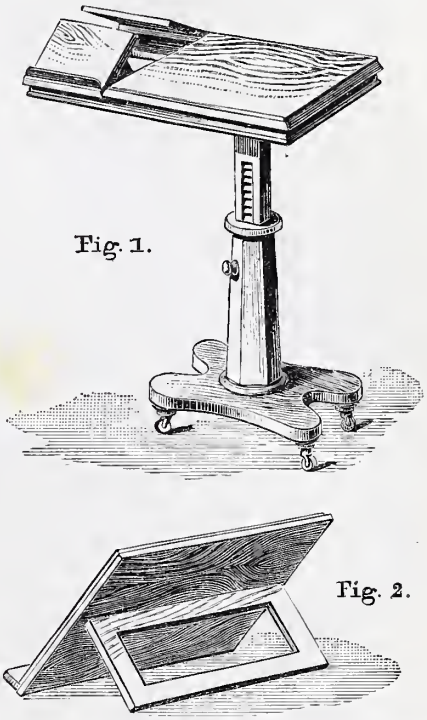


Fig. 1.—Reading Desk for Bed. Fig. 2.—Showing one of the Flap's support.

small pieces are each hinged to the framing, and have a narrow strip along the hinged edge to hold a book, etc. If a pair of music hooks are fastened to each of these strips, they will keep the leaves of the book down when it is open. A small mortised and tenoned frame is hinged to the under side of each flap, and will keep it at an angle. Fig. 2 gives an idea of these frames. The thickness of the top board might be ¾ in., the bottom board ½ in., the depth of the framing 1½ in. or 2 in.—J. S.

Lantern Slides.—P. J. (*Islington*) asks where rack-work for revolving lantern slides may be procured. In a general way, they may be obtained of any manufacturer of lantern appliances. I can, however, give P. J. a list of prices from Messrs. Lancaster, Birmingham, which list does not appear in their catalogue but which I have obtained privately. I would here say, with the Editor's permission, that if it will be of any advantage to any reader of Work, I will undertake to supply any optical appliances at catalogued prices. By this means time will often be saved to the persons engaged on any instrument. Lancaster's prices are as follows:—Double rack-work for chromotrops, 3s. 6d.; single racks, etc., for levers, windmills, etc., each 2s. 6d.; wave slides, 2s. 3d.; levers, with glass in each, 1s.; two rollers for snow effects, etc., per pair, 1s. 6d. All in brasswork only, no wood frames.—O. B.

Spinning Hair-Lines.—Spider (*Castle Douglas*).—For apparatus with which to spin hair-lines in the most approved fashion, Spider will have to go to Redditch, the headquarters of the fishing-tackle trade. Mr. W. J. Llewellyn, of the Wellington Iron Works, Redditch, will supply him with the machine he needs, as also with such information about working it as he may require.—M. M.

Folding Chair.—M. H. (*Bristol*).—It would be a moral, if not a legal infringement to follow the lines of the chair you mention so closely, and yet not copying it, as to amount to the same thing; but to meet your requirements I have specially designed the one here shown (as you ask for a chair "like, if possible, the patent hygienic folding chair, No. 34"), which resembles the above-named chair no nearer than that does other chairs of the same character, with the exception of the rocker, the combining of which facility, in conjunction with that of folding, certainly entitles the inventor of it to credit, and I hope he will not consider that I am running too near it in meeting your wishes with the present design. It may happen, however, that this approaches too closely to some patented brother, although I do not think it does, as I have seen some dozens of different kinds, and always endeavour to avoid copying them. But if any reader has seen any chair which he thinks this too closely resembles, I would thank him to send notice of the fact, as "patent rights" is very dangerous ground to trespass on. I have designed one or two more of this class of chair, but, as space is limited, I only show one. I generally steer clear of folding chairs which may be said to represent a × breed (!), but as nearly all of them are patented, and the personal right of making one of them not allowed, perhaps, with the Editor's permission, I may some day give a chapter of a few designs, when, of course, no one will be precluded from making one. The scantling for this chair will be 1½ in. by ¾ in. thick. The longer

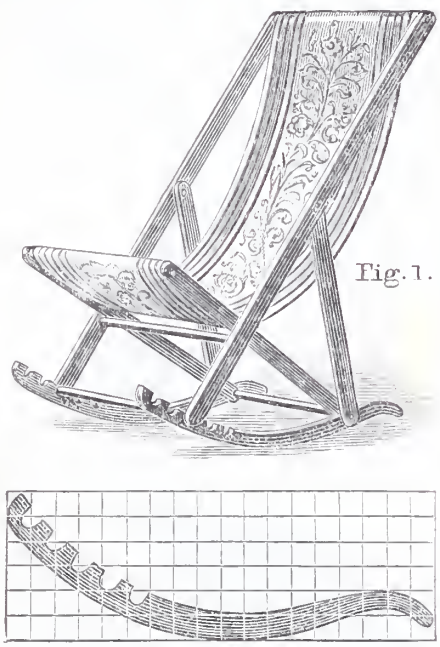


Fig. 1.

Fig. 2.

Folding Chair and Rocker.

sides will be 4 ft. 6 in. in length; the shorter ones 2 ft. 9 in.; the back connecting rails 2 ft. 2 in. Note, in my drawing, the position of the different rails; they are firmly pivoted together, with the exception of where they cross each other, and at the bottom end of the longer bars. Where they cross, the shorter ones are supported by the spindle between the longer bars. This spindle should be fitted at 15 in. distance from the bottom end of the longer bars—my drawing shows it hardly far enough. At 2 ft. 3 in. distance from the same part of the latter rails, is pivoted one end of the back connecting bar, the other end of which will be pivoted to the rocker. Also to the rocker is pivoted the bottom ends of the seat-bars. The rocker is the most principal and difficult part. From where the notches begin, to the front end of it, it *must* be an arc of a circle in shape, and the central point to strike it from will be at a little distance under the spot where the back connecting rails and the longer side bars meet. To make it more convenient for you to make it correctly, I have given Fig. 2. If you understand anything about scales, you will clearly comprehend this diagram, as it is drawn to ¾ in. scale. If, however, you do not understand, get your board or a sheet of paper, and mark the *same* number of squares upon it as I show, but each one of them 2 in. wide; you will then be able to copy it almost exactly. It should be a good strong rail, and might be 2 in. or 2½ in. wide at the front half. You must cut the notches in it rather deep. The width of the chair can very suitably be 18 in. I daresay you will understand how to fix the carpet; and also how the chair works.—J. S.

Upholstery.—F. E. (*Bath*).—I cannot name any positive date for the commencement of a series of papers on this subject, nor can I undertake to reply to questions bearing on what has appeared, or is appearing, in other serial publications.—ED.

Sandal Wood.—F. H. F. (*Kensington*).—This wood is imported from India and Australia, the former being the best and most expensive. Bombay wood can be bought at about 1s. 6d. per pound, the price depending upon the quantity wanted. The wood is hard and heavy, and is of an oily nature, but I should think it would work all right. It has a strong but pleasant odour, the Indian wood having more smell than the Australian.—A. J. H.

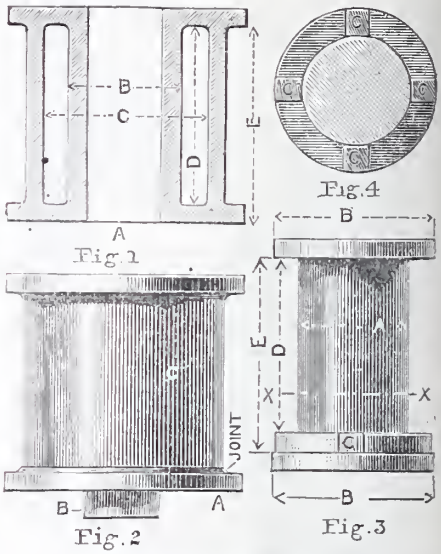
Telephone Matters.—E. W. (*Hurstpierpoint*).—It is a pity that you have not yet received an answer to your former queries, but no doubt you will, long ere this appears in print. You must understand that the space in "Shop" being limited, and the circulation of WORK so very wide, and the circle of correspondents so very great, some time must elapse from the receipt of a query until the answer appears. Yours reached us in due course, and I remember distinctly answering it; and your present questions are nearly all answered; however, I will just go over them now as they lie before me in your present note. The telephone companies will not annoy you in any way for having in your possession a pair of telephones like those described in WORK. It is quite true that the United Telephone Co. have bought up the patent rights of the Bell telephone, and you cannot set them up and use them for business purposes or purposes of convenience. I have already mentioned the *English Mechanic* receiver in WORK, and shown the difference between it and those already described. I could not give a sketch of a switch board in this column, as it would take up too much space, but I will write an article upon it, which may help you. The induction coil in certain instances is an improvement in telephone circuits. You need not trouble yourself about the composition of silicium bronze wire, as you could not make it, and besides, it is only used for extremely long distances, because of its excellent conducting capacity. I have never heard of "coppered iron wire," and I think you must be making a mistake about this. Anyway, good copper wire covered with cotton is all you want. You should read up the subject in some handbook.—W. D.

Wax-Ends.—R. W. S. (*Godalming*).—To make wax-ends for making or repairing boots and shoes, get a ball of hemp and a ball of shoemaker's wax, and some bristles from the leather-seller's. Take the ball of hemp in the left hand, and draw off with the right as much as you require to work with—say, from one yard to a yard and a half. Do not cut it, but place it down on your right knee, and with the palm of your right hand roll it over from you till it untwists and will break off easily, leaving two fuzzy ends. Place these two ends together, and draw off another length, breaking it off in the same manner. Repeat this operation till you have got as many strands as you require. Four-fold is generally sufficient, but it depends on the size of the hemp and the work to be done. If you have broken off your hemp in the way described, you will have each end tapering off to a fine point. Now wax it well from end to end. Hold one end in the left hand, and twist it well by rolling over from you on your right knee, giving the ends a few extra twists and strokes of wax. Take the two ends in your left hand, and hook the middle over a hook or nail, and rub it till smooth with a soft piece of leather. This rubbing melts the wax into the hemp, and prevents untwisting. You have now a strong four-fold thread of well-twisted and waxed hemp, with two finely-pointed ends, to which you must attach bristles. Taking one in your hand, you will observe the one end is split into three parts; open the splits about one inch more, and, holding them apart with the thumb and finger of your left hand, insert the fine point of the waxed thread between them, and with the thumb and finger of the right hand twist two fibres of the bristle round the waxed end until firmly united. Place it between your third and fourth fingers to prevent untwisting. Take hold of the single fibre of the bristle, and twist that also. Now let the two twist together, which is done by the thumb of the left hand. The fine end of the waxed hemp is now firmly fixed and twisted in between the fibres of the bristle, and this is the secret of making a wax-end. To finish, you make a hole with a pin or fine awl in the thread half an inch from the split end of bristle, and insert the point of the bristle, and draw it through. This fastens it off, and prevents the fine ends from getting loose. Nip off the point and it is ready for work. Of course, you fix a bristle on each end.—J. M.

Furniture Frames.—SPOT (*Gosforth*).—I suppose you want suites of frames for upholstering. If you are in the trade you must use your own discretion as to which house supplies them "best and cheapest." It is useless for me to give names and addresses, as no doubt you are acquainted with wholesale houses. They generally let their existence be known to those with whom they wish to do business. If you are not in the trade, the names of wholesale houses cannot be of any legitimate use to you, and you can easily get what you want through a local upholsterer. I am reticent about names, as you may be one of that large class who think they can be clever enough to buy retail lots at wholesale prices. If I am mistaken let us know, and I may help you further, though WORK is not a "trade organ."—D. D.

Shock from Leclanché Battery.—MANCUNIUM (*Manchester*).—You would not experience any shock or any sensation in the nerves from taking hold of the wires leading from a small Leclanché battery. It is useless trying the battery that way. Either test it practically by connecting it to the bell, or to a galvanometer. If you cross the tips of the wires on the tip of your tongue, and then slip one off the other whilst on the tongue, you will probably experience a slight shock in the nerves of that member.—G. E. B.

Water Jacket Cylinder Pattern.—CORE BOX.—Fig. 1 is a section of your casting, Fig. 2 the pattern, and Fig. 3 the core box. In the pattern, A is the bottom flange, B the print for the central hole, A, in Fig. 1. The flange and print are fastened together but left loosely dowelled to come away from the body C in Fig. 2, the pattern moulding with the flange and print in the bottom. In the core box, Fig. 3, the diameter A corresponds with the diameter B in Fig. 1, and the diameter B with the diameter C in Fig. 1. The core is rammed as an annular ring round A, and shickled off round B, and is stiffened with rods running the whole length and passing through holes drilled in B, B. Since you must get the air off your core, it is impossible to make the casting with both ends blank; you therefore make holes at one end to allow of the escape of air, and these holes have to be filled up afterwards in the casting with blocks of iron before the flanges are faced or the covers bolted on. In Fig. 3, C, C represent the provision made for these holes in the core box, and the lengths D and E of the core box, which correspond with the lengths D and E in the casting, are apparent in a comparison of Figs. 1 and 3. The four portions of sand at C also afford a support to the core in the



Water Jacket Cylinder Pattern.

mould in the absence of prints. But it is better to allow four of the longitudinal stiffening rods to pass right through C, and press them into the bottom of the mould, so that the core cannot shift under the pressure of metal. Vent holes are also brought down through C into the bottom of the mould. The holes C are filled up with cubical blocks, filed to a fit and rusted in with sal ammoniac. If the annular water space is wide enough, you could cast ¾ in. or 1 in. round holes at C, and screw and rust studs in instead of square blocks.—J.

Scrap Screens.—H. B. (*Kettering*).—Your queries are so clear and pertinent that it is a pleasure to answer them. (1) The best foundation, I have found, is either an unbleached calico, that shrinks after being wet (this should be proved before using), or American oil cloth, self-coloured. If the former, then paper should be pasted on when the calico is strained in place. If strong paste be used, and rubbed well into the calico, as well as applied to the paper, the chances of its rising in blisters, that you dread, are practically absent. (2) Personally, I dislike intensely a black ground, especially if black and white prints are to be used. There is a good royal red American cloth, that looks well with coloured scraps; and a dull sage-green, or a dull terra-cotta paper, is pleasanter than black. If black and white prints, then no mixture of coloured prints; if coloured, no black and white, is to me an inflexible rule, that, if it be broken, means certain failure. Used with judgment in an all-over design, with the background of some cut away, but no actual ground showing through, the coarseness of the black sackcloth you mention would, I expect, be not only unsightly between the scraps, but make the sticking-on a labour and a penance. Plain dead-gold paper for coloured scraps is good, and I believe a plain gold American cloth—that is, a bronze colour, something near to gold—is to be had; but where, or at what cost, I know not. If the scraps are arranged, like a modern wall paper, with frieze-filling, band for chair-rail, dado, and skirting, the effect is good, and the separating borders of rich wall paper add to rather than mar the effect of the whole.—E. B. S.

Portable Music Stand.—A GRATEFUL READER (*Glasgow*).—Do you really want a stand to extend to six feet?—that is very tall. You want it with pillar, so I have given you two pillars, as additional strength will be obtained by these; but if you only want one pillar, it is, perhaps, needless to say that it is only necessary to discard one of the two I show, and put the remaining one in the centre of the article. I have designed this stand so that it may be a very firm one when open, as in Fig. 1, and will fold up very flat, as in Fig. 2, without any one piece coming entirely apart from the others. I think I show the frame at the top as something a little fresh. The various pieces of music can be placed on the back frame in readiness for choosing any one piece to appear on the front one. If this is not desired, it can be used as a double stand. Fig. 3 shows the former adaption; Fig. 4 the latter (in section). The ends of the frames are shown in Fig. 11, and by means of these being pivoted to the cross-piece on top of the column blocks, the frames can be turned to almost any angle, and can be fixed as desired by means of a small hook. A small bracket is hinged to one or each of the top column blocks, and serves to keep the back frame up, or allow it to fall down. Each column works the same as a telescope. The two top slides should be 20 in. long, the bottom one 18 in. This latter should be square in section, because the feet will be hinged to both of them in such a manner that they will fold round to the back; and this can be accomplished better on a flat surface than on a round one. Fig. 8 gives a plan of the bottom part (which should be joined together by means of fretwork) with the feet folded round them. To keep the stand firm when extended, fix between the tops of each pair of columns a rail, which in section will be as Fig. 7. Before fixing these, slide into each of them two pieces of iron. Then cut the tops of the columns as in Fig. 10, and the bottom end (within about 2 in.) as in Fig. 9. Now fix the above-mentioned rails exactly between the holes in the tops of the columns. Thus, it will be apparent, when each pair of columns are drawn from the others, if the irons in the rails are pushed apart, they will pass through one pair of columns and fit into the notches at the bottom of the other pair. For better explanation, I have given Figs. 5 and 6, which show respectively the irons completely in the rails, and the ends of them pushed out. Brass tubing will be preferable for the columns. You will, doubtless, make the frames according to your requirements; but for the benefit of others, I think 15 in. by 10 in. would be suitable. And if any one else wishes to make this stand, I think he will have to reduce the height, for I daresay it will be found too high for most "musicianers."—J. S.

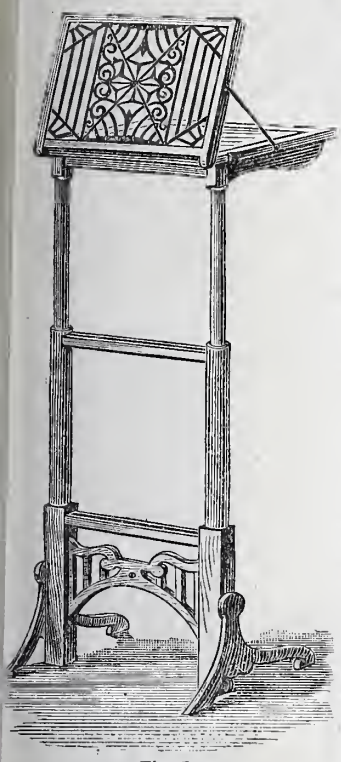


Fig. 1.

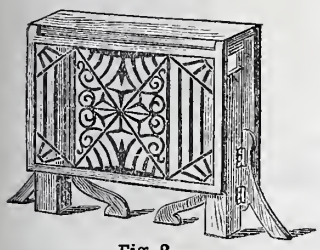


Fig. 2.

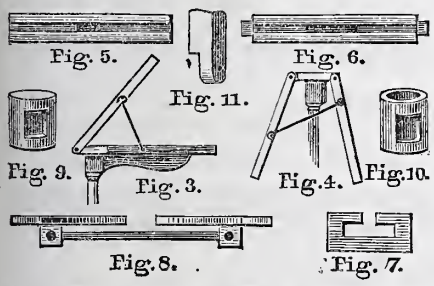


Fig. 1.—Stand extended. Fig. 2.—Stand closed. Figs. 3 and 4.—Frames up and down respectively. Figs. 5 and 6.—Cross Rails showing Catches in and out respectively. Fig. 7.—Section of Cross Rails. Fig. 8.—Bottom Part: plan. Figs. 9 and 10.—Ends of Columns (top and bottom respectively). Fig. 11.—Ends of Side Rails in Frame.

Bookbinding.—BOOKBINDER.—Articles on this subject have appeared in the following pages of WORK: 81, 110, 138, 220, 221, 253, 269, 285, 318, 365, 493, 494, 510, 572, 588, 590, 605, 651, 715, 716, 732, 779, 795.

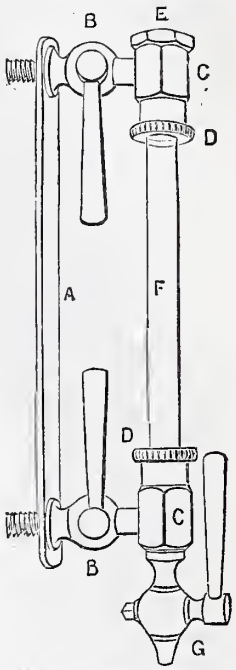
Making Cameras. — Detective cameras are made in very great variety, each claiming some special advantage. An ordinary ¼ plate camera fitted into a bag or box is a very workable form. The lens must have the focus fixed and the means of liberating the shutter on the outside of the bag or box. Why not write to the gentleman named and ask him?—E. D.

Acid and Gilding.—A PAINTER.—Glass embossing, or glass etching, is the process whereby certain portions of the surface of the glass are dissolved or eaten into by *hydrofluoric* acid. The parts of the surface *not* required to be acted upon are carefully painted in with a "stopping-out" mixture. Good Brunswick black alone will answer for experimental purposes as a stopping-out article, but to make it thoroughly reliable the addition of some 20 per cent. of dissolved white wax is advisable. A margin of wax or tallow is put round the glass to confine the acid, and, the stopping-out mixture being quite hard, the acid is poured on. As the fumes arising therefrom are dangerous to health, they must be avoided as far as possible. When the action of the hydrofluoric is completed, we pour it off and well clean with water. The stopping-out mixture is then removed with turps and soda water, or the latter alone will answer. The design is then "brought out" by grinding the surface with fine emery powder, which gives it an opaque appearance, and leaves the acid-eaten, sunk portion quite clean. This was the method usually adopted by glass embossers until very recently, when the introduction of a *white acid*, which will bite out and leave the surface opaque, has obviated the necessity for grinding. White acid is used in similar manner to the former kind. About half an hour is required for it to act, but both kinds should be tested for strength before being used, and if necessary, diluted with cold water to allow working them comfortably. In using white acid the *design* is stopped out, contrary to the method with hydrofluoric. They must, of course, be kept in gutta-percha vessels. Messrs. Wilkinson & Son, Attercliffe Chemical Works, Sheffield, advertise a sample pound of each acid and varnish, including gutta-percha bottles, forwarded on receipt of P.O. for 7s. 6d. This is a special line and worth the money. Doubtless the complete subject will be written upon in WORK all in good time. The canisters you mention are, I suppose, "show" articles at the grocers. Write with "japanner's gold size," and gild with "extra deep" gold leaf at about 1s. 3d. per book. For gold leaf, etc., write to J. Smith, 39 and 41, Bridge Street, Manchester.—DECORATOR.

French Polishing Bureau. — W. B. (*Bruntcliffe*).—Very likely, as you suggest, your bureau has been polished with beeswax; and if you are wise, you will not attempt to French polish it. However, as you intend to do so or die in the attempt, I feel bound to help you in order to save you from a premature end. The fact of the bureau being a larger thing than you have hitherto polished hardly makes any difference. If you have managed to do small articles you can do it, the process being the same. A larger surface has to be covered, and that is all. You must first thoroughly clean the bureau to get rid of the dirt which has accumulated. If the thing is solid you may wash it with a little soft soap or soda and water without much risk, but if it is veneered in parts, or inlaid, you must be careful not to make it too wet, for obvious reasons. Very likely a damped cloth will do all that is necessary. When washed, the bureau will look ugly. Do not be frightened—the colour will come back again when you French polish it. In the corners by the "cock" beading, the present unsightly appearance is probably owing to nothing more than an accumulation of dirt in those places which cannot be so easily rubbed clean. The only thing you can do when polishing such parts is to use extra care in working your rubber well into the corners. The brass handles should be taken off before polishing the wood. They should be thoroughly cleaned. If they have been lacquered, remove the old lacquer by soda and hot water. Polish brightly and relacquer, if you wish them to keep their brightness; if not, an occasional rub will remove tarnish. It is seldom that an amateur can manage to relacquer properly, but there is no reason why you should not try.—D. D.

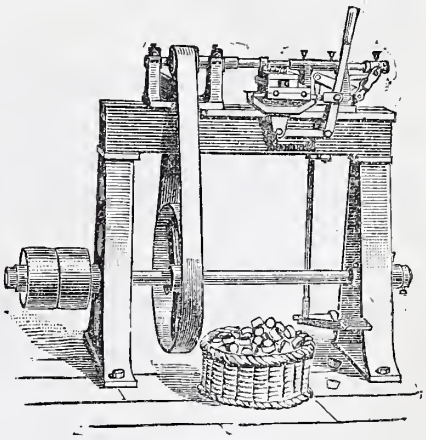
Polishing.—J. B.—You cannot do better than stain your bookcase a dark mahogany colour, which, you are doubtless aware, is very similar to rosewood, unless you are skilful enough to paint in the dark markings peculiar to the latter. From your letter it may be safely assumed that you are not, in which case an attempt to do so would certainly be a failure. Stain the wood with weak walnut colour, and polish with red polish. Make the stain with vandyke brown mixed with a little ammonia and water. The polish is ordinary French polish reddened with Bismarck brown. Read the previous answers in "Shop" to correspondents.—D. D.

Model Water Gauge.—YOUNG ENGINEER.—You will find this a troublesome job, and I think unless your boiler is of fair size you might be content with gauge cocks. Here is a tracing of a model water gauge from Mr. Lee's book, where its price is 7s.; you see it has three very small taps, and the glass is $\frac{5}{32}$ in. diameter; it is therefore drawn to scale and is full size. Mr. Lee makes a smaller and simpler gauge for 4s., with $\frac{1}{8}$ in. glass and no taps; but then if the glass should break you cannot shut off the steam. This is one of those things it is better not to have unless it is really well made; it would quite spoil the appearance of the boiler to have it leaking at the taps or glass, and it is sure to do so unless very well made. In the figure, A is a bit of wood or metal to represent the boiler; B, B, are little taps screwed into the boiler; C, C, are the sockets screwing on to the ends of the taps B, B; D, D, are the stuffing glands to keep glass from leaking where it is inserted; E is a little cap screw taken off to insert the glass; F the glass; and G the blow-off cock screwed into lower socket; you see how many small pieces there are (about seventeen), and how many joints and chances of leakage. Make up your mind, if you attempt it, to do it very well indeed, or you will have it leak.—F. A. M.



Model Water Gauge.

Wood Bungs.—READER (*Lynn*).—Below is a cut of the machine for making either the wood bungs or chives, and the spile pegs or vent pegs used for beer casks. It is the only machine I know of, and is by the eminent firm of Ransome & Co., whose cask machinery is superior to any others. READER will see at once that it is a form of lathe, and is fitted for the especial purpose.—B. A. B.



Wood Bungs.

Japanese Materials.—F. C. (*Stockwell*).—Your screen queries will have been answered ere this appears; but your new suggestion as to crewel-work panels is, of course, admirable *if* you can get bold decorative work. I should mount such panel like an oil painting, and sink two back to back in a framing thick enough to contain them.—E. B. S.

Brooch Pins.—J. P. (*Reigate*).—Brooch tongues or pins made of German silver can be bought ready-made for a few pence per dozen, from any jewellers' material shop, such as Pringle, Clerkenwell Road, E.C., Gray & Son, Clerkenwell Green, E.C.; or Plucknett & Co., 29, Poland Street, and there are

dozens of others in both Clerkenwell and Soho whose names you can find in the directory. If it is gold tongues that you are making inquiry about, then I strongly advise sending them to a working or manufacturing jeweller of good standing; or why not try and do them yourself, by the aid of the article in No. 41 of WORK, published December 28, 1889, and send to the jewellers' material shops for gold wire, chenier, solder, etc. etc.?—H. S. G.

Circular Saw Bench.—H. C. T. (*Newcastle-upon Tyne*).—Send particulars of this for "Shop," then C. W. T. (*Leicester*) and other readers besides will have the advantage of your contrivance.

Violin Wood.—R. P. (*Walkden*).—It is generally admitted that Swiss pine is the best wood for a violin belly. For the back, sides, and neck, sycamore or maple is chiefly used. The instructions you inquire about will appear in Vol. II. of WORK. If you ask questions on more than one subject, please do so on separate sheets; this will save time.—B.

Polishing Flower Stand.—J. H. (*Crewe*).—To polish your walnut flower stand, proceed in the usual way, which has been given several times in "Shop." Oil the wood if you wish to darken or enrich the colour. Use ordinary French polish, and, of course, before applying this, fill the grain with whiting mixed with a suitable brown colouring. Body up with the polish, and afterwards spirit off to get the gloss. To darken pine to walnut colour, use a stain composed of vandyke brown, mixed first with liquid ammonia and then diluted with water.—D. A.

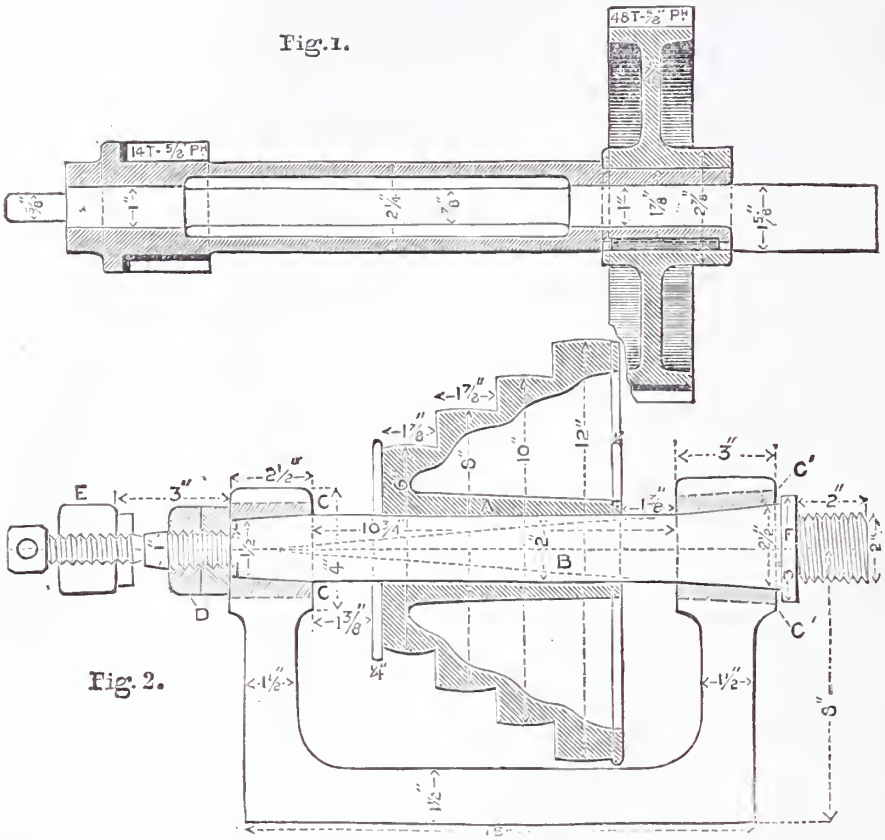
Pantograph.—P. M. F. (*Falmouth*).—Particulars of this have already been given in the "Shop" columns of No. 42; see page 669.—D. A.

Overmantel.—DR. H. (*Askeaton*).—I am afraid an overmantel of peculiarly elaborate and splendid design, which shall be a *chef-d'œuvre* in the tall pointed Gothic and semi-ecclesiastical style, is hardly a thing which could be appreciated by many of our readers. Such a thing is not to be designed or thought out in a day, and I am not surprised at your having failed to get what you want from dealers in fretwork. Your best plan will be to get designs prepared by some good furniture designer, or even an architect, though I must tell you that architects' furniture is not generally successful. Possibly, if you are known to any first-class cabinet maker, you might arrange with him to supply you with a design, but you will probably have to pay less if you apply direct to the artist. If you do not know any, we can give you the name of one who might be willing to undertake the commission.—D. D.

Lapidary Work.—The best book I know of is Holtzappfel's "Turning and Mechanical Manipulation." Vol. III., Section II., is "A Descriptive Catalogue of the Apparatus, Materials, and Processes for Grinding and Polishing Commonly Employed in the Useful Arts." That volume will answer, I think, all your questions. If it does not, write again, but limit and define your wishes, for the means taken to produce fine-cutting edges will vary according to the shape and the use to which the tool is to be put. And the same remark applies to the other six questions you ask or imply in your letter. As the work mentioned is a very valuable work for reference, and is also very expensive, you might apply at your public library, and, if it is not there, make an application to have it added. It is published by Holtzappfel, Charing Cross, London, and altogether consists of five volumes. A cheap book from which you may get some good hints is "The Mechanic's Workshop Handybook," Hasluck, published at 2s. by Crosby Lockwood & Co. In this, Chapter VII. on "Tool Grinding," and Chapter IX. on "Abrasive and Finishing Processes," particularly apply to your inquiries. By-the-bye, have you not to some extent tried to mislead us by defining your queries as "lapidary's" work? Should it not be instrument maker's or cutler's work?—H. S. G.

Lathe Dimensions.—G. H. R. (*Saltley*).—If I were you I would buy the castings of your proposed headstock and work to them. Remarking upon your drawing, you have only ½ in. of metal round the gun-metal bushes of mandrel; you would burst your casting by driving in the bushes. Have 1¼ in. there. There is only $\frac{1}{16}$ in. allowed between the front of headstock and back of collar on mandrel head; why, the mandrel will wear back till collar touches headstock in a year or so, and then where will you be? I would allow at least ½ in. between collar and front of headstock. You show in your drawing below the base of headstock 8 in. wide; I think 6 in. is plenty. It need not be wider than the poppet, and that must pass between the wings of the saddle. Now, as to the way the mandrel is made, with two conical bearings pointing the same way: I know Whitworth has made lathes that way, but then he uses hard steel, and the wear is practically nothing. I don't approve of this plan, because you cannot be sure the two cones will wear equally, and there is no means of adjusting one without the other. Suppose the front cone wore in $\frac{1}{16}$ in. the first year, and the back cone not at all (a very likely thing), then you could not take up the wear. No, no! Stick to the usual plan; fit a loose cone on the back end of mandrel, and turn it the opposite way. Size of your front cone will do; body of mandrel on which loose pulley turns may be reduced 1¾ in.; then reduce again to 1¼ in. where the sliding cone fits on with a feather. Not having myself an 8 in. back-geared lathe, I applied to some well-known makers (the Britannia Co.), and they have kindly sent me a tracing of the back-gear spindle of 8 in. lathe. You will get from this the width of wheels, which will enable you to determine the length of your headstock; wheels are 6·16 in. apart from centre to centre, 48 and 14 teeth, ⅜ circumferential pitch, and 5·03 diametral pitch.—F. A. M.

Fig. 1.


48T-5/8" Pit
14T-5/8" Pit
E
3"
2½"
C
C'
B
D
F
10¾"
1⅞"
1½"
2"
1⅜"
4"
6"
8"
10"
12"
1½"
1½"
1½

24 Pages Illustrated. Weekly, price *1d.*

CASSELL'S

SATURDAY JOURNAL.

This Week's Number contains—

IN THE NICK OF TIME.

Complete Story.

By RICHARD DOWLING.

Illustrated.

Mr. John Morley, M.P., at Home.

Illustrated.

Entrapping a Rascal.

Complete Sensational Story.

POLICEMEN ON AND OFF DUTY.

A Duel on a Tight-Rope.

Complete Story.

Pictorial Posters and their Makers.

&c. &c. &c.

"The best and cheapest pennyworth of popular literature ever produced."—The Times.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers.*

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets, containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

NEW AND ENLARGED EDITION.

Price *1s.*; or in cloth, *1s. 6d.*

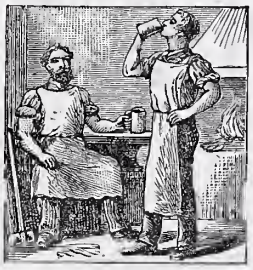
PHOTOGRAPHY FOR AMATEURS.

A Non-Technical Manual for the Use of All. By T. C. HEPWORTH. *With Illustrations.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

HOME INDUSTRIES EXHIBITION,

TO BE HELD IN CONNECTION WITH

THE NATIONAL CO-OPERATIVE FESTIVAL,

CRYSTAL PALACE, AUGUST 16TH TO 23RD, 1890.

Gold, Silver, and Bronze Medals, Money Prizes, and Certificates for all classes of work.

Schedules free upon application to WM. BROOMHALL, General Secretary, 49, Bedford Street, Strand, W.C.

Seventh Thousand. Price *1s.*; post free, *1s. 1d.*

WORKING MEN CO-OPERATORS: **What they have Done, and What they are Doing.** By ARTHUR H. DYKE ACLAND and BENJAMIN JONES.

"The co-operative movement is one of great social and economic importance, and those who wish to learn what hold the principle has obtained over working men cannot do better than consult the little book prepared by Mr. Acland and Mr. Jones. It cannot, we imagine, but prove a useful little manual for those for whom it is intended."—*The Times.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

HARNESS'

ELECTROPATHIC BELT

Naturally, speedily, and permanently cures almost all disorders of the nerves, stomach, liver, and kidneys, and is the safest and best remedy ever discovered for

RHEUMATISM

and kindred ailments. Those who have any doubt as to its remarkable healing and strengthening properties should write at once for book of testimonials, or call and personally examine the originals at the **Electropathic and Zander Institute** of the **Medical Battery Co., Ltd.,**

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place.)

Advice free of charge, personally or by letter, **Write for a Belt or Pamphlet** to-day, before you forget it.

NOW READY, price 6d.

"Little Folks"

For JULY,

forming the First Part of the New Volume, and containing as a Frontispiece a ***Handsome Picture in Colours,*** entitled "SECRETS," the commencement of **Two New Serial Stories,** full regulations of the "New 'Little Folks' Painting Book" Competition, and other novel and interesting features.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

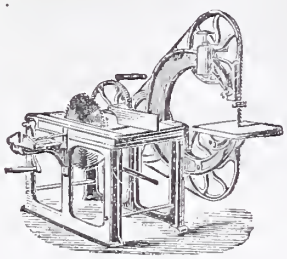
Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

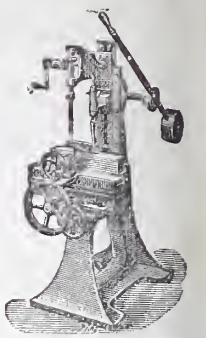
LEWIS & LEWIS,



ENGINEERS,

CAMBRIDGE HEATH,

LONDON, N.E.

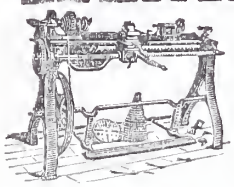


THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,

For Hand or Power, will take in 22 in. Circular Saw, and will cut by hand-power up to 5 in. deep.

THE "HACKNEY" MORTISING & BORING MACHINE, With 8 Chisels, 1 Coredriver, Key, 3 Augers, and 3 Drills.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT

SAMPLE BOX 6d OR FOR 7 STAMPS BIRMINGHAM. [33

London Warehouse: 124, NEWGATE STREET.

PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine**, any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,

TOOL MAKERS, DUBLIN.

GRATEFUL—COMFORTING.

EPPS'S COCOA

BOILING WATER OR MILK.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 69.] SATURDAY, JULY 12, 1890. [PRICE ONE PENNY.

A DESIGN FOR A SELF-ACTING FOUNTAIN.

BY C. MAYNARD WALKER.

UNTIL perpetual motion becomes an accomplished fact, the term self-acting must always be one of convenience rather than accuracy, as, strictly speaking, there is no such thing known as a self-contained force. An ordinary clock appears to be self-acting, but, as every one knows, it comes to a dead stop so soon as the force which was put into it by the act of winding up the spring or weight becomes exhausted; and, in like manner, any other piece of self-acting machinery must, of necessity, be under the same law. So that what are known as self-acting fountains are contrivances for forcing up a jet of water to any required height by the exercise of a reserved power, and are distinguished from ordinary fountains in that they are portable and do not require to be connected to any water supply or waste overflow. They are thus very interesting, and convenient for decorative purposes where it would be difficult and inconvenient to run a water service. I have been careful thus to clear the way in the foregoing remarks in order that the reader, who may be a novice in hydrostatics, may be deterred from expecting too much; for I frequently find that no sooner does an ingenious sort of man, not fully informed on this subject, get hold of the idea of a self-acting fountain, than he straightway wastes a good deal of time in a vain endeavour to make it go on for ever. I think perhaps it is the absence of any wheels, weights, etc., in the apparatus which makes it appear that the water rises up of its own accord, and with a little further improvement might be made to keep itself going. Believe me, the whole thing is on just as hard and fast lines as any other piece of mechanical work, and after using up the power you put into it, will come to a stop. There are numerous methods of making the water rise in these portable fountains — some with plungers, some by the gradual fall of a heavy weight on a flexible reservoir, some by a spring, others by air bellows, etc.; but, undoubtedly, the simplest and most effective method of all is that which is known as Hero's

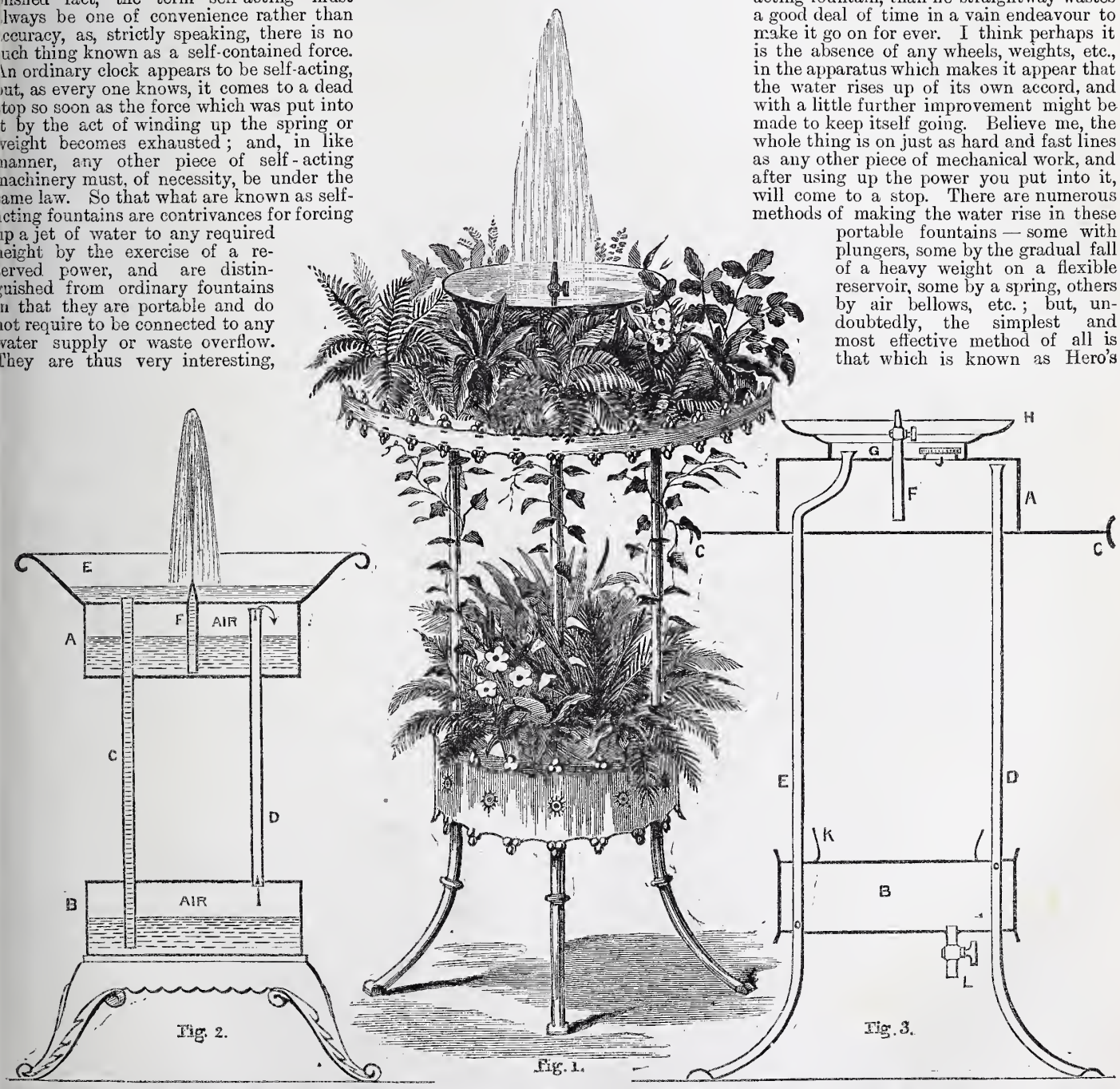


Fig. 1.—Design for Ornamental Self-Acting Fountain Table, complete and furnished with Plants. Fig. 2.—Diagram showing Construction and Working of Hero's Fountain. Fig. 3.—Section of Fountain Table showing Method of Construction.

fountain, which contains no weights, wheels, springs, or any movable parts, and yet works with unerring accuracy so long as the vessels remain sound. This principle is called hydro-pneumatic—the action of water and air. The principle admits of an indefinite number of forms and arrangements in the exterior, of which Fig. 1 is one; and may be made in any dimensions. This kind of fountain is interesting, moreover, from the fact that it is one of the oldest contrivances in existence, and is known to have existed two thousand years ago, being described in the "Spiritalia" of Hero, who lived some fifty to one hundred years before the Christian era; and, however much the exterior may have changed phases since, the ingenuity of mechanical men has been unable, through all those centuries, to make any improvement in its construction which will render it more effective. Fig. 2 is a diagram illustrative of Hero's arrangement. It consists of two vessels, A and B, air and watertight, except at their openings, which communicate with each other by pipes, having a lip, or basin, on the upper edge of A. If water is poured into E, it will run down the pipe C, filling B, the air escaping up D, and out at the jet-pipe F. The water will continue to run until the pipe D becomes full, and the bottom of A covered with water sufficiently high to cover the mouth of the jet-pipe. No more will, however, run in then, as the air is no longer displaced. Now, if the fountain be turned upside down, the contents of B will run through D and fill A, the air escaping through the jet pipe. If, now, the fountain is set upright, we have A full of water and B full of air. If water is then poured into the basin, it will, as before, run down C, but the air can no longer get out at the jet-pipe, because the latter is immersed, so that the air in B becomes compressed by the hydraulic force of the water of the pipe C, and as this compressed air passes up D into the upper part of A without loss of force, it follows that the water of A is under the same pressure as B, but as it is so many inches higher up than B, the water of A will, if released at the jet-pipe, endeavour to flow as high as the length of the pipe C, minus its dip, and will continue to do so as long as any compressed air is left to force it up, but not a moment longer. The process of reversing the apparatus—or some other method of getting the water out of B and lifted up into A—must now be performed if the work of the fountain is to be repeated. It is just this power which has to be exerted (varying in proportion as the dimensions vary) which stands between our self-acting fountain and perpetual motion. The object of the design at the head of this article is to cover the bald arrangement of Hero, with some attempt at ornamentation as well as usefulness; and to so arrange the periodical recharging of the upper vessel as to reduce its inconvenience to a minimum.

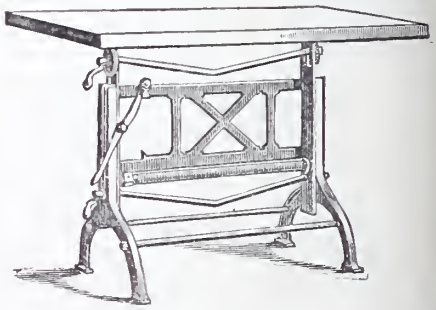
Any one who can solder may undertake the making up of this fountain with a certainty of success; and as the ornamental portion is bought ready made, and really covers the work, even a little clumsiness of soldering will be out of sight; but the worker should, before setting to work, thoroughly read and understand the working of the fountain—the rest is very easy. Fig. 3 shows in section the arrangement of parts. The vessels are made of No. 10 sheet zinc, and are ornamented with zinc fret, which can be obtained from Messrs. Still & Co., metal spinners, Charles Street, Hatton Garden, E.C. The legs consist of lengths of brass tube, four in number, arranged as shown (Fig. 3). The question of measurements is one which must be left entirely to individual taste. I may mention, however, that I found a very convenient size measured—height over all, 3 ft.; width of fern tray (C C), 18 in. (inside); water vessels (A and B), each 12 in. diameter × $3\frac{1}{2}$ in. deep; legs of $\frac{3}{4}$ in. brass tube; water well, or basin (G), 8 in. diameter × $1\frac{1}{2}$ in. deep; glass centre-dish (H), 11 in. or 12 in. diameter. It will be seen that very great inconvenience would arise if it were necessary to invert this fountain each time it stopped playing, to obviate which a draw off tap L is used, in conjunction with an *air-tight* screw filling-plug J. With above sizes, the fountain will throw up a pretty jet to a height of about 20 in. for about one hour at each operation, the process of recharging occupying about one minute, the same water being used over again.

To make up such an one, the worker will require to cut out a circle of zinc $18\frac{1}{4}$ in. diameter, and three circles of $11\frac{3}{4}$ in. diameter. These should be turned up at the edges all round for $\frac{1}{8}$ of an inch. If not experienced at this, send the sheets to the tinman to be jennied, costing a few pence only. For the ornament round edge of fern tray, use No. 240 fret (Still's Catalogue), soldered on securely all round, and *water-tight*, or a disagreeable mess is made when watering the plants. I have used the same fret for B, but with the stamping upon a wider margin; but as this is difficult to procure in small quantities, the maker of one or two fountains must be content to use an edging of narrow fret top and bottom of B, making up the complete cylinder in sheet metal first. The brass legs are carried right through the lower vessel and under side of top. Great care must be taken that the holes for these are true with each other. These are made with a $\frac{3}{4}$ centre-bit. Having settled these, it is best to solder to each leg (at the point where the bottom of vessel will be soldered) a small piece of metal, so as to prevent the vessel going too far on, and to hold up the work until it can be tacked together. The novice will find the four legs somewhat "wobbly" as he endeavours to make them stand upright. To get over this, prepare a piece of board, and sink four holes to correspond with the size and position of those in the zinc; pass the leg through B, and put over their upper ends the piece of wood, the sunken holes of which will hold the legs tight and true until you get the lower part soldered up. Notice (Fig. 3) that a hole must be made in the pipe D at the point indicated, also a hole in the pipe E just above the bottom of vessel. The other two legs are dummy pipes. All the legs must be stopped up by soldering at bottom. The pipe D reaches to not quite the top of A, to allow an air vent. The upper curved end of E is employed to bring it inside the basin G. If the worker can manage it in one piece the better, but if not, a bit of $\frac{1}{2}$ in. compo. tubing may be joined on. A length of $\frac{3}{8}$ in. compo. will do for the jet-pipe, and a convenient jet is formed by using what is termed among gas-fitters a cigar-light cock, to be had through a dealer in gas-fittings. The glass dish can be obtained at the same source, termed a "glass consumer," with about a 1 in. hole in the centre, cost about 1s. 6d. retail. This rests loosely upon G. For the filling-plug J use a "lamp feed screw," with a soft and effective washer. The bareness of the legs is taken off by festooning them with artificial ivy cut from zinc, and fastened with wire stems on to wire about $\frac{1}{8}$ in. thick run spirally round each leg. The cutting of these leaves is quite easy with a strong pair of scissors, and look effective when painted a natural tint. The tray K is formed by soldering on a ring of zinc about $1\frac{1}{2}$ in. deep, and affords a handy receptacle for small ferns and lycopodium. Before attempting any painting, the work must be thoroughly tested, as the slightest leak will be fatal to its working. Having settled this matter satisfactorily, we will give the fountain a complete trial, thus—take off the screw-plug and pour in water until the top vessel becomes full, replace plug, and at the tap L draw off any superfluous water there may be, turn off the tap, and nearly fill the basin G, when the water will instantly rise from the jet, and continue playing until exhausted. Then draw off at L, and refill as before. Paint the work to your taste, and plant ferns, etc., all round space outside top vessel and centre of legs. Your zinc work will last much longer if the inside surface before soldering up is painted over with Brunswick black; and, in conclusion, permit me to add that I will gladly answer any inquiries on points that may not be quite clear in the columns of "Shop."

AN IMPROVED DRAWING-TABLE.

BY JOHN CHARLES KING.

Fewer tasks in a draughtsman's office demand such intense application of mind to ensure accuracy as in the scale drawings of machinery intended to serve for the exact guidance of pattern-makers, model-makers, and constructive machinists. With the most perfect instruments and best paper, good light, and office secure from jar and interruption, there is still need of a desk or table adjustable so that the strain on the human frame shall not be intensified by having to reach over to the top of the drawing-board with instruments held or moved on the paper often beyond the easy stretch of vision with its dual watchfulness



An Improved Drawing-Table.

of the instrumental manipulation and the critical resultant effect on the paper, shown sometimes to the hundredth part of an inch.

How few tables fulfil the requirements of the worker in aiding him and saving him from constrained physical effort: more brain-wearing and nerve-exacting to ensure the exactitude of an almost infinitesimal point in a drawing than would be the vigorous use of a sledge-hammer at the forge.

This has long been felt as one of the neglected matters in the appliances of a drafting office. Many makeshift contrivances have been adopted from time to time, but even these are attended with the irksome feeling that they are unstable, and may move slightly at a critical moment of work. From

incinnati, U.S., a drawing-table has been troduced to draughtsmen, which fulfils ost of the urgent requirements for an adstable table, with perfect immovability uring work, and admitting ready alteraon to any height or angle of surface of rawing-board.

On the centre line of the under side of the able are two vertical iron sliding pieces tting to the uprights of the standing frame; horizontal shaft is shown at the bottom of e sliding frame, which has racks engaging ith wheels on the ends of the horizontal aft. A spiral spring is shown wound ound this shaft, its purpose being to serve balance the weight of the movable part of e frame and table-top; this secures the oard from sinking if left at any elevation ithout clamping securely.

The raising or lowering of the frame is ffected by a hand lever, having its fulcrum n the standing frame.

Two pieces of bent tubular iron are shown ith bolts through their lengths, with clamp andles for screw tightening at one end of ach. The ends of these pieces of bent tube imply butt against the sides of the upright liding pieces.

The action of turning the clamp handles s to straighten the tubes by the internal olts, pressure making them grip the upights firmly, while the grip of the bolt-head nd clamp holds the upright at any height, r the table-top at any required angle of nclination.

Simplicity and ingenuity combined ensure n economical instrument in light malleable nd wrought iron, ready for fixing the rawing-board in its place.

They are named the "I. X. L. Drawingables," and are made by Jones and Mack, , West Fourth Street, Cincinnati, U.S.A.

PRACTICAL DETAILS OF BOOKBINDING.

BY GILBERT CLARKSON.

Book Sewing by Machinery—End or Waste Papers—Case Making.

Book sewing can now be done by machinery. There are a few different kinds of machines made by different makers for this purpose; but *the* machine is that one known in the trade as the "Smyth Book-sewing Machine" (Fig. 15). It is, considering it as a machine, a most wonderful invention. Its movements seem so full of intelligence—so human-like that one can almost fancy it must have a brain concealed somewhere to regulate and govern them.

If I tried to describe it I would fail, for words of mine could not give it justice. I can only quote from the catalogue lying before me, and as I have had a long personal experience with it, I can endorse all that is there said about its capabilities.

"This is an entirely new and original machine, for sewing together the sheets or signatures of a book. The work it produces is more solid and much stronger than that produced by hand, and it can sew a book however thick, from a demy 4to to a royal 32mo.

"On a comparison of results, the hand method produces in a liberal average 2,500 signatures sewed per day. With this machine 15,000 to 20,000 signatures can be sewn per day, leaving a margin of 13,000 signatures to balance investment and running expenses. It sews without tapes, or with one, two, three, or four tapes."

The above quotation is from the report of the judges (who were leading bookbinders) at the exhibition where it was first exhibited, and where it gained for its inventor the Grand Gold Medal of Honour of the American Institute.

There are four radial arms on the machine which project from a vertical rod; on these arms the sheets are placed one at a time. The arms rotate, rise, and adjust the signature, so as to bring it to its proper position under the curved needles.

As each arm rises, small holes are punched, by means of punches, in the sheet from the inside to facilitate the entrance and egress of the needles.

The loopers then receive a lateral movement to tighten the thread, and this movement is made adjustable in order that books may be sewn tight or loose as required.

It has become very popular in this country. There are hundreds of these machines now in use—some shops running as many as twelve and fourteen. Just fancy the number of books that will be sewn with twelve of these machines in a day!

Oh, shades of Caxton and Wynkyn de Worde; oh, Roger Payne and Clovis Eve, rest in your graves! Come not back to visit us now! We would frighten you, we would bewilder you with our thousands and tens of thousands of volumes folded, sewn, and bound in a single day.

The careful workman when he gets the books from the sewer will take up each volume separately and knock it up to the back on his lying press, and then grasp it tightly by the fore-edge, and tap it gently along the side of the back with the hammer to lay down any unnecessary swelling. This may not seem a very important matter, but I like to see a man beginning the process of forwarding in this manner. Before putting on the end papers, or, as they are sometimes called, the waste papers, the first and last leaf of the book should be pasted down. Throw back the last leaf and paste the second last leaf neatly about ⅛ in. from the back, and turn over the last leaf again to its place and rub it down with the finger; treat the first leaf in the same manner.

The waste papers may be white or coloured, enamelled or marbled. They may have cloth or leather joints. For plain, half-bound books, a good white waste paper looks best. About 20 lb. printing demy is the very thing for 8vo magazines. It is even heavy enough for quartos. If the joint of the book is well made, there will be no fear of the paper splitting. For each book double waste papers or four fly leaves will be required. They are put to the book in the following manner:—The paper is first cut a trifle larger than the book, then folded, and spread out on the board or table, the fold to the right hand, each sheet set back about ¼ in. from the other and pasted. Each sheet will have thus a line of paste down the back ¼ in. broad. Lay the book on the bench with the fore-edge toward you, lift a sheet of paper and lay it carefully on the book flush with the head, and the fold flush with the back, draw the heel of the hand down it to give it a set; open the sheet, and in the inside paste another in the same manner, taking care to have the fold of the paper again even with the back of the book. I do not like the fashion of pasting the waste paper solid, *i.e.*, pasting the first two leaves together, it makes the joint far too hard, and instead of making it stronger as the intention is, it makes it more liable to break, and besides, gives the book a very uncouth appearance. Marble papers should be treated in much the same manner. Put on the white as directed above, and paste one half of the marble paper—that part which is to come nearest the book; rub it well down with the hand.

These remarks only apply to ordinary jobbing. When there are thousands of volumes to waste paper, we have to consider what is the most expeditious method and act accordingly. But, at the same time, we must not sacrifice neatness and cleanliness for mere speed. A cheap book may be a neat book; at the least, it can be clean.

Before leaving this part of the subject, I want to give a nice wee wrinkle to those whom it may concern about cloth joints. There is wanted for a pair of marble or coloured papers with cloth joints the following:—Two fly leaves of white paper, two strips of cloth and four pieces of marble or coloured paper, and, of course, the glue-pot and brush. Fold the cloth lengthwise, and instead of gluing it all over, glue only one half. Lay the white sheet with the fold along the glued portion of the cloth, turn it over, and fold it again. The cloth will now be in the inside, half of it sticking to the paper and the other half loose. Glue the coloured paper all over, and lay it to the edge of the cloth and rub it down in the usual manner. There will now be a loose bit of white paper along one side; when putting the waste papers to the book, this should be kept to the outside, and when the book is bound and comes to be pasted up this loose piece will have to be cleaned off the result will be a cloth joint that will no need much persuasion to make it stick to the board, and the book will close ever so much nicer.

I trust I have made this plain. I know it will be like the news that was brought by the fiddler to some binders. I learned it long ago when Family Bibles were more fashionable than they are now.

When books are waste papered, they are next glued up. To do this, knock them well up at the back so as to get them square. Glue them with good thin glue. Rub it well in between the sections and leave them to dry.

While they are drying, I will draw your attention to some remarks about case making, *i.e.*, making cases for cloth-bound books.

This method is resorted to in these days for the sake of speed.

We have to bind books not only cheaply but quickly. So when we have a few thousand volumes, instead of going round the old-fashioned way of fitting the boards to the book after it has been cut and covering it with cloth or leather, we cut the boards all one size and make the cases many a time before the books are printed.

Case making is a very simple matter, and is generally entrusted to girls. Very little explanation is necessary. The whole secret lies in getting the boards square to begin with.

The boards may be cut with the guillotine or the Rotary Mill-board Machine (Fig. 16), nick-named the dulcimer. The last named is a very useful machine when the boards are thick and we want to save the guillotine knife. But, for most work, resort will be made to the guillotine.

This machine is too well known to require description here. To tell a binder about a guillotine would be as useless an undertaking as carrying coals to a well-known coaling district. Still, all guillotines are not alike, and some deserve special mention. I am thinking now of one of Messrs. Furnival & Co.'s "Self-Clamp

Machines" (Fig. 17). What a powerful machine it is! and what an amount of work it can accomplish. A touch of the finger is all that is wanted to start it at full speed, when it will clamp, cut the job, and return in two or three seconds. There is practically no limit to its capabilities. As fast as the cutter-man can manipulate the stuff it will cut. It can be stopped instantly at any part of its ascent or descent. Where steam power is available, these self-clamp machines are a great boon.

While on the subject of cutting machines, I may mention something quite new in this line—something not generally known—a machine which is sure to find its way into every binding shop which has a right to the name. It is called the "Ever-sharp Quadruple Cutter." It is specially adapted and intended for trimming the edges of printed books, pamphlets, and stationery. The machine in a less complete form has been long known in the United States, where about 800 are at work.

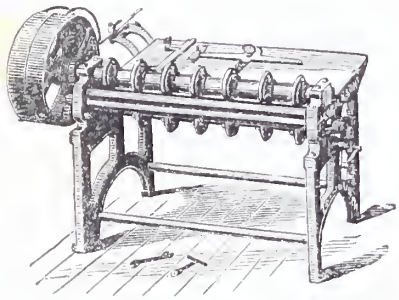


Fig. 16.—Rotary Mill Board Machine.

It will be an important adjunct to the ordinary guillotine in large binding and printing establishments. It has been little known in this country, although it was introduced into one large establishment in Scotland some years ago, where it cut so clean that it was proposed to reduce the cost price paid to the binders for gilt edges because no scraping was needed. An objection was made to it because the knife required sharpening oftener than the ordinary guillotine, but the quantity of work done was not taken into consideration, and these and other objections prevented its general introduction.

Several improvements have been made, including an apparatus for keeping the knife continually sharp, and all objections to it in its primitive form have been overcome, and it is now finding its way into the large printing and binding establishments in London and the provinces, and also, I understand, in our Australian colonies.

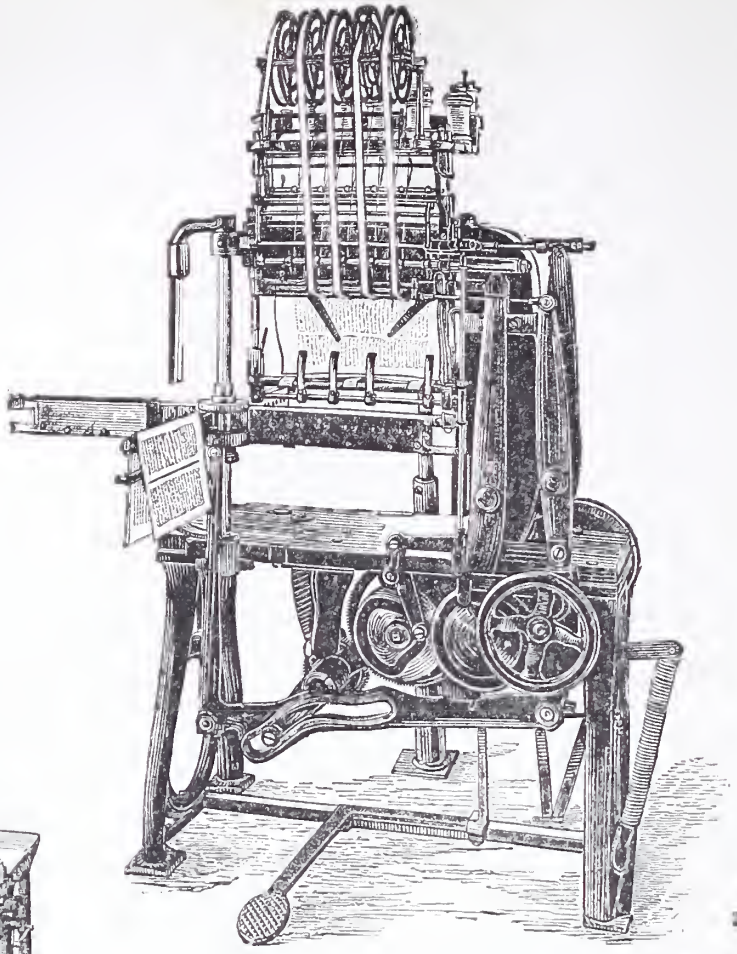
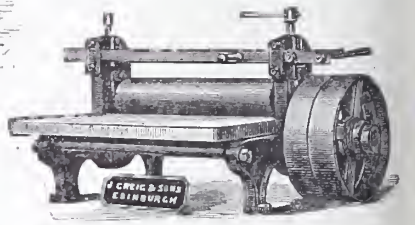


Fig. 15.—Smyth Book-Sewing Machine.

The latest addition to it—the patent sharpener—has just been made by Mr. W. C. Horne, who is the English maker of it.

The machine is in most respects very unlike the well-known guillotine. The knife is stationary, and the work moves to it just the reverse of the usual operation of paper cutting. The work is placed on a solid iron bed, in the centre of which for small work runs the clamping screw, and against the square sides of which the backs of two sets of books are placed. The gauge for the cutting is a wooden platen, exactly the size of the book to be cut, and when the work is placed in order and screwed down, the table is slidden towards the knife until the wooden gauge touches it; and then, on pressing a treadle, the table rises up an incline of 45 degrees, the knife cutting the work as it rises in a rapid and clean manner.

Fig. 18.—Greig's Case-Rolling Machine.



As soon as the cut is made an automatic action returns the table to its starting point, and then the workman turns the work round for the next cut, the same operations being repeated until four sides are cut. The blocks for the various sizes of work can be placed in position in a few seconds. Work, according to its character, to 8 in. thick, can be trimmed in one cut, and it will cut from 4 in. × 2½ in. up to 12 in. × 16 in. From the rapidity of its movements it has received the name of the "Demon."

It is not intended for sheet work, but it is a valuable addition to the cutting power of an establishment. Let

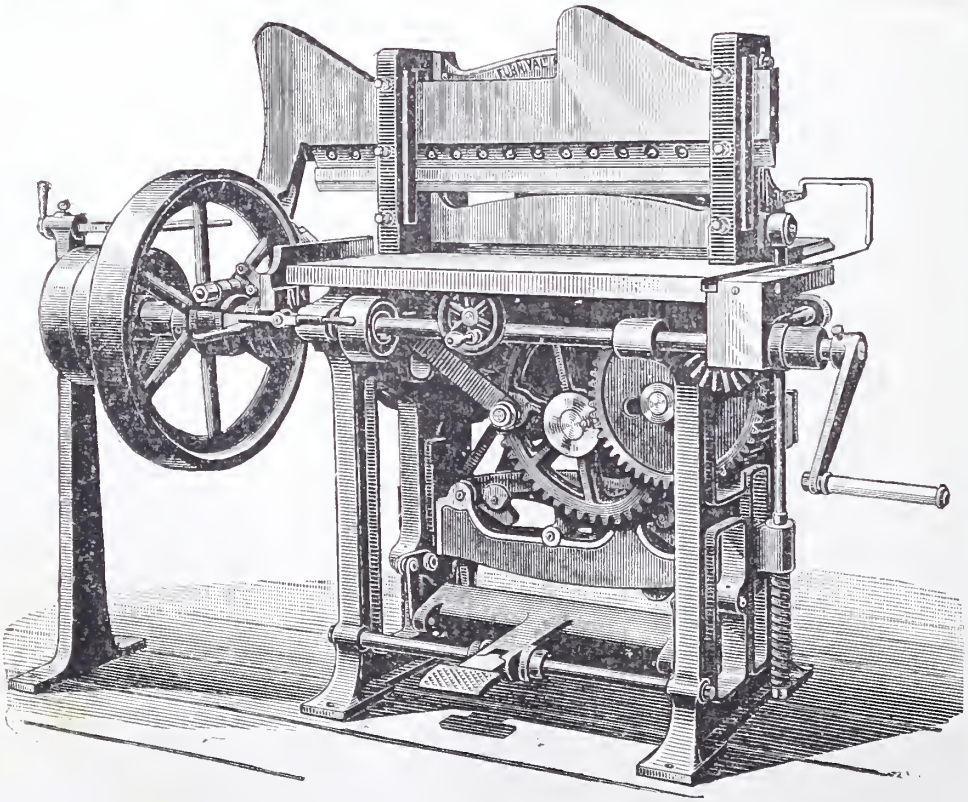


Fig. 17.—Furnival & Co.'s Self-Clamp Machine.

hope * that it will be the means of causing publishers to trim their periodicals before sending them out, and so do away with that ever *blunt* paper-knife, the forefinger.

But to return to case making. The usual method of making cases after the boards and cloths have been cut is to glue a cloth and lay it flat on the table; give it a look over to see if the gluer has left the hairs of the brush on it. If there happens to be one pick it off, for a hair shows very badly, specially on satin-grained cloth. Lay a board to the left-hand side, put the back gauge close up to it, and put the other board close up to the gauge. Turn all over and give a sharp rub with the hand, cut the corners with a pair of scissors and turn it in, rub down with the folder, and repeat *ad libitum*.

Messrs. Greig and Sons, Edinburgh, make a case-rolling machine (Fig. 18) which is a very serviceable machine in cloth-binding shops.

When the cloth is turned in, the case is simply passed through the machine. The rollers are of rubber, and whether the case has bevelled or plain boards, it does not require to be touched with the folder after it has passed through the machine, so there are no folder marks on the cases. They are turned out quicker and much better than by hand.

MECHANICAL MOVEMENTS.

BY FRANCIS CAMPIN, C.E.

RELEASE AND TRIP MOVEMENTS—CAMS AND CAM BARS.

Release or Trip Gear.—For some particular purposes very sudden movements are required, and such may be obtained by the release of a weight or a spring; preferably a spring, because its motion is more rapid than that of a weight. In order to produce this instantaneous effect, the spring must first be put under strain and then suddenly released. In Fig. 12 such an arrangement is shown. A is a shaft carrying a toothed sector, which gears with a rack on the rod B, to which the sudden movement is to be imparted. This rod is guided at the bottom, and connected there with the particular detail to which its own motion is to be imparted. At the top the rod passes through G, a part of the framework of the machine, and its upper end is surrounded by a spring D, on the top of which rests a washer plate E, and on the top of which the end of the rod B is secured by a nut F. At the back of the rod B is a tooth C, and on a dead centre M fixed to the framing is a pawl I, pressed against the rod by a spring K. Made in one piece with the pawl I is an arm L, which passes behind the rod B as shown. If the sector revolves in the direction of the arrow, its teeth will act upon those of the rack, and the bar will be depressed, compressing the spring D between the plates F and G. The parts are so proportioned that before the sector leaves the rack the tooth C will have been carried below the pawl I, which will arrest its return (against the pressure of the spring) until the striking piece H on the same shaft as the sector, but behind it, strikes the arm L and releases the tooth C from the pawl, when the spring D will be at liberty to act. An indiarubber washer N will deaden the blow upon the plate G. The position of the piece H upon the shaft in its angular relation to the sector will be determined according to the position at which the spring is required to be discharged. The fact of the rod B being held up by the spring D will ease any concussion to which the teeth of the rack and sector might be subject on first engaging together. The amount of tension on the spring D is adjusted by means of the nut F. There may be required a movement which shall act instantaneously in both directions, to operate a valve for instance: this may be managed by means of the contrivance shown in Fig. 13. The valve rod is jointed at B to one end of a lever carried on a dead centre A between the arms of the lever (which is double); on the other side of the centre A is a roller C, lying between two plates G, H, and at the end is a catch I, which engages alternately with the pawls K, K′ carried upon pins L, L, and kept in position by springs N, N. To a rod M are fixed two bars D, D, which pass through holes in parts of the framing O, O, and also the loose plates G, H, between which and the framing are the spiral springs E and F. Upon the bars D, D are collars P, P, which cannot pass through the holes in the plates G, H. In the position shown the rod M is at the bottom of its stroke, the spring E is compressed, and the end I of the lever I A B locked by the pawl K. An up stroke being now made, the plate H will be forced up, compressing the spring D, and the tappet Q will strike back the tail of pawl K, the spring E will throw up the plate G, and roller C and the lever top I will engage with the pawl K′, and hold up the plate H and spring D until released by the down stroke of the rod M and bars D, D; thus at each end of the stroke of the rod M an instantaneous movement will be communicated to the rod jointed at B to the lever I A B. The roller C may be made of rubber to deaden the noise of contact with the plates G and H. The rod M is actuated from some moving part of the machine to which it is attached. There is an arrangement of mutual release and locking quadrants, Fig. 14, which has been much used in connection with single acting pumping engine valve gear, and which may be applicable to other purposes. The quadrants A and B are keyed on the ends of shafts C and D, which also have arms, C E and D F, carrying at their ends the weights G, H. The details of machinery to be actuated by the rocking shafts are connected with them by arms not shown in the diagram. C I and D K are tappet arms. In the position shown the quadrant B is locked by A, and the weight H is resting on a support to take the strain off the arm C E. If, now, the tappet arm C I is depressed so as to turn the quadrant A through a quarter of a circle, the quadrant B will be released, the weight G pulling the shaft D round; and A will be locked by B until the tappet K is pushed up, when it will be released and the state of affairs shown will be restored. A trip gear set to act after a certain interval is shown in Fig. 15. A is a cylinder like a pump

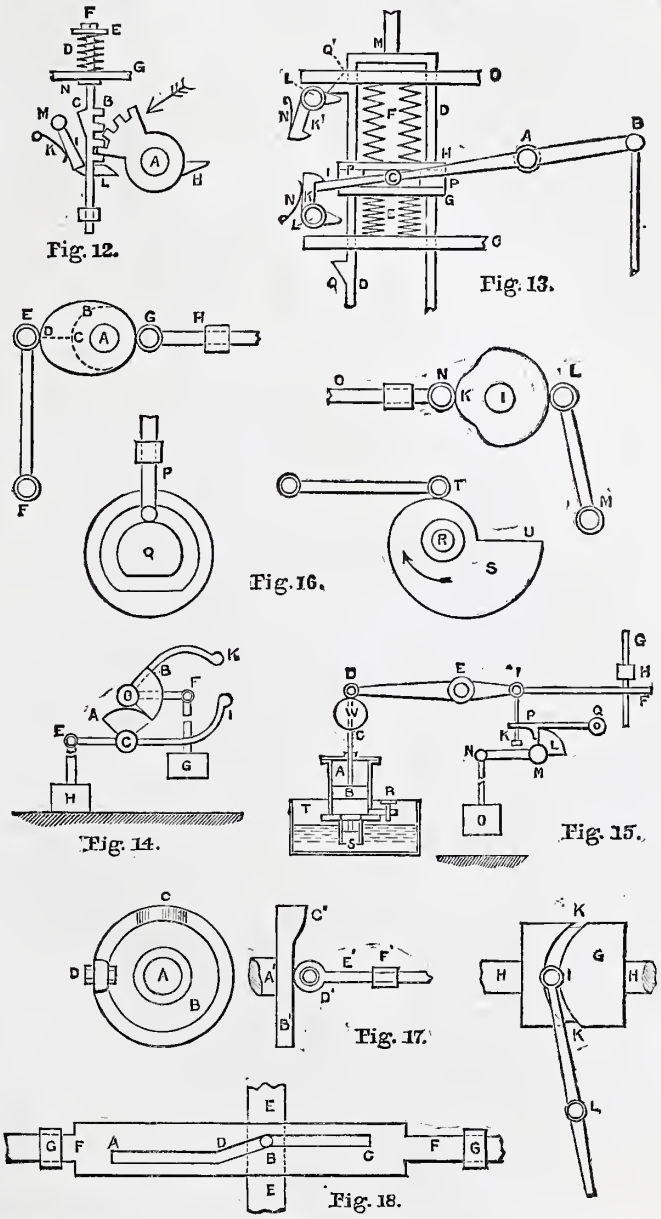


Fig. 12.—Segment and Rack Trip Gear. Fig. 13.—Double Trip Gear. Fig. 14.—Interlocking Quadrants. Fig. 15.—Time Trip Gear. Fig. 16.—Edge Cams. Fig. 17.—Face Cams. Fig. 18.—Cam Bar.

* I do not burke Mr. Clarkson's aspiration as I might, but I must say I am in no way in sympathy with it or him. To many, as to myself, a trimmed periodical is an abomination, for when the binder, who is employed to bind the parts or numbers, as the case may be, into a volume, has had *his* turn at the edges, the margin is so much reduced that the book may be said to be disfigured for life. I never use forefinger, walking-stick, or umbrella to cut even a newspaper, much less a periodical; and for my part I prefer even bound volumes to have rough edges, and whenever I have the happy chance of indulging my proclivities in this respect my books are bound so.—ED.

barrel fitted with a piston B, an outlet cock R, and an inlet valve S. To the piston B, which moves water-tight in the cylinder A, is fixed a rod C passing through a hole in the cover (which is perforated to allow the air to flow freely in and out, as otherwise it would affect the motion of the piston), and on this rod is a weight W, and the top of the rod is connected by a pin at D with one end of the lever D F working upon a fixed centre at E. The rod G passes through a hole in the end F of the lever, and has a collar H that will not pass the hole. The trip gear consists of the quadrant L on a rocking shaft M, carrying the arm M N and weighted rod N O. The quadrant L is locked by the tooth on the catch P Q, pivoted at Q; through this catch passes a rod I K, pivoted at the top to the lever D F, and made with a collar at the bottom to lift the catch P Q. The action is thus: The rod G descending, depresses, by the collar H, the end F of the lever D F, and raises the end D with the weight W and piston B drawing water freely through the inlet valve S from the tank T; the rod G then ascending leaves the weight W pressing upon the piston B to force out the water from the cylinder A through the cock R. When the piston reaches the bottom of its stroke, the rod I K is lifted, and the catch P Q with it, releasing the quadrant L. The time taken by the piston B making its down stroke will depend upon the extent to which the cock R is opened, and during that descent the machine controlled by it will be at rest.

Cams and Cam Bars.—The cams and cam bars are innumerable, and in this article I have only space to show the principles of the chief types. Cams may generally be divided into edge cams and face cams. Of the former some are shown in Fig. 16. A is a shaft carrying a cam B, by the revolution of which the roller E on the bar E F, pivoted at F, is caused to oscillate through the distance C D, or the same amount of motion is given to the roller G on the rectilineally moving rod H. The cam K on the shaft I gives several movements during one revolution to the rocking bar L M on the sliding one N O. S, called a snail, revolves with the shaft R in the direction of the arrow, and gradually raises the roller T, letting it drop suddenly when the point U reaches it. In all these cases the roller upon which the cam operates must be held in contact with it by weight or spring, and where this is not desirable the modification P must be used. In appearance this is a disc turning upon a shaft Q, and having cut in its face a groove in which a pin or roller attached to a rod receives its motion, being positively controlled throughout the revolution by the groove; in action this is an edge cam. In Fig. 17, B is a face cam running on a shaft A; the cam is a disc with one or more elevations C on its face near the periphery, which passing under the roller D impart motion to it parallel to the axis of the shaft A, and so moves the rod E′ working in guides F′. The letters A, B, C, D, refer to the front elevation, and A′, B′, etc., to the side elevation. One great disadvantage attending cams of this class is the bending strain, which tends to loosen them or their shafts. In this example the roller must be held up to the cam unless the modification G is used, which consists of a barrel on a shaft H H. The roller I at the end of the lever pivoted at L works in a groove K K, cut on the periphery of the barrel; thus the motion of the roller is controlled throughout the revolution. Fig. 18 shows an example of a cam bar. F F is a bar moving rectilineally in guides G, G; in it is a slot A B C, in which works a pin or roller D, fixed to a bar E E, which is capable of movement in a direction at right angles to that of F F. As the latter bar is moved motion will be given to the bar E E by the action of the inclined part B of the slot A B C upon the roller D. Cam bars are also used acting against one another by inclined surfaces, in which form they are pre-eminent for the amount of friction occurring. It is easily seen that all kinds of intermittent movements may be obtained by means of cams, and they are easily set out. It must be noticed, however, that the angles made between the directions of the pressures and resistances should be as large as possible, in order to keep the friction down.

In the first paper on this subject I referred to the action of the fly-wheel in equalising the motion of machines. Its action is that when an excess of work is being done during one part of a revolution, that excess is taken up and stored in the fly-wheel, the velocity of which is slightly increased thereby; and when the work done upon the machine falls short of the resistance, the stored-up work in the fly-wheel is given off, and its velocity falls. Thus, the total work done on the machine being equal to the total work done by it in one revolution, the fly-wheel serves for the more uniform distribution of work over the period of that revolution.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

Mechanical Aids Thereto: Patents and Special Materials.

So far as may be possible within the limits of a short paper, I purpose herein to bring before the general readers of WORK, and especially to the notice of those interested in graining, some particulars of the many inventions in tools, processes, or materials connected with my subject, which have been put upon the market within a comparatively recent number of years. In compiling this article, I have remembered the world-wide and cosmopolitan circulation of our technical magazine, and have, therefore, directed attention towards some specialities which—although not indispensable to a full and proper knowledge and acquisition of the imitative art—are, nevertheless, likely to prove of practical utility to the very occasional imitator of woods.

Oak Combing Rollers (Figs. 1 and 2) are the most serviceable of the "mechanical aids" that have so far come into use. Notwithstanding this invention has been known and used for nearly a score of years, I am confident there are many in the trade who are still unacquainted with it, and, therefore, are ignorant of the assistance it may give to the worker when graining ordinary oak. This simple arrangement was first used, I believe, by a prominent Manchester grainer—Mr. William Jones—and one who still takes an active and leading position in the trade there. In noticing these tools, the advantages of an illustrated magazine are very apparent—one's description is much simplified and the reader's interest thereby secured. Although I have been informed that such an arrangement of circular discs has been made and used successfully in leather, such have not come under my own observation. The present construction of the rollers is with iron handles, which contain the small roller or axle whereon the metal discs revolve. The latter are usually made of sheet zinc, being stamped, or cut, in circular form, and afterwards notched out at different intervals around the circumference. Each of the wheels, if I may so term them, is placed upon the cylinder, and revolves loosely and independently of any other, so that given a number of these discs, and each notched out, they will ensure a succession of short fine lines of various irregular lengths and spaces apart. I have known many grainers to make their own rollers, and this some of the readers of WORK will probably undertake; I therefore reproduce separately a single roller (Fig. 2) and the "feeding brush" (Fig. 3) specially made for the rollers.

I have previously explained how steel and leather combs, with various sizes of teeth, are manipulated in order to obtain the effect of the dark pores we see in oak and some other woods, this being effected *before* wiping out the lights or figure. When the grainer uses the rollers under notice, he proceeds on a different plan. The oil graining colour, which can be used somewhat thinner than with combing, and which needs no megilphing, is spread in the ordinary way, and the "lights" and half tones wiped out as instructed. When dry, upon the inverse principle, the grain is put on by using a thicker and darker graining colour. The feeding brush is charged with colour, and then held against the handle of the roller—as indicated by the arrangement shown on the brush handle—by the left hand. With the right the roller is held, and the two hands then cause the roller to travel up the panel from the bottom to top with a slight but steady pressure. The metal discs thus revolve, and, in so doing, the edge of each is charged with colour from the face of the brush, and transmitted thence in fine irregular lines—"grain"—upon the work. Those readers who may succeed in making a useful roller of about 2 in. wide, may also save the expense of a proper feeding brush by using a partly worn paint tool of the larger sizes, such as Nos. 9—12 (Fig. 4).

The intelligent student will scarcely need telling that where the "lights" are wiped out, the pores made by the roller must also be cleaned away with rag, and the roller grain should then be softened off lengthways with a badger, or large dry tool. Care must be taken to obtain clean, sharp rolling, and also in getting the pores all running at one perpendicular, or the natural, angle of the grain. "Oak graining rollers" can be used both in distemper and oil colour. They are retailed complete, six in the box, with brush, as shown, for about 18s.; whilst a 6 in. roller and brush in a box are sold for 8s. The price for single rollers is—½ in., 1s. 7d.; 2 in., 2s. 6d.; 4½ in., 3s. 9d.; and 6 in. for 4s. 6d.; the brushes corresponding to these sizes being 9d., 1s., 1s. 9d., 2s. 6d., and 3s. 6d. each.

Patent Graining Machines, or rollers, have been in the market now for many years. Upon reference to the illustration (Figs. 5 and 6), the construction and working of these tools will be readily apparent. A frame with wooden handle—similar to a paperhanger's roller—is affixed to a revolving cylinder. The surface of the latter is covered with prepared leather, and the pattern of the figure is then conveyed to its face. Similarly to the means used in making a wood engraving block, the ground of the leather is then chased away, leaving the pattern in relief. The action is reversed in working, however, since the graining colour

spread all over, and the roller *takes out* e figure. Graining machines for oak and ost of the woods are only made in the rm of the woodcut (Fig. 5), I believe, but varying sizes; for imitating Spanish ahogany and similar woods, the roller made very similar in shape to the paper-nger's tool—viz., small in circumference, d much wider than that of oak (Fig. 7). e piece of leather upon which the pattern inscribed is then fastened along one end ly to the roller, and is long enough to go und the cylinder twice or thrice. When use the unfastened end is pressed against e top of a panel, and the leather thus rolled against the work. The right hand orks the tool, whilst the left cares for the ose end of the leather (see woodcut). ese graining rollers, the principle of hich is also carried into rollers for marb-ig, are manufactured by Mr. J. F. Bellamy, , Offord Road, London, N.; and as they e termed "Bellamy's Patent," I conclude ey are the invention of the maker. All rge brush retailers can, however, supply e rollers, and since also with them full rections are given for using, I need not go to that matter here. As some criterion their value, I may add that a 3 in. roller sts 16s., a 6 in. one 26s. If we consider e nature of the tool, and the amount of ear they stand, the price is very reason-ble; and, although the amount of "art" splayed by the worker who uses them may difficult to discover, I am well aware at for graining cheap furniture, and such-e purposes, they have been used largely d satisfactorily from every point of view.

"*Gransorbian*," or *Photo-Graining Paper*, a very recent invention in graining, but e that is so far in advance of any other troduction the trade has yet seen, that one mpetent English authority, after careful sting and examination, pronounces it as kely to create a practical revolution in the hole process of graining. Without question-g the reliability of purely trade journals in neral, I may here point out that it is only tural when, as is often the case, the mple to be tested is accompanied by a od order for advertisement space, the riter of the notice can scarcely bring an biassed and independent mind to bear on the merits of an invention. When e financial and editorial issues are vested one and the same person, it is, therefore, ten advisable to take such notices of new ventions and patents carefully — *cum ano salis!* Gransorbian is, however, a good thing." The invention is described a photo-graining paper, and consists of surface in relief, which is of an absorbent ture—presumably a sort of thick blotting per—so that when brought into contact y pressure with the wood, it takes up the lour in the same way as do the graining llers. The great superiority of Gran-rbian appears to lie in the splendid selec-on of figure the user has at command, ch pattern being 78 in. long before re-eating, and in the fact that it may be sed, when graining in oil, from twelve to xteen times, and when in distemper from xteen to twenty times. The width in which is manufactured is a standard one of 4 in.; so that, given a piece of work 6 in. ide, the pattern, when cut into four, ould grain 26 ft. before the design re-eated. Taking it as possible that one piece *m* be used twenty times in water graining, follows that the vendors promise that bout 2½ lineal yards will execute for us 520 . of a pattern, 6 in. wide—all this for the significant outlay of 1s. 3d. per yard.

Gransorbian is made in no less than fourteen varieties, consisting of four kinds of figured oak, two of sap oak, two of pitch pine, and one each of pollard oak, walnut, mahogany, Hungarian ash, English ash, and maple. In graining oak, the ordinary combing process is utilised on the stiles, but the panels, and lock rail if covered with "sap," are best only evenly laid off. The patent paper having been cut to the size of panels, it is now carefully brought into contact with each panel, and the pressure of a small roller being passed over the back, the imitation is effected. The material is very absorbent, so that it should touch the painted surface only when in its exact position.

From the foregoing it will be apparent that, whilst a person of very little practical experience may easily succeed in creditably graining any quantity of plain surface work, it requires the practice and judgment of a competent grainer to use the "paper" to the best advantage, and then to finish and overgrain the work.

I have seen it stated that a church at Colne was grained throughout by Gransorbian at a cost for material of only 7s. 6d.

At the present time, the photo-graining paper is quite a new thing to the trade and the public in general, but the inventors are confident that it has a grand future of usefulness before it. One of the drawbacks to a large sale is, to my mind, the sum required for a sample lot, viz., 20s. It does not require many yards to practically test a process such as this, and if a few small pieces about 24 in. long were supplied as samples for about 2s. 6d., the proprietors would, doubtless, find a more rapid and increasing demand for their invention. The sole manufacturers are the Gransorbian Photo-Graining Company, Limited, 27, Water Street, Liverpool, from whom any further particulars can be obtained, and who also supply a special leather-covered roller at 1s. 6d. as well as graining colour put up in tins of various sizes.

By the courtesy of the Gransorbian Company, I am able to reproduce, in Figs. 8 and 9, samples of the figured and sap oak, respectively, executed by their process. No. 8 would correspond with a panel about 24 in. by 15 in., and will enable the reader to see the natural arrangement of the lights, which I believe has been taken from real oak. No. 9, besides showing the variety in which sap oak is made, will also furnish the student with an excellent copy for imitating in the hand methods.

Mathieson's Oak "*Scumbling*" is the name given to a specially-prepared material for graining, and is the last of such articles that I need dwell upon herein. This introduction, which hails from Scotland, has been put upon the market as a complete and perfect substitute for the various preparations of pigments, driers, etc., that are usually compounded by the worker into "graining-colour."

"Scumbling" is the technical term such mixtures are given in the North, and that under notice is manufactured by a practical grainer who undoubtedly understands what characteristics proper graining-colour should possess. Without unduly analysing its nature and parts, I may here state that it has the appearance of a pigment ground into a stiff paste in prepared linseed oil. Its practical and serviceable nature may be still further indicated by the fact that it requires no addition of a drying agent, but simply thinning with linseed oil and turpentine, in proportions to suit the time allowed for its drying. For special purposes, it may even be made to dry in one hour if diluted with liquid drier instead of oil. I would here caution the learner against unduly forcing the drying of oil paint of any nature by large excess of driers unless such is absolutely necessary. It should be borne in mind that the oxidising action, set up by a drying agent and the atmosphere, does not cease with the drying of the surface, but continues, and in reality brings about a consuming and destroying process, when the drier is *greatly* in excess of its proper proportion. Besides being equally serviceable for both in and out-door graining, the scumbling makes an admirable stainer for wood. For staining a rich and deep-colour margin around the floor of a room in the style now so general and popular, nothing could be better, I believe, than the "dark" shade thinned with linseed oil, and I am certain nothing would be as cheap or durable. "Mathieson's Scumbling" is the invention—if I may so term the article—of Mr. Edward Mathieson, and its manufacture is now largely carried on by Messrs. Mathieson Bros., Ardrossan, near Glasgow.

With reference to the *colours* of the graining-colours for oak which Mr. Mathieson, as a grainer of long and practical experience, advocates by his "Scumbling," I may be pardoned for here noting that they fully support my own instructions in these papers. I have previously expressed an opinion that were the process of oak graining in oil necessarily confined to raw and burnt umbers only, there would be a general gain rather than loss in natural colouring. Of the three shades in which this scumbling is prepared, the lightest seems no darker than good raw Turkey umber; whilst with the dark, the natural richness of the burnt pigment appears very prominent.

Mr. Mathieson, who is not only a practical man, but a lucid writer upon the subject, evidently considers *three* degrees of colour, "light," "deep," and "dark," to be sufficient, either used separately, or when compounded, for nearly all varieties of oak graining. The preparation is sold in three qualities at prices ranging from 25s. to 56s. per cwt. Having, personally, tried the scumbling, and finding it fully up to the position of useful merit claimed by the makers, I strongly advise those professional workers who are numbered amongst the readers of WORK—and they are not a few I am well aware—to try it and judge for themselves. Comparing the simplicity of having to dissolve the scumbling with liquid only to the ordinary process of taking "so many parts of pigment" and so many of driers, etc., the bother and time the former saves is a matter of moment to the professional grainer; and, furthermore, when such an article is sold at the price of a good pigment only, there can be no questioning its practical claim to notice in this paper. For the assistance of the occasional grainer, the makers have arranged to dispatch a sample tin—nearly 1 lb., or sufficient when diluted with oil and turps to grain the woodwork of a room—with instructions, post free, upon the receipt of nine penny stamps, and 7 and 3 lb. tins for 4s. and 2s. respectively. To many readers this will be a great boon.

Having now discovered to the student to what extent the practice of imitating woods may at the present day be aided by mechanical and special aids, this suggestive thought may come to the mind of the reader: "If graining can be executed so

well by patent rollers and patent paper process, what great advantage has the hand and brain worker over such methods to compensate him for his study and labour? To such a thought I would make answer by sketches, etc., by good artists? Far from it! but rather serves to educate the community to a higher knowledge of such matters, and therewith a demand for truer work from the individual artist. So with practically following my advice and instructions, that such mechanical processes as Gransorbian are scarcely likely to affect the marketable value of a good grainer's skill; and, as the best evidence of this, we have the

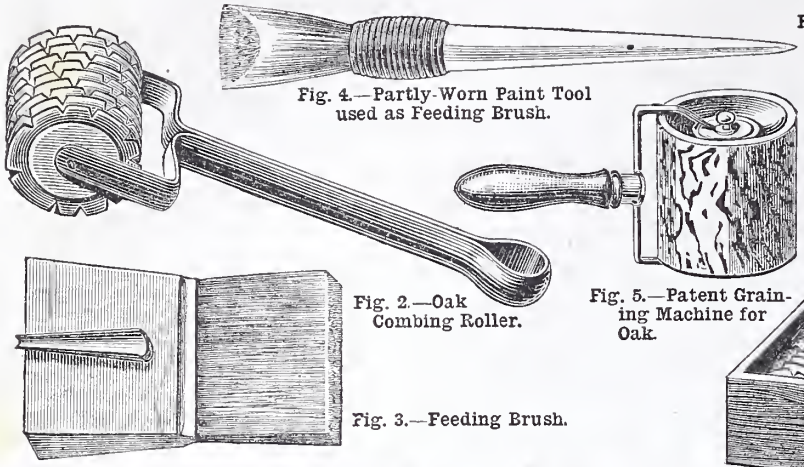


Fig. 4.—Partly-Worn Paint Tool used as Feeding Brush.

Fig. 2.—Oak Combing Roller.

Fig. 5.—Patent Graining Machine for Oak.

Fig. 3.—Feeding Brush.

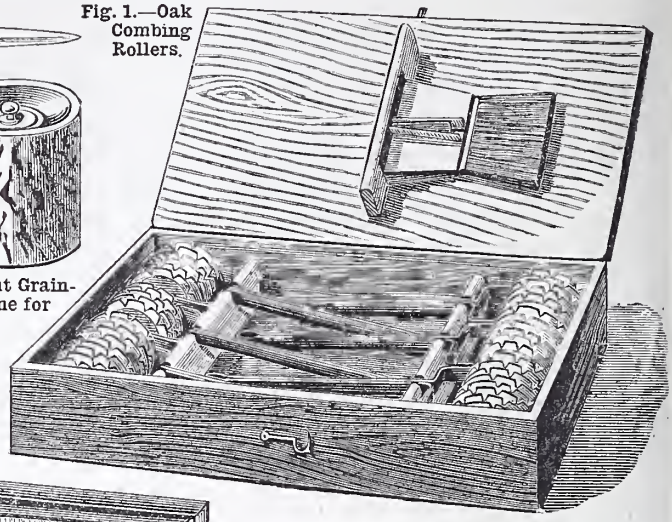
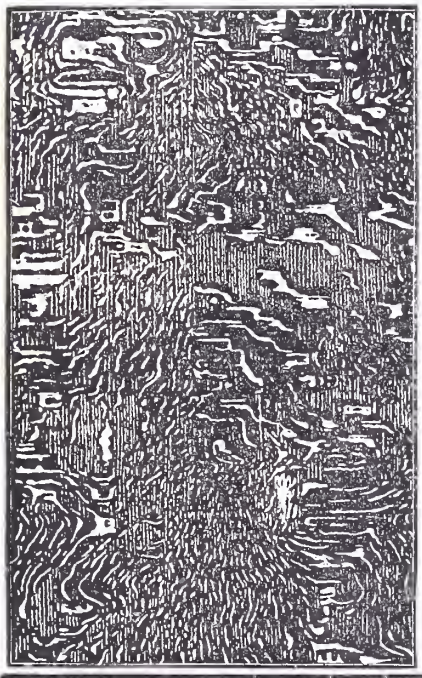


Fig. 1.—Oak Combing Rollers.



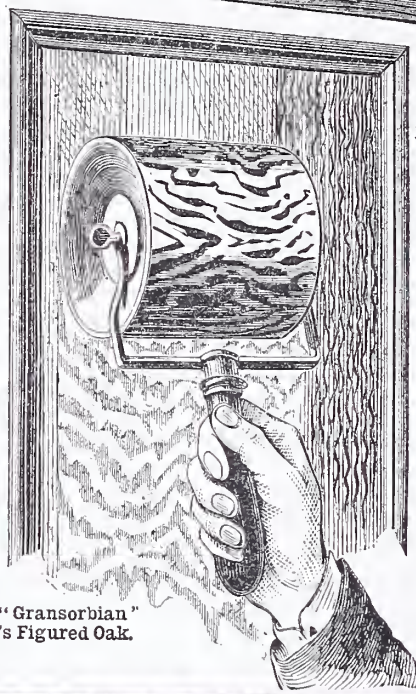


Fig. 8.—"Gransorbian" Company's Figured Oak.

Fig. 6.—Patent Graining Machine in use.

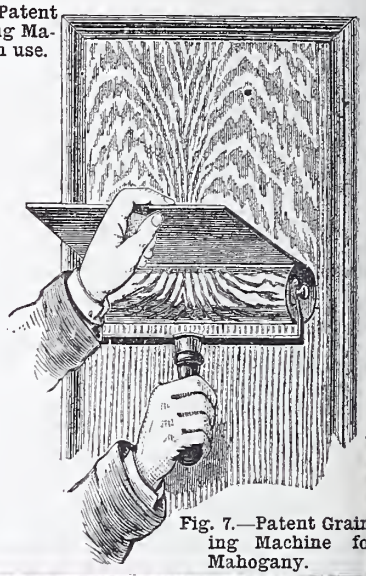


Fig. 7.—Patent Grai ing Machine fo Mahogany.

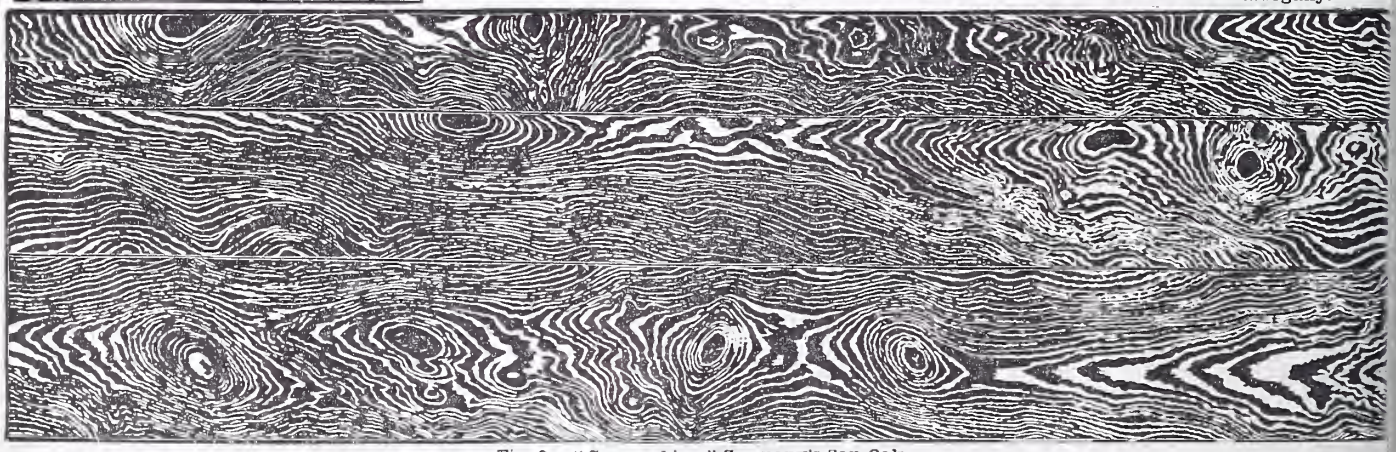


Fig. 9.—"Gransorbian" Company's Sap Oak.

another similar question: "As oleographs, chromo-lithographs of water-colour works, photographs, and cheap etchings can be produced so cheaply, and yet so artistically as we find them at the present day—will, or does, this tend to lower the artistic and commercial value of genuine oil paintings, the art of graining; for the successful introductions of such patents and materials as I have noticed are sure signs of an awakening to the true artistic and utilitarian merits of the craft.

Beyond this I may state, for the encouragement of those readers who may be knowledge that at the present time a hig class and costly work on hand grainin is being brought out by the same critic authority who believes "Gransorbian is de tined to revolutionise the process of grai ing."

Messrs. Crowden & Garrod, 62, Southwa

Street, S.E., and Messrs. Hamilton and Co., of Soho, the well-known London brush manufacturers, are agents for most of these specialities, besides smaller but equally reliable firms such as Brodie and Middleton, Long Acre; J. Hill, Pentonville Road, N.; and Pavitt and Sons, Southampton Row, W.C.

CARVED PANELS FOR HANGING CABINET.

BY FRED MILLER.

The Chrysanthemum as a Motif.

Man is a tool-using animal said the professor in "Sartor Resartus," and that accounts for the popularity of wood carving as an amusement. It is finger occupation like such woman's work as knitting, and yet it is more than that. It makes demands upon the fancy, judgment, and invention, especially when we originate our own designs, as all wood carvers should be desirous of doing. In the course of these notes that accompany the various designs for wood carving I have contributed to the pages of Work, it has been my endeavour to explain the principles of designing, for it is an extremely difficult thing to offer the tyro that kind of assistance he stands in need of when he essays to design his own work. I should always take nature as our starting point, and my aim is to so adapt and bend natural form to suit the particular work in hand. I have spoken elsewhere on "knowing what to leave out" as an artist's first duty, and this principle has very particular application in the case of wood carving, for it is apparent at the outset that there is very much in plant form that cannot adequately be rendered by the means at our command. Grinling Gibbons has shown us how far in an imitative direction wood carving can be carried in those wreaths and festoons of flowers and fruit he was so fond of working. He compels us to admire such work because of his skill in almost hiding the insurmountable difficulties he tried to overcome—we admire such work as a *tour de force*—but I feel that that is not the direction wood carving should be carried in a general way, and very few wood carvers, either professional or amateur, have such a command over their tools as to carve us a lily with the petals almost as thin as the real flowers. I lean to the Gothic school of wood carving, which is content with a much simpler character of work; which does not attempt anything in the way of imitation; which has robustness, vigour, an almost archaic simplicity, in place of gentility and womanly rather than masculine grace. It always

Carved Panel for Hanging Cabinet—The Chrysanthemum as a Motif.

seems to me better to succeed in a quiet unaffected way than to fail by aiming too high, and as long as we keep to well-known plant forms, attempting no great amount of relief, and just simplifying and fitting in the growth to the particular space to be filled, we cannot help succeeding, seeing that we are never hazardous and so court failure.

In panels such as that given in this number for a hanging cabinet we can, as our work is concentrated, attempt a little more elaboration than if our work were on a large scale and extended over a large surface. I will now select, taking the latter for our present consideration, such well-known forms as the poppy and chrysanthemum as the *motifs* of our work, and I will endeavour to explain what ideas guided me in drawing the panels, for my object in writing these notes is to teach my readers how to design their own work. If I were working direct from nature, *i.e.*, suppose I did not have drawings of the plant by me, I should first of all make a study of some characteristic piece of chrysanthemum, and in choosing the specimens to draw our power of selection can be shown. Don't take too complicated a specimen—where the growth is too full and prevents us seeing the skeleton, as it were. And do not choose a specimen that is eccentric through some malformation or personal peculiarity, for in our carving we want to give the first principles of plant form; we want to lay hold of *the* character of the plants. Make a careful study in pencil, or sepia, or charcoal (I would not trouble about colour, as this tends to confuse one and may prevent one seeing the general form and growth) life size. I always make my studies life size, for it is easy to reduce afterwards, whereas in working from one's own studies one is apt to get the work out of proportion, if the study is not life size. Note all these peculiarities and characteristics of the plant: the way the leaves articulate from the stem, the curves and angles the stems themselves take, the contour of the leaves, the way the flower is set upon the stalk, and so on. Don't think about minute points such as how many veins there are in a leaf (though you will observe the deviation the veins take and any striking feature about them) or the number of serrations to the leaves (though of course you will notice the form of such serrations); these are matters that more concern the botanist: go for breadth, mass, line, for these characteristics you *can* reproduce, and if you miss such important features your work will be tame and wanting in nervous force.

The companion design—a study of the poppy—will be given very shortly, and I may add that the remarks made here on the treatment of the chrysanthemum will apply equally to that of the poppy, and *vice versâ*.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

37.—Stick-all Cement.

This is a new patent cement sold wholesale by the "Everclean Collar Company," 100, Wood Street, London, E.C., and supplied in self-opening tins at 6d., or in larger tins holding three times the quantity at 1s. The cement is said to be sold retail "everywhere," which means, I suppose, as trades are getting very mixed in these days, and one can hardly tell where each really begins and ends, by stationers, oilmen, grocers, and by some chemists and druggists. The Company, however, send sample tins post free for 9d. and 1s. 3d., according to size, to any persons who may not be able to get it from any retail dealer. The manufacturers say: "It is very tenacious, and will securely stick paper, leather, wood, ivory, marble, earthenware, iron, stone, indiarubber, or any other substance." Its adhesive properties are really marvellous, but I have not had time or opportunity of testing it on earthenware, iron, or marble. It is easily applied. The contents of the tin should be liquefied by placing the tin on the hearth, over the gas, or in hot water. If too thick and viscid, water may be added to thin it.

38.—Watkins' Exposure Meter.

I have received from Mr. Alfred Watkins, of Hereford, one of his new Exposure Meters, which are supplied by Mr. W. E. Haines, photo chemist, Hereford, and by many other dealers in photographic appliances, at 12s. 6d. each, or 12s. 9d. post free. It is convenient to state here that rolls of bromide paper for refilling are supplied at 7d. post free. Mr. Watkins tells me that it is a decided success, although only just brought out, and this I can readily believe, as one of the points which is most perplexing to an amateur photographer is the time of exposure. He further tells me that "W. Jeromo Harrison, Esq., F.C.S., author of a 'History of Photography,' writes—'I consider it a well-conceived, ingenious, and very useful instrument. I have carefully tested it and found its indications to be correct. I congratulate you on perfecting so complete an instrument.'" Mr. Watkins further writes—"A few days ago I exposed with its aid four negatives: a cloud picture ½ second exposure; an evening landscape, 4 seconds; interior, mantel-shelf, 7 minutes; old oak cabinet, bad light, 65 minutes. All developed together at the same time in one dish, and all came out equally good and correct negatives." The Exposure Meter will calculate the proper exposure of photographic plates under every imaginable condition. The nature of the instrument may be seen from Fig. 1. It consists of a brass tube 1⅛ in. in diameter, with a cap at each end. The interior is divided into two chambers, one of which contains a simple actinometer in the form of a strip of bromide paper for testing the light, which acts on the bromide paper through a hole in the cap by which the chamber is covered, and the other a chain pendulum for counting seconds or half seconds, for

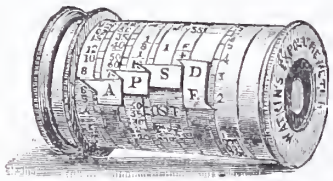


Fig. 1.—Watkins' Exposure Meter.

timing both the actinometer and camera exposure. On the tube, between the milled rings against which the caps close, are six flat rings, two fixed, and the others movable. All of them are suitably graduated, and the four movable rings carry each a pointer, the first being lettered A (actinic force of light falling on the subject), the second, P (the sensitiveness of the plate), the third, S (the colour or character of the subject), and the fourth, D (the diaphragm or stop used). Below D is a fifth pointer E, which indicates the correct exposure on the fixed ring next to it, when the other pointers have been so placed as to indicate on the rings next to the left the numbers representing the value of each factor. Full instructions showing how to use the appliance, and a valuable paper read by Mr. Watkins before the Hereford Photographic Society on "The Mathematical Calculation of Exposures" (which will be forwarded to any applicant on receipt of a stamp for postage), is sent out with each instrument, which promises to be a most valuable addition to the stock-in-trade of the photographer, whether he be an amateur or professional.

39.—Ellicott's Patent Cartridge Case.

Mr. William Ellicott, Broad Street, Launceston, wishes me to call attention to his Patent Cartridge Case with Coned Base, a section of which, exhibiting the interior and construction of the cartridge, is shown in Fig. 2. It is intended for use in sporting or military guns or small arms. The case is 2⅜ in. long, and is made with a solid drawn cup of metal with a coned base forming the base and lining of the powder chamber. It differs in this respect from the ordinary cartridge which was made with a flat base, and this prevents the waste of powder which lies round the edge of the bottom of the flat base and below the flash hole. The form of cartridge introduced by Mr. Ellicott ensures a more complete and certain ignition and combustion of the powder in the powder chamber, and

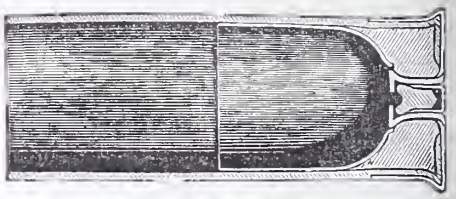


Fig. 2.—Ellicott's Patent Cartridge Case with Coned Base.

greater safety, inasmuch as bursting at the rim is impossible, the reaction of the gases taking place on the sloping base of the cartridge, and the lateral strain and recoil being thus reduced to a minimum. The metal lining is so arranged that with 42 grains nitro powder pressure shall be uniform, and this uniformity of pressure and protection at the point of strain renders the cartridge especially well suited for nitro compounds and ejector guns. The disadvantage of the absorption of the strength of nitros by paper-lined cases is completely done away with by the adoption of the cupped metal lining, and it has been found that cases of the new style of cartridge with coned base leave the gun in better condition than any other. Mr. Ellicott says that the Martini cartridge would not jam if made on his principle. Although only just put on the market, it is approved by all sportsmen and military men who have made trial of it. For cartridges of No. 12 gauge the price is 4s. per. 100, or 4s. 6d. post free.

40.—Parkinson's Gas-Burner Regulators.

An effective and reliable gas-burner regulator is a good thing, undoubtedly, and anything of this kind that is of obvious utility should find a place in "Our Guide to Good Things." My attention has been called to this burner regulator by a correspondent who writes from Birmingham where they have been used in the workhouse since 1883, when 1,500 of them were fixed and are still working satisfactorily. He writes—"I send you a burner; it is an automatic one for regulating the supply of gas, which the makers guarantee it will do for a lifetime. The only thing it requires doing to is cleaning by taking it to pieces every two or three months. I myself have tried this one that I send you at all pressures up to 2½ in. of pressure, and have found it correct. The burners are made in seven sizes to pass from 2 to 8 cubic feet per hour. The price is 14s. per dozen, or a sample is sent post free for 1s. 3d. by the patentees, Messrs. G. J. Parkinson & Co., Birmingham. It is claimed for these burner regulators that there is a saving of from 30 to 50 feet of gas consumed under ordinary circumstances; that perfect combustion and increase in the illuminating power of the gas is insured, and that the lights burn steadily and silently; and further that it is the smallest and most compact regulator burner that has yet been produced, and will repay its cost in a few weeks' use by the gas saved. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

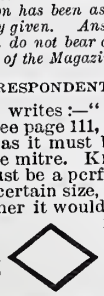
NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

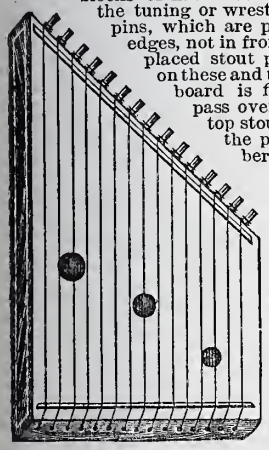
In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Mitre Cramp.—Codgeto writes:—"I would like to ask H. B. (*Chatham*) (see page 111, Vol. II.) what is the size of the block A, as it must be a certain size or it will not cut a true mitre. Kildonan (see page 636, Vol. I.) says it must be a perfect right angle, but I say it must be of a certain size, or when the mitre is cut and put together it would make a frame after the style shown; it would not be square. If H. B. will send me the exact size, it would useful, not only to me but to others, especially amateurs like myself. If the writers in Work, when sending a design, would indicate the exact size, it would save a lot of trouble and time."



Zither.—R. F. (*Norwich*) writes:—"The instrument illustrated by J. D. (*Dublin*) (see page 654, Vol. I.) is known in the trade as 'Prince of Wales' Harp,' and may be purchased of any musical instrument dealer, who, if he has not got it in stock, will order it. They are very easily made, and consist simply of a shallow box, having at top and bottom blocks of hard wood for the insertion of the tuning or wrest pins, and the hitch pins, which are placed in the outside edges, not in front. At the sides are placed stout pieces of wood, and on these and the blocks the sound-board is fixed. The strings pass over bridges having on top stout brass wire to take the pressure. The number of strings vary from eight to nineteen or more, and the size of the instrument and length and size of strings depend entirely upon the pitch required. The zither proper is an instrument of a vastly different character, and is quite outside the range of 'Shop,' although it is quite within the capabilities of a good amateur to make; but it would require an article to itself to do it justice. I send a sketch of the 'Prince of Wales' Harp.' J. D. will observe that the longest string is on the left-hand side, not the right as in his drawing. The top block slopes at an angle of 45°."



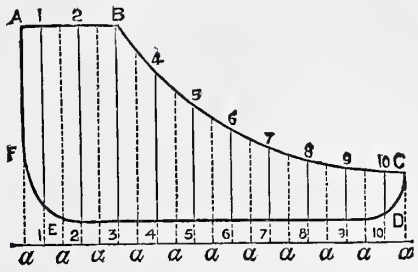
Prince of Wales' Harp.

II.—Questions Answered by Editor and Staff.

Fret Pattern.—M. G. (*Glasgow*).—Before I can answer your question, where you can get a fret pattern such as you want, I must ask what you mean by the "Freemason's coat of arms." If you do not quite know what you mean, let me advise you to ask some mason to take you into a lodge. When you have sat in one, you will be able to explain as fully as you desire to, and I, or any other mason, will, as a brother, respond equally fully and explicitly. Meanwhile I may say that it is, to say the least, very improbable that you will get anything indicative of masonry in fretwork.—D. A.

Electric Lighting of Workshop.—M. R. (*Burnley*).—When you have read my forthcoming articles on "Model Electric Lights," I think you will not seek to light your workshop with electric light maintained by a battery. I need say no more here. A coil is useless for the purpose.—G. E. B.

Horse-Power of Engine.—J. H. S. (*St. George's East*).—To find the indicated horse-power of a steam engine, we must have an indicator diagram, which will be of a form similar to that shown in the accompanying sketch. The line A B C D E F A is drawn by the indicator pencil, and the height to which it rises shows the pressure per square inch (to a given scale) at every part of the stroke; the length of the line *a a* is proportional to the stroke; the paper upon which the diagram is made being drawn round on a barrel by attaching to it a card connected with some moving part of the engine, so that the paper moves horizontally in a certain proportion to the travel of the piston, while the indicator pencil marks the pressure at every point. The diagram shown is for a non-condensing engine, and the indicator piston spring indicates one pound per square inch for every 50th of an inch above the atmospheric line *a a*, on which the pencil rests when out of use. There is a back pressure shown by the height of line D E above *a a*. The effective pressure at any point is represented by a vertical line ending top and bottom at the boundaries of the diagram. To find the mean pressure of steam for the whole stroke, proceed as follows:—Divide the length of the diagram into any number of equal parts—say, then, as shown by dotted lines drawn up from *a a a*, etc.; then lines drawn up the centres of these parts, 1, 1—2, 2,



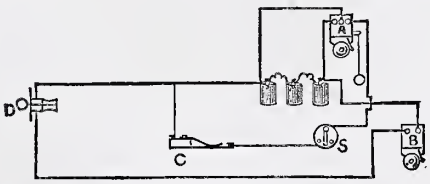
Engine Indicator.

etc., will be the mean pressure for each part, and all these mean pressures added together and divided by their number will be the mean pressure for the stroke; thus, take a scale of inches divided into fifty and apply to the diagram, we then find the lengths to represent:—

1-1 = 45 lbs.	The total, 305, divided by 10, the	
2-2 = 52 ,,	number of measurements, gives 30½	
3-B = 52 ,,	lbs. per square in. as mean pressure. The area of the piston multiplied by this gives the total pressure on the piston. The area of a circle is equal to its diameter squared, multiplied by 11, and divided by 14; but you can get it from a table of areas. Suppose the piston to be 16 in. in diameter: 16 multiplied by 16 is 256; this multiplied by 11 is 2,816, which divided	
4-4 = 40 ,,		
5-5 = 31 ,,		
6-6 = 25 ,,		
7-7 = 19 ,,		
8-8 = 16 ,,		
9-9 = 14 ,,		
10-10 = 11 ,,		
Total 305 ,,		

by 14 gives 201 square inches area of piston. Total mean pressure on piston, 201, multiplied by 30½ lbs., equals 6,130½ lbs. Let the stroke of the piston be 2 ft. 6 in., and the engine make 60 revolutions per minute—that is, at 2 strokes a revolution, 120 strokes a minute—the piston therefore moves 120 multiplied by 2½ ft., which equals 300 ft. per minute. The steam therefore in each minute does work equal to 6,130½ lbs. through 300 ft.—that is, 1,839,000 ft. lbs. per minute. A horse is assumed to do 33,000 ft. lbs. of work per minute; therefore, dividing the work of the engine by that of a horse in the same time, or 1,839,000 ft. lbs. by 33,000 ft. lbs., we find the indicated horse-power in our example to be 55⅔. The rule put compactly is:—To find the indicated horse-power, multiply the area of piston in square inches by the mean pressure of steam in lbs. per square in.; multiply the product by the length of stroke in ft., and by the number of strokes per minute, and divide by 33,000.—F. C.

Ringing Two Bells with One Battery.—Godiva.—Connect up your two bells to the battery as shown in the annexed sketch. In this we will call B the door bell. Lead one wire direct from this to the front door pull D. From the pull lead a wire to the zinc of battery; then from the carbon of battery lead a wire to the free terminal of bell B. This will complete the circuit of one bell. Now for the alarum bell A. Lead wires from the two terminals of the battery to the continuous ringing



Mode of Connecting Two Bells to One Battery—A, Alarum Bell; B, Door Bell; C, Contact; D, Door Pull; S, Switch.

arrangement terminals of the bell. Of course this will not ring when the lever is up. Connect one part of the burglar contact C by a piece of wire with the line wire of the pull leading to battery. Connect the other to the switch S, then from the switch to the free terminal of the bell A. At night, when you pull over the switch, the alarum bell will start ringing if the burglar alarum is also in contact. In the daytime, when the switch is off, and the lever on the bell up, it will not ring. By this arrangement the two bells may be rung from one battery without interfering with each other.—G. E. B.

Fire Forge.—W. R. (*St. Day*).—It will require a separate paper to do justice to this subject.—W. P.

Index to Work.—E. J. A. (*Chorley*).—An Index is published with the yearly volume of Work.

Spring Mattress.—Patras.—I am sorry that instructions for making this cannot be given in the "Shop" columns, as at least two pages of space would be required. You and other inquirers must therefore be good enough to wait till an article on spring mattress making can appear. The number of springs varies according to circumstances.—D. A.

Fret, Polishing, etc.—Artisan.—Do you really expect to find combined in one machine all the best qualities of those specially constructed for thick and thin wood? If so, I am afraid you will be disappointed. I do not know of any machine which is equally good for ¼ in. and 3 in. stuff, but by getting a Britannia Co.'s No. 8 you may cut anything up to 1 in., and for larger sizes the fret appliance for working with their circular saw is as good as any. Size of saw blades, of course, depends on work to be done. The small fret saws are freely advertised at about 2d. per dozen. Get an assortment. The larger saws for big work (bow saws) are about 1d. per inch. Your questions on polishing are far too comprehensive to be answered fully in "Shop." Fumigation is managed by enclosing the wood to be darkened in an air-tight box or room with some strong liquid ammonia. I have never noticed that "polish soon gets rotten on furniture stained in the prevailing dark shades," so cannot assist you. As stains do not contain anything injurious to polish, if they are such as usually used by polishers, I am inclined to think that you have originated a fanciful complaint If any stain produces a bad result, try another. Any of those which have been recommended in these columns may be used with perfect safety. I do not care to recommend the filter you inquire about, but that is far from saying it is bad. Many people speak highly of it, and I only give my own opinion. Try it for yourself, and note the cost. On sand-papering machines, and machinery required in a small shop, little can be said here, for how on earth can I know your requirements? You know what you want to do, so get the articles as opportunity presents itself. For a small shop where all sorts of odds and ends are made, I do not consider machinery a saving. It seems to me you want to fit up a small shop with machinery to do everything on a small scale. If so, it won't pay.—D. A.

Telephones.—Clericus.—It is very difficult to give advice in telephone matters, for the simple reason that it is almost impossible to construct a set of apparatus that will not in some way be an infringement upon the United Telephone Co.'s patents. There have been no end of instruments devised by practical men, and companies started to make and sell these instruments to the public, and in almost every instance the result has been a law case, and the United Telephone Co. placed in the position of—to use a vulgarism—"the cock of the walk." When I wrote the article on the speaking telephone, I only described such apparatus as could be used experimentally. I did not wish to place amateurs, or any one who followed my instructions, in an awkward position. For we cannot make and use for our convenience, as far as I know, any set of telephonic apparatus, consisting of magnetic receiver and carbon transmitter, without, as I have already said, infringing upon the United Telephone Co.'s rights. However, with regard to your difficulties, I will answer your last question first. Use the form of microphone described in my paper, No. 28 of Work, and given as Fig. 1 in your own sketch. It is easily made, and answers most admirably for experiments. The stand is made of wood, and the wires are connected to the carbons by simply lapping them tightly round. If you are well up in electrical matters, you could deposit a coating of copper in the ends of the carbons and solder the wires to them; this is the most workmanlike method, but the other will answer your purpose well enough. The carbon blocks may be fastened to the upright piece of wood by boring a hole in the carbon block about half way through, and passing a common screw nail through the wood into the hole, or they may be fixed with melted shellac or sealing wax. You seem to be a little hazy about the connections, and have jumbled up "line" and "earth" and battery wires most hopelessly. The "line," of course, means the connection between the two instruments; the "earth" wire means a wire in communication with the earth, to save the trouble of a return wire. If you make a set of apparatus, you will require a transmitter, a receiver, and a battery at each end, and your connections for each will be the same. I have shown these at Fig. 1. A complete set of apparatus for two stations consists of receiver, transmitter, indicator, call bell, and battery. These, with the exception of the battery, are generally mounted on a board called a switch board, which is made to work automatically, so that either piece of apparatus is switched in or out of circuit as required, and these are connected with a single "line" wire. I may just whisper to you that after a while I am going to give the description of a set of apparatus, original, although but modifications of existing instruments, easy to make and reliable. This, of course, cannot be given in "Shop," so you can work away with what information you have got in the meantime.—W. D.

Covering for Wire.—P. K. (*Birmingham*).—Cover with soft spun silk or with soft cotton. Inquire of any silk mercer in a fairly large way of business, and tell him what you want it for. It is several years since I bought any, as I find that it does not pay me to cover my own wire, as those in the business can do it cheaper and better.—G. E. B.

Preparing Bird Skins.—J. H. F. (*Manchester*).—The wire system is far the best for preparing bird skins, for the following reasons:—(1) On account of quickness in finishing the specimens. (2) You can pack the birds in less space until dry. (3) It would be almost impossible to fix the birds in a natural position, on account of the birds being put in boxes and partly covered over with bran, and you would be unable to watch the bird dry unless you took it out every day, which would mean disarranging the feathers. (4) Waterton's method is impracticable to any one but those who can spare unlimited time over one specimen.—J. A. W.

Camera Dimensions.—E. J. P. (*Hockley*).—"Half plate" size is 6½ in. by 4¾ in., which is more than the half of whole plate. To construct a camera for this size plate the focussing screen must be 6½ in. square, and the length of bellows about 10 in. or 12 in. The back of camera must be made to suit the focussing frame, and the woodwork rather lighter: in fact, the size of the focussing screen regulates the size of the rest of the apparatus. The dark slides may be made as substantial as for whole plate, but to hold the smaller plate.—D.

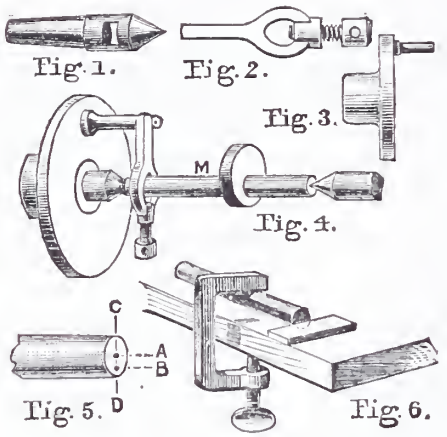
Roller Slide.—P. W. (*Bradford*).—In making the slide referred to, the principal points are to have the film or paper evenly stretched on the same plane, which is effected by a tension spring and rollers. The space in which they work is determined by the kind of film or paper used. The thinner the material the less the space, and *vice versâ*. To give a detailed description would occupy some pages of this journal, and impossible in these columns. Obtain one of the more recent forms of this kind of slide, and look it over carefully.—D.

Reversible Spring.—BEWILDERED ONE.—This question is impossible to answer as it is put, as the querist does not give enough particulars. He is doubtless aware that a spring will not give out anything like the power that is put into it, therefore it is difficult to see how, when the spring is wound up, it can unwind without pause at the same speed, and make the same number of turns with the same power. The nearest approach I can at present remember is in the drill stock used by china riveters and others, which has a loaded spindle (acting as a fly-wheel), and two cords affixed to spindle so arranged as to turn contrariwise, one cord unwinding as the other is coiled upon the spindle; an alternate rotary motion of, say, eight or ten revolutions is thus secured; the operator supplies the power by working a handle attached to the cords. No *single* coiled wire spring can be reversible, but a pendulum spring like a harmonium reed is so, and the hair-spring of a watch *with a balance wheel* is practically so. No doubt, if further particulars were given, useful assistance could be given by B. A. B.

Chime Clock Parts.—F. H. (*Streatham*).—The number of wheels in a chime quarter clock are as follows:—The going part, great wheel, centre wheel, third wheel, 'scape wheel, with centre, third, and 'scape pinions; the number of teeth in the wheels and leaves in the pinions depend upon the length of pendulum: if a seconds, then have the great wheel, 96; centre, 64; third, 60; 'scape, 30; pinions, all 8. Hour striking: great wheel, 84; pin wheel, 64; pallet wheel, 70; warning wheel, 60; pin wheel pinion, 8; pallet wheel, 8; warning and fly pinions, 7, with 8 pins in the pin wheel. Quarter chiming: great wheel, 100; second wheel, 80; pallet wheel, 64; warning wheel, 50; wheel on chime barrel, 40; all pinions, 8. Hour striking and going barrels about 2½ in. diameter; quarter, a trifle larger, say ½ in. Motion work on the wheels that carry the hands may be 2, with 40, and hour wheel, 84; minute pinion, 7. The moon may be driven by putting a pinion, say, of 40 on the hour wheel socket with a wheel of 80 working in it, on which put a stud that shall drive a large wheel of 59, on which paint two full moons; this last large wheel is generally mounted on a stud or screw in the top of dial, and has saw-like teeth, the stud or pin in the wheel of 80 just catching in it and moving one tooth at a time. Fuller descriptions and drawings of a quarter clock may be seen in Britten's "Watch and Clockmaker's Handbook," a very useful publication, and should be in every amateur's hands. All the wheels, pinions, and every requisite for the above, may be got from Grimshaw & Co., 35, Goswell Road, Clerkenwell, London, or J. Mayes, 55, Red Lion Street, Clerkenwell, who make a special line of clock materials, and I can highly recommend them.—A. B. C.

Varnish for Bicycles.—W. B. (*Huddersfield*).—Silica enamel is a transparent varnish, used for covering bright parts and nickel plating to prevent rust. It may be got in 1s. bottles from any of the cycle dealers. It is applied with a brush which is supplied with the bottle. The best thing for nickel plated parts when the machine is to be put past for a season is to coat them with ordinary glycerine or vaseline paste.—A. S. A.

Turning Eccentrics, Fly-wheels, etc.—J. W. R. (*Cockermouth*).—There is an article in the Editor's hands on "How to Make a ¼-Horse-Power Steam Engine," with full-size working drawings of all the parts, and sketches showing how to chuck the different eccentrics, etc. etc. It contains the information you appear to be in search of. As I do not know how long it may be before it appears, I will give you a few hints to go on with. You have a lathe with "back-gear and a face-plate, but nothing else for metal turning," and you want to make model engines. You will require besides the face-plate a pair of "centres," a "carrier," and a "catch-plate" or "driver" chuck. Figs. 1, 2, 3, show these three requirements. Fig. 4 shows the eccentric in position for turning its sides (and its boss, if it has one). You see from this sketch how the centres, driver, and carrier are used. M is a rod of steel called a mandrel, centred and turned so that it will fit tightly into the hole you bore straight through the eccentric casting; the carrier being screwed on one end of this mandrel, the arm of the driver chuck will catch it and drive it round. Thus arranged, you can turn one side of the eccentric true with the hole; then drive it off the mandrel, turn it round, and drive it on the opposite way to turn the other side. Now you require to turn a flat groove in the edge, and to do this it must be rechucked, so that the body will run true and the hole eccentrically. One way to do this would be to make two other centre marks or holes at the ends of the mandrel. Fig. 5 shows one end of the mandrel so centred, A being the first and B the second centre upon a line C D, which must be parallel with a similar line containing the two centres at the other end of the mandrel; this is easily ensured by clamping the mandrel down upon a flat board or face-plate, then providing a bit of parallel wood or metal of a thickness equal to half the diameter of the mandrel. Fig. 6 will show this at a glance, and how the line joining the two centres could be scribed along A B, and then the bit of wood moved to the other end of



Eccentrics, Carriers, etc.

the mandrel and a similar line marked there while the mandrel remains fixed. Evidently the distance A B between the two centres is the throw of the eccentric (equal to half the stroke of the valve), and if this method is to be adopted, that distance must be less than half the diameter of the hole through the eccentric. This mandrel so prepared will serve for any number of eccentrics of the same size. Another way to chuck the eccentric to turn the outer groove, would be to fit a small brass chuck to the lathe, and, having surfaced the front of it quite flat, tin it, and tin one side of the eccentric; then having carefully fixed and wired the eccentric upon it in the correct position, heat the two till the solder melts and unites them. Many other ways might be named; it depends partly on the work and partly on the workman which will be the best. Having chucked the eccentric, turn the groove to fit one of the half-straps, which must have been bored out before the eccentric itself was undertaken. In all such work as this, where there is a central hole of any size, it is best to begin with the hole; finish that first, true and smooth, then chuck the piece by the hole by driving it on a mandrel; this ensures that the rest of the work will be true with the hole. In a fly-wheel, however, the hole is too small to take a mandrel large enough to hold the wheel firmly; it will be better then to hold the wheel to the face-plate by three of its arms, by means of screws or bolts passing through to the back of the plate, and putting a little bit of wood under each of the three arms to take the pressure, and hold the wheel off the plate; or you might screw a piece of board to the face-plate, turn out a recess, and drive the casting into that recess to hold it. Now proceed to turn the projecting part of the rim, then the boss, and very carefully bore the hole. A common drill can hardly be depended upon to do this truly; a half-round, or D bit, will do it, so that when the wheel comes to be mounted on the shaft it will run true. The wheel will then be unchucked by taking it out of the recess, a fresh recess turned to fit the turned edge, and the wheel pressed into it to turn the other side and the remainder of the rim. For making model engines you will want a set of drills, and an American "Universal," say 3 in. or 3½ in., will be extremely useful.—F. A. M.

Soldering Bronzed Ornaments.—J. H. B. (*Stratford*).—You ought not to have any difficulty about this. I myself have frequently to repair this kind of thing, and have never had the least trouble. You must scrape the bronze or lacquer off a little each side of the joint, and use clean raw spirits and a fairly hot iron, so as to melt the zinc a little and cause it to unite firmly to the solder. Use a very little solder at a time, trim off with a file and scraper, and then touch up as follows: pound a small piece of sulphate of copper (bluestone), dip a brush in your killed spirits, and dip this brush in the powdered bluestone, and apply to the parts soldered.—R. A.

Starch Gum.—J. R. O. (*Mitford*).—The adhesive matter used on postage stamps is, we believe, dextrine, or starch gum. Starch is converted into gum by certain acids, by diastase, or by heat. What is known as "British gum" is said to be converted at a high temperature, 600° or 700°. To this, probably, the bad colour of which our correspondent complains may be owing, though we question whether it would be improved by his beer and sugar.—S. W.

Giving to Plaster the Appearance of Ivory.—J. R. O. (*Mitford*).—Various matters have been used for the saturation of the plaster; to gain something of this appearance, that most commonly employed is wax. Melt white wax in a vessel deep enough to "bath" the cast; the latter, which must be thoroughly dry from casting, must be heated, and then laid in the melted wax. As soon as the wax rises to the surface the saturation will be complete, and the cast must be removed.—M. M.

Malleable Iron Castings.—PERCY FIRTH.—Malleable iron castings are moulded in green or in dried sand like ordinary castings. But they must be poured with white or with mottled iron in which the carbon is wholly, or almost wholly, in the combined condition. Grey iron, in which the carbon is in the graphitical condition, is not used. The iron being white or mottled, the runners must be of the flat thin type, rather than round, so that when broken off they will not leave unsightly depressions on the castings, or tend to draw and break them. Hematite pig from Cumberland is employed; and for small castings, Moxeley sand from Birmingham. After the castings are fettled they are put into annealing pots: preferably cylinders of cast iron with covers, similar to the cast-iron pots commonly used for case hardening. In these the castings are embedded in layers of red hematite ore, ground, and passed through a riddle of about an eighth of an inch mesh. Or iron scale, free from dirt, is alternatively employed. The thickness of the intervening layers of hematite or scale may be ¼ in. or more, dependent upon the bulk of the castings. All the castings in a single pot should be as nearly as possible of the same size; if of different sizes they will be unequally decarbonised. The pots are heated to a bright red, and kept at that temperature for sixty or eighty hours, according to the size of the articles, after which they are allowed to cool down gradually for about thirty hours in the furnace, then taken out, and when quite cool are emptied of their contents. You will find it much cheaper to buy your castings than to make them.—J.

Castings of Cylinder, etc.—F. H. H.—Can you not get a local pattern-maker to make them for you? If not, ask the Editor for my address, and I will give you a price. There is no book worth having on *model* steam engines. But if you mean working engines, there are plenty: Bourne, Sennett, Scaton, Forney, and others advertised in the publishers' catalogues. Oak stain, American potash, 2 oz.; pearlash, 2 oz.; water, 1 quart. There are plenty of good petunk machines which you might copy without requiring a description, and which you could purchase for less than they would cost you to make. The Britannia Company, of Colchester, can give you choice of several excellent machines at moderate prices.—J.

Electric Bell Fittings.—S. (*Reading*).—To connect your front gate with an electric bell in the house, you will require an electric bell pull (cost from 4s. 6d.) let into the gate post; 400 ft. of No. 20 gutta-percha covered copper wire (cost about 9s. 6d.); a 3 in. electric bell (cost from 6s. 6d.); four cells No. 2 Leclanché battery (cost 8s.), and about 2s. worth of No. 20 cotton wire for indoor use. Total cost not less than 30s. for material. By using No. 18 wire at an extra cost of 5s., you may work your bell with one cell less. Bunsen batteries are altogether unsuitable for bell work. If you can locate the battery in a cellar or similar cool place, that will be the best spot for it. Shall be pleased to advise you further if you need advice.—G. E. B.

Conversion to Lathe.—THREE LEGS.—I do not advise you to try to improve your sewing machine; but as for the treadle and stand, you may make that useful in other ways. No doubt Mrs. J. M. seldom requires the lower part, preferring for short work to turn by hand. You can therefore utilise the treadle and stand for a *small* lathe or fret saw. Mind, it must be a small one—say, about 2½ in. centre; the treadle and fly-wheel will not give you power to work anything large, and your feet and legs will soon get cramped if you do that work for long. Still, a very small lathe, to be removable at pleasure, and to which you could sit to turn chess-men, draughts, pen-holders, tool-handles, and make small screws and pins of metal, etc., would be very useful, even if you had a larger lathe by-and-by, and would be a very interesting thing to fit up. Perhaps you might meet with a clockmaker's lathe, second-hand, that would suit you.—F. A. M.

Enamel Painted Furniture.—F. J. S. (*Birmingham*).—This can hardly be said to be the work of a French polisher, painted work being generally a branch by itself. Still, as polishers have many ticklish jobs pass through their hands at times, and you seem to have tried to succeed, I will gladly help you as far as I can. You do not say whether

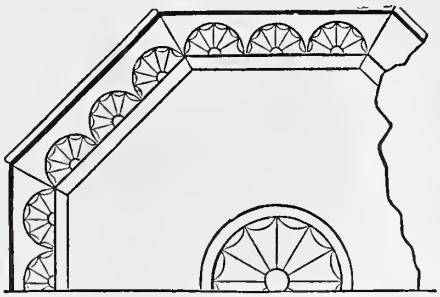
you have made your own enamel paint: whether it was mixed with spirits or turps. The mistake seems chiefly to have been in using enamel paint instead of enamel varnish. The latter should give a resultant gloss, that should not need the application of white polish to finish it as you seem to surmise. I have generally met with satisfactory results by using a white spirit enamel, and the plan I sometimes adopt—though not the one followed out by enamel painters—is as follows:—First size over with clear patent or Young's size, to which has been added some finely-crushed dry whiting, to prevent suction; when dry, glass-paper quite smooth; then give as many coats of spirit enamel as may seem desirable—generally five or six, allowing a sufficient time to elapse between each coat—using a little worn glass-paper if necessary, but preferably levelling each coat by means of a perfectly flat rubber of white polish, used rather thin. It requires a little tact and judgment to well level varnish by means of a polish rubber; the happy knack lies in knowing just when to leave off, and when to apply the next coat of varnish; experience alone will teach this. To make spirit enamel:—Mix finely-crushed flake white with white or transparent spirit varnish. This should be thoroughly well mixed, the flake white being added till the whole looks pure white. It should then be well strained through muslin and thinned with spirits, if necessary, before using. A suitable spirit varnish can be made by 1 pint rectified naphtha, ¼ lb. white shellac, 2 oz. gum sandarac, 1½ oz. gum benzoin, ½ oz. clear resin; the gums to be finely crushed and dried before using. Dissolve by gentle heat and well strain. Of course, if you can get transparent varnish, so much the better. It is better that this latter should be bought at a respectable gum merchant's or varnish maker's. The process of purifying through charcoal is, to say the least, tedious; it is quoted by a well-known London maker at 12s. per gallon, whereas, white hard varnish is 7s. per gallon. You say white polish is not transparent, and gives a dirty appearance. This ought not to be the case; perhaps the shellac was dirty, or too much heat used in dissolving. It is almost best that transparent polish be bought ready made, still, it may be useful to know how it is made. Transparent polish:—Take 3 oz. clean white shellac, ½ oz. clean benzoin, 1 oz. juniper, 1 pint methylated spirits; dissolve well by means of gentle heat. When cold, pour off carefully all the clear, then warm again and thoroughly strain. It may be well to state that most japanners for a white ground use copal varnish and zinc, or flake white; they seldom make their own, preferring to buy direct from the varnish maker. Another plan, and one generally adopted, is to use the enamel paint as you have done, only instead of finishing by means of French polish, they finish by the application of one or two coats of enamel varnish, made of the best, or preferably, colourless copal varnish and flake white. For large flat surfaces, these varnishes are best applied by means of brushes such as painters use rather than camel hair. Should this varnish be of first-class quality, it will give that hard porcelain surface which you so much admire. You will notice that in white enamel the colour is recommended to be used throughout; in tinted or coloured enamels this is not necessary. The finishing coats may be of clear varnish.—W. J. M.

Edco Battery.—ELECTRIC LIGHT.—(*Leytonstone*).—I have not had any experience with the Edco battery, but have had to do with batteries of similar construction, and my experience is similar to your own. In my articles on "Model Electric Lights," I shall give directions for making electric light batteries.—G. E. B.

Delay in Replies.—CLERICUS SECUNDUS.—You and other readers complain of the delay in getting replies to your queries. The pressure upon the "Shop" columns of WORK since the commencement of the magazine has been such that had the whole sixteen pages weekly been devoted to correspondence there would have been an excess of matter. Arrangements are under contemplation for dealing with this demand upon our space, and of bringing answers eloser to date.—ED.

Renovating Chairs.—A. M. (*Maida Hill*).—Unless the leather is very much worn, it is generally possible to improve its appearance. To do so, however, requires a considerable amount of care, and the risk of further spoiling the leather is not small. The best material to use for the purpose is thin French polish, applied with a soft rubber. Be careful not to saturate the leather, but just go lightly over it with a moistened rubber. The polish may be coloured if necessary to match the leather, but it is not generally necessary. White of egg has sometimes been recommended as a substitute for polish, but I have no personal experience of its use, and merely name it in case it should be more convenient if you like to try the experiment. I cannot agree with you about the advisability of giving costs of materials used in the construction of any article described in WORK. Where there is likely to be any difficulty in obtaining out-of-the-way things, names of suppliers are often given, and this ought to be enough. Any would-be maker can generally find out for himself the cost of materials in his own neighbourhood. Locality you must know has often a great deal to do with price of raw material, and what is applicable to London would be wrong at, say, John o' Groats or the Land's End. WORK does not pretend to remove all trouble from the shoulders of workers, and something must be left for them to do. It only assumes to suggest, direct, and advise those who take advantage of its friendly counsels. Papers on the subject you name will appear as soon as practicable. There are so many subjects to be treated that it would be unfair to devote too much space to any one of them. Perhaps you will kindly explain this to your anxious friends, and assure them that their wants will not be overlooked.—D. D.

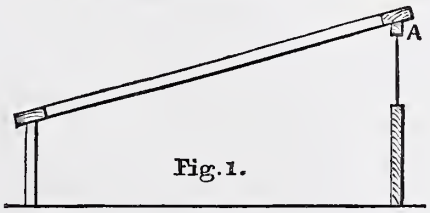
Inlaying Top.—DRAPER (*Lawrencekirk*).—Such an immense variety of inlays would be suitable for your table that you can hardly go wrong in adapting any design you like. As a suggestion for a simple one, this illustration may help you.

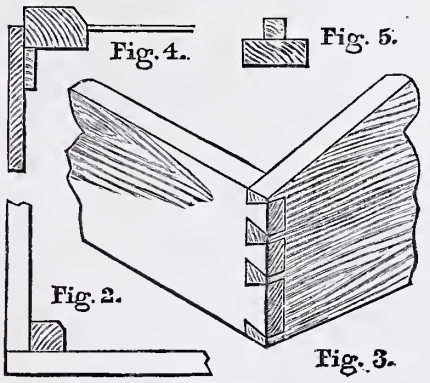


Inlay for Table.

The different pieces are to be shaded by the hot sand process. In the centre put an inlay of similar style, but circular instead of semicircular, like those nearer the edge. Various stringings can also be inlaid.—D. A.

Garden Frame.—C. H. L. B. (*South Shields*).—There are so many varieties of design and make in the way of garden frames that it is rather difficult to give you an idea of one without knowing exactly your particular requirements. I give you, however, a few diagrams that may be of help, as, if they do not quite suit, they may at least give you an idea how to proceed, and you can modify the details in accordance with your wants. If you want a good substantial piece of work, use 1 in. boards for the front, back, and ends, and make your frame after the style of Fig. 1, which is a cross section. The woodwork of the back is the same height as that of the front, and the upper





Garden Frame.

part is filled in with glass. If you make a short frame, say about 5 ft., you must put a rail along the top of the back, about 2 in. square (A, Fig. 1). If your frame is longer, then divide it into equal parts and make two or three top sashes instead of one, as they will be easier handled. The sashes are best made to slide. Fig. 4 shows how to put the fillet on the ends for this purpose, and Fig. 5 is a section of the intermediate sash bearers; these bearers must have an upright support at the upper end to carry the weight of the glass of the back. You can either dovetail the sides and ends of the frame, as in Fig. 3, or put it together with 2 in. corner posts, as in Fig. 2; the latter is much the easiest, and will serve all practical purposes. I do not know if you can make the sliding sashes, but if not, you will have a paper in WORK shortly that will give you full and detailed instructions. Necessarily, this is but a brief description, but I hope you may get an idea out of it that will enable you to construct your frames to your satisfaction; if not, write again, and say more explicitly what you do want.—G. LE B.

Upholstery.—A STUFFER.—Your previous letter was duly answered, but, owing to the increasing number of "Shop" inquiries, it has had to wait its turn. You will see it before this meets your eye. The branch of upholstery to which you refer will not be omitted, but it is such an extensive one that the articles on it will have to be suggestive rather than comprehensive.—D. D.

Mahogany Stain.—E. B. (*Derby*).—For a good mahogany stain which will strike well into the grain of pine and not merely lie on the surface like paint, use a little Bismarck brown added to the vandyke brown stain instead of burnt sienna. Dissolve the Bismarck in a little spirit and then mix it with the other. Remember that as Bismarck brown is a very powerful colour, you must not use too much of it. Excess of it will give a fiery red colour, which, whatever it may be, is not mahogany colour.—D. A.

Book on Wood Carving.—E. L. R. (*Oxford*).—There are several handbooks of a more or less elementary character, but I do not know of any in which you will find it "explained in all its branches." Perhaps the best for your purpose is Eleanor Rowe's "Hints on Wood Carving," 1s., obtainable at the School of Art Wood Carving, City and Guilds Institute, Exhibition Road, South Kensington. You will find much valuable information on wood carving both in the "Shop" and general columns of this magazine.—D. D.

Toy Making and Varnish.—D. McD. (*Paisley*).—I am afraid your question borders so closely on the frivolous that it need hardly have been put. If you have "nous" enough to make the whistles and arrows, surely, as you have the patterns before you, you can devise modes of working them better than we—who have not seen the particular articles—can possibly do. Probably a spirit varnish has been used; but this you can easily ascertain by taking the things to some dealer, or, better still, manufacturer of varnish. Really, if one may judge from your letter, the acumen with which "Paisley bodies" are credited must be on the wane.—D. D.

French Polishing.—W. G. (*Exeter*).—Messrs. Wyman & Sons, Great Queen Street, London, W.C., publish "A Practical Guide to French Polishing" at 2s. 6d., but you will probably find the references to any articles on the subject in this Magazine of much more service to you. My advice is, study the "Shop" columns weekly, and you will gather a store of hints which you will not be able to get elsewhere.—D. D.

Bamboo Cabinet.—R. J. L. (*Salisbury*).—No, your previous inquiries were not overlooked. A reply was written without loss of time, and will, no doubt, have appeared in "Shop" ere this meets your eye. The only cause of delay is the extreme pressure for space on this part of the Magazine. It is impossible to say exactly when the next article on bamboo work will appear, as so many subjects have to be treated. Some very good things will, however, be given as soon as the time for their publication arrives.—D. A.

Taking out a Patent.—J. W. B. (*Birkdale*).—It will always be uncertain whether any invention, however valuable it may appear to be, will take with the public, and we cannot assume the responsibility of advising J. W. B. either to patent or otherwise. To us his invention appears a useful one, and we see no reason why it should not be brought into general use, but he must himself decide whether he is inclined to incur any risk with regard to it. Should he decide to do so, he should obtain provisional protection; he can then safely show a model of the article to influential firms in the business to which it applies, and from their reception of it judge whether he will or will not be justified in completing his patent. He should not show his invention till he has secured his provisional protection.—C. C. C.

Whitewashing Ceilings.—NEW SUB. (*Banbury*).—A full and complete answer has been published since you wrote, viz., the paper on "Distempering," at the end of Vol. I. The only way to get "snowy white" ceilings is to first wash off the dirty old stuff with brush and water, and when dry coat with jellied distemper, which has been slightly tinted to a grey with *lime blue* powder. When dry this assumes the above appearance, and whiter than the unstained whiting and size would be. You can coat over ceilings which are not very dirty once or twice with a *thin* coat of white, but after that they will require washing off down to the plaster, otherwise the accumulated coats will crack and peel off.—F. P.

Upholstery Work.—J. A. S. (*Nottingham*).—Undoubtedly upholstery work, both plain and fancy, will be treated in due course.—D. A.

Polishing Oak Seats.—LIGHT OAK (*London, S.W.*).—Your best plan will be to clean up the seats and parts on which the polish is defective, and then repolish as if the work was new. Use a scraper to remove the present polish. It depends on the depth to which the stains have penetrated how much you must scrape. If you find that the stains are in the polish only, you will probably be able to dispense with filling. As you do not wish to study the whole subject, I cannot do better than refer you to the answers on polishing, which have been given in back numbers of WORK. If you

do not find what you want to know in them, write again, stating the point on which you desire instruction.—D. D.

Wire Thread Fret Saw.—A. B. C. (*Houndsditch*).—Personally I cannot see that for ordinary work these have any advantages over the usual blades. Owing to the claims set forth on their behalf, I gave them a trial. They did not commend themselves to me. You will have noticed that they have been commented on in the Editorial "Guide to Good Things." Why not get a dozen or two and try them for yourself?—D. A.

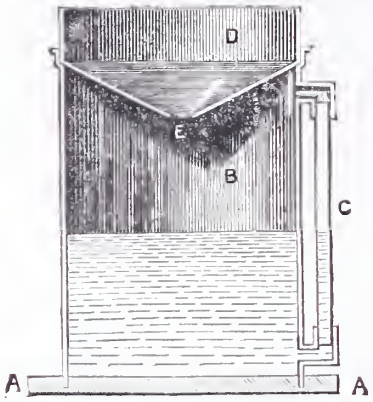
Secrétaire Dimensions.—W. H. T (*Stretford*). Yes, a paper on the construction of a davenport will be given in course of time, but it must wait, as writing arrangements have had a good share of attention in WORK. The sizes you name are altogether too large for a davenport, which at the outside rarely measures more than 2 ft. from back to front and across front. Generally they are even smaller. The height of writing slope you can easily arrive at for yourself, but as a rule it is rather less than greater than that of an ordinary dining-table. "Secrétaire" is only a general term for almost any kind of writing-table or desk, and is too vague to indicate any special piece of furniture. Thus, davenports, cylinder and register desks, and a whole host of fancy arrangements, such as the screen secrétaire, to which an article was devoted a few months ago, are all classed as secrétaires. If you tell us the particular sort of thing you have a fancy for, I will, if possible, give you such details in "Shop" as may help you. Would not the bureau, such as has been described, suit you? It might be made small.—D. A.

Colouring Photographs.—P. P. C. (*Dudley*).—(1) Your question how to colour photographs and fix them to a folding screen was not easy to answer. I purposely interviewed one of the chief dealers in London to obtain address for the makers of colours, presuming that special ones were employed. But so far as he knew ordinary water colours mixed with a little gum were always used. The difficulty in applying these was overcome by—forgive the vulgarity, he blushed when he whispered it, I blush as I write it—licking the print over with one's own tongue. After this painful operation, the water colour will be found to work well; of course, in bromide or platinum prints the preliminary process may be foregone. While not recommending Judson's penny packets of dyes, which afford transparent stains, I should feel inclined to try them for washes in skies or large masses of foliage. There are clear liquid colours sold for map-tinting by all artist's colourmen. (2) To use coloured photographs as decoration for a folding screen seems full of practical difficulties. First, thu prints must be coloured after they are stuck on, for there is surely no way to mount a photo. That dispenses with both surfaces being thoroughly damped, and soaking a water colour is not considered advantageous. But even granting that the awkward plan of colouring photographs after they are mounted does not deter you, I can hardly suggest any mount that would stand the strain. It is possible that well-strained canvas — papered with more than usual care, and extra thick paper—might do, but short of an actual trial we could not advise it. A series of papers on screen-making and decoration are in preparation; the subject is constantly being approached by subscribers, who will then find thu full details required.—E. B. S.

Coach Painting and Building Books.—CREST (*Oldham*). — There is a "Handbook for Coach Painters," edited by G. A. Thrupp, price 1s., by post, 1s. 3d., to be had of Cooper Bros. & Attwood, Long Acre, London, W.C. Another book, called "Coach Painting," by Arlot, price 6s., can be had of Spon & Co., 125, Strand, London. There is another book which is at present in the press, and will be entitled "Boag's Guide to Coach Painting," by A. Boag. The price, *if ordered before publication*, is 10s. 6d. If you wish to subscribe, you write to Mr. P. J. Jackson, Advertising Contractor, 15, and 17, Grainger Street, Newcastle-on-Tyne; the money to be paid when the books are ready. As I have not seen any of the above-mentioned books, I am unable to give an opinion about them. But it's a poor book indeed that one cannot gather a wrinkle from. I am only acquainted with two journals which are published in this country appertaining to coach building, although there are several in America. *The Coach Builder's and Harness Maker's and Saddler's Art Journal* is a monthly journal; the annual subscription is 25s. post free. Artisans' subscription for the same is 20s. per annum post free. This *Coach Builder's Art Journal* is published by J. & C. Cooper, 64, Long Acre, London. The other journal is *The Saddler's, Harness Maker's, and Carriage Builder's Gazette*, also published monthly, at a yearly subscription of 4s., and can be bought of the publishers, Mr. John Kemp & Co., 46, Cannon Street, London, and at 75, Piccadilly, Manchester.—W.

Patenting Medical Receipts.—A. A. (*Liverpool*).—To do this the same steps must be taken and the same fees paid as in patenting an invention of any other kind (see "Taking Out a Patent," Vol. I., page 545). But many of the "patent medicines," so called, have never been made the subjects of patents: they are merely vended under the protection of the Guvernment stamp. The use of this "Appropriated Medicine Stamp" has not the fully protective effect of letters patent, but being supplied only to the persons at whose cost it has been prepared, or to his accredited agent, it affords a considerable amount of protection. For information respecting the supply of such stamps, application should be made to the Secretary, Stamps and Taxes, Inland Revenue, Somerset House, W.C.—C. C. C.

Rain Gauge.—F. W. T. (*Ipswich*).—The accompanying sketch shows a vertical section of a rain gauge. Upon a heavy base A A, a cylindrical vessel B is mounted; to its side is fitted a glass tube C, to show the height of water in the collecting vessel B. D is a funnel or tin dish of exactly the same internal diameter as B, into the top of which it fits as shown. The vessel B should be coated with non-conducting material to prevent the contained water from being evaporated by external heat, and the hole E in the funnel should be no larger than necessary. The top of the tube C is connected with the body B, so that any vapour



Rain Gauge.

formed in the tube may return and be condensed instead of passing away; and if a dry wind were blowing across the top of an open tube an appreciable quantity of moisture would be lost. Although a rain gauge is a simple instrument, it must be used with judgment for its readings to be of any scientific use. It should not be less than 10 in. diameter, and may be 14 in. to 18 in. high. It must be put in some open place, and not far above the ground, for the raindrops increase in size as they fall; this is due to the fact that they come from a colder upper region, and in their descent continue to condense moisture from the warmer air through which they pass.—F. C.

Book on Smiths' Work.—W. S. C. (*North Shields*).—The only books published on art wrought iron work are expensive ones. There is "Metal Work, and its Artistic Design," by Digby Wyatt, published at about six guineas, second-hand about £2. "Decorative Wrought Iron Work of the Seventeenth and Eighteenth Centuries," by D. J. Ebbetts, published by Batsford, High Holborn, 10s. 6d. "Examples of Ornamental Metal Work," by Henry Shaw, published by Pickering, 1836. I do not know the price, but you can get a second-hand copy for 15s. or £1. I fancy Ebbetts' book might suit your purpose best, but there is really no information worth mentioning as to methods of work to be obtained from any of this class of books. You could gather far more by taking a trip to the wrought iron gallery at South Kensington Museum, where there are a large number of examples of different ages and countries. And I do not know of any books on smiths' work that can be recommended; I believe there are only two or three in existence, and a smith would not think them worth looking at. If you have the first volume of Holtzapffel's "Turning and Mechanical Manipulation," you will find in that the best summary of *principles* ever written, and which I have seen reproduced, more or less, in perhaps half a dozen books and cyclopædias. If you want to learn smithing, take a few practical lessons from a local craftsman; and, as far as written descriptions can help, I will promise that you shall find more in WORK, when I get to the practical section, than you will find in any book or journal yet printed. You need not have got Low Moor iron for ornamental work; Lord Ward's best brands, at about half the price, which you can obtain of local ironmongers, would answer the purpose just as well. Do you mean that you cannot get iron light enough for the scroll work of light candelabras? You can get it as thin as ⅛ in. If you want it thinner, use hoop iron, and, if thinner still, get the thin strips used for bent iron work.—J. H.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. J. (*Belfast*); CRESCENDO; H. J. A. (*West Hougham*); J. T. (*Seacombe*); A NEW SUBSCRIBER; A. F. (*Warrington*); S. P. (*Middlesbrough*); J. G. B. (*Walthamstow*); W. C. Y. C. (*Walthamstow*); P. Q.; G. T. (*Old Shildon*); A. W. P. (*Jersey*); W. E. R. (*Penryn*); M. (*London*); C. C. (*Milford*); CYCLIST; W. K. (*Easky*); C. B. (*Notting Hill*); N. B. (*Totnes*); J. B. (*Birkdale*); T. D. (*Oldham*); PURCHASER OF CYCLE; W. R. (*Oswestry*); R. W. D. (*Poplar*); P. J. (*Leytonstone*); EXPANSION; L. W. P. (*London, W.*); L. B. (*West Bromwich*); E. S. (*London, W.*); D. O. W. (*Ipswich*); W. W. (*Glasgow*); W. B. (*Stockport*); F. M. (*Ayrshire*); S. J. (*Stockport*); W. J. T. (*Gateshead-on-Tyne*); J. A. N. (*Portsmouth*); A. W. S. (*Enfield*); T. T. (*Silvertown*); A. H. S. (*Edinburgh*); ELIPH; INKERMAN; R. E. D. (*Gateshead*); WRIGHT (*Greenock*); D. M. & CO. (*Manchester*).

Trade Notes and Memoranda.

THE Committee of Council on Education have allocated for the financial year 1891-92 the sum of £5,000 for grants in aid of technical instruction given under the Technical Instruction Act. In a discussion on the subject in the House of Commons, Mr. Mundella remarked that there was not a canton in Switzerland that would not be ashamed of such a paltry provision for technical education. Mr. Goschen, however, explained that the smallness of the amount was the result of the comparatively small demand made by the local authorities, and that there was every disposition on the part of the Government to meet the full requirements of the Act. The grants in aid will not necessarily be equal to, and in no case will exceed, the amount contributed by the local authority out of the rates, and each grant will be computed, as far as possible, on the basis of the amount spent on subjects of technical instruction other than those for which the Science and Art Department gives aid.

INCREASED telephonic facilities are being provided in the Midlands. Nottingham, by means of numerous trunk wires, is now in communication with Sheffield, Manchester, Liverpool, Bradford, Leeds, Bolton, Blackburn, Huddersfield, Hull, Birmingham, and other towns *en route*. Nearer home Nottingham has telephonic communication with Derby, Leicester, Loughborough, Burton, Mansfield, Worksop, Ilkeston, Long Eaton, Langley Mill, Ripley, Clay Cross, and Chesterfield. It is further proposed to lay down trunk wires between Nottingham, Newark, and Lincoln. Several important additions have just been made to the facilities for telephonic communication in Scotland. Direct communication has been established between Edinburgh and Dundee, over a line 100 miles long. A trunk line has been completed from Edinburgh to Selkirk, Hawick, and Galashiels. Two additional trunk lines have been constructed between Edinburgh and Glasgow, making four lines in all between these two cities. Other and minor extensions have also taken place between Cupar and St. Andrew's, and between Arbroath and Montrose. The National Telephone Co. have published a map of the North of England showing the extent of the telephonic communication now in operation between all the chief towns in this part of the country. We understand that in a few months the company hope to place these towns in direct telephonic communication with London and the towns in the south of England, an event of no ordinary significance in this country.

WORK

is published at La Belle Sauvage Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	.. .. ..	1s. 8d.
6 months, "	.. .. ..	3s. 3d.
12 months, "	.. .. ..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [9 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [4 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

Machinery and Tools.—Largest Stock in London. BRITANNIA CO., 100, Houndsditch. Cash or Hire Purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks and Dies, Forges, etc. Catalogue of new, 6d.; second-hand, 2d.—BRITANNIA CO., Colchester.

Best Book on Lathe, Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [7 R

Diamond Frame Safety Bicycle for Sale.—Perfect condition; practically new; not ridden 50 miles; ball bearings; usual parts beautifully plated; cannot fail to please. Price £7 10s. Must sell.—TEW, 34, Hill Street, Ipswich. [1 S

Model Ships' Fittings, engines, castings, parts, etc. Illustrated Catalogue, 4d.—STIFFIN & CO., 324, Essex Road, Islington, London. [2 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

SPRING CLEANING.

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.

SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

PRICE, TALBOT & CO., LIMITED,
LATE DALE & Co.,
26, LUDGATE HILL, LONDON, E.C.

Post free.

Cassell's Classified Catalogue.

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

TOOLS TOOLS
MOSELEY & SON.
323, HIGH HOLBORN.
200 PAGE-CATALOGUE
BY POST 6D
ORDERS OF 10/- CARRIAGE PAID

The Library of Wonders.

Illustrated throughout.

Paper covers, 1s. each; cloth, 1s. 6d. each.

Wonderful Adventures.

Wonders of Animal Instinct.

Wonderful Balloon Ascents.

Wonders of Bodily Strength and Skill.

Wonderful Escapes.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

60th *Thousand*, price 1s.; post free, 1s. 3d.

Cassell's Shilling Cookery. This new and valuable Work contains 364 pages, crown 8vo, bound in limp cloth.

"This is the largest and most comprehensive work on the subject of cookery ever yet published at the price." —*Christian Age.*

Cloth gilt, 2s.

Cassell's Popular Cookery. With Four Coloured Plates.

AN ENCYCLOPÆDIA FOR THE HOUSEHOLD.

1,280 pages, royal 8vo, cloth, 7s. 6d.; half-roan, 9s.

Cassell's Domestic Dictionary. With numerous Illustrations.

"As a manual of ready reference for all household purposes this work has no rival."—*Queen.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

24 Pages. ILLUSTRATED.
ONE PENNY.

CASSELL'S

Saturday Journal.

Contents of this Week's No.:—

LADY PAT AND HER EDITOR.
Complete Story.

About the New South London Subway. *Illustrated.*

After Many Days.
Complete Story.

Political Parties and their Colours.

A Moment of Peril.
Complete Story.

HOW DECAYED ARISTOCRATS GAIN A LIVING.

&c. &c. &c.

"The best and cheapest pennyworth of popular literature ever produced."—*The Times.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

MELLIN'S FOOD

For INFANTS and INVALIDS.

MISS CLARKE.
Aged 12 Months.

"*The Brewery House,*
"*Addlestone, Surrey.*

"*I send photo of one of the children I have brought up on your food (I am now bringing up the third on it). The photo was taken 2 years since, when the child was 12 months old, and she has been fed on your Food and Milk from one month.*

C. H. Clarke

"*February 26th,* 1889."

Samples, Pamphlet, and Prospectus post free on application to

G. MELLIN,

MARLBORO' WORKS, PECKHAM, S.E

Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

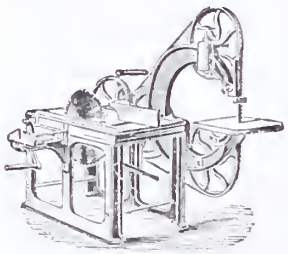
SOLD EVERYWHERE.

LEWIS & LEWIS,

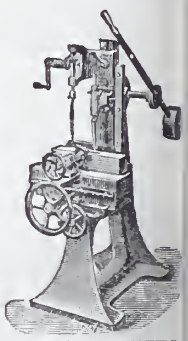
ENGINEERS,

CAMBRIDGE HEATH,

LONDON, N.E.



THE "ANERLEY" COMBINED CIRCULAR AND BANDSAWING MACHINE,
For Hand or Power, will take in 22 in. Circular Saw, and will cut by hand-power up to 5 in. deep.



THE "HACKNEY" MORTISING & BORING MACHIN.
With 8 Chisels, 1 Coredrive Key, 3 Augers, and 3 Drill

A NOBLE LITERATURE.

The Right Hon. A. J. Mundella, M.P., in his Speech on Education at Scarborough, said:—

"Where was the nation that possessed a literature like ours, the noblest the world had ever seen, and was it not right that our children should b acquainted with it? If they could not have pure literature, he was afraid that they would get hold of the trash with which the land was flooded. Th only way was to put into their hands some of the noble literature of our land. It never was cheaper, and he was convince that if a child had once acquired a taste for pure literature, he would never take up any other. One of the best example was to be found in 'CASSELL'S NATIONAL LIBRARY.' He had himself taken all of the books in that library, whic had reached 200 volumes, and was indeed a perfect collection of English literature. These volumes, of which millions ha been published, had proved an immense boon. They had cost him 4½d. a volume, but there was no man, except one of great wealth, wh could have possessed such a library as that fifty years ago. They included the noble English classics: Shakespeare, Milton, Chaucer, splendid works travel, and even a translation of Plutarch, for this nominal price. The child who had once mastered these would never condescend to the garbage of th current literature they heard so much about.

*** *A list of the* 209 *Volumes now ready in* Cassell's National Library, *price 3d. each, or in cloth, 6d. each, will be sent post free on application.*

CASSELL & COMPANY, Limited, *Ludgate Hill, London.*

Printed and Published by Cassell & Company, Limited, La Belle Sauvage, London, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 70.] SATURDAY, JULY 19, 1890. [PRICE ONE PENNY.

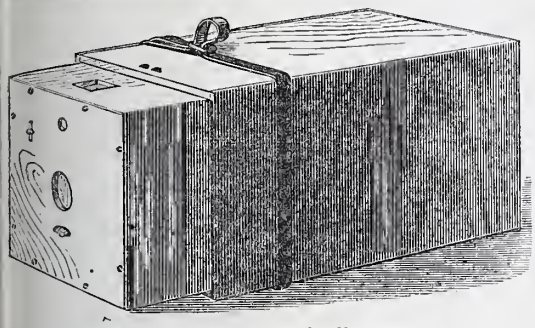


Fig. 2.—Camera open for Exposure.

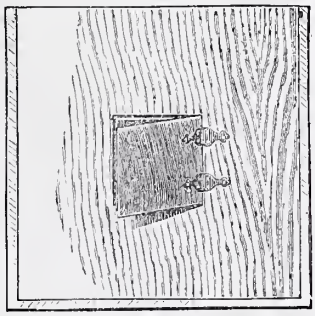


Fig. 5.—Showing Door in End.

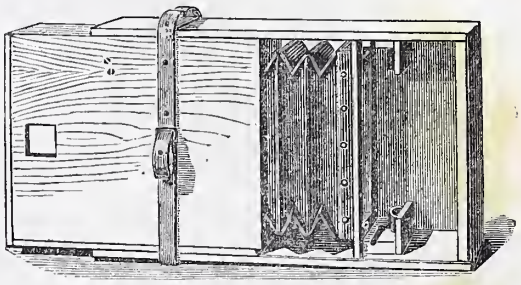


Fig. 3.—Camera with Top removed.

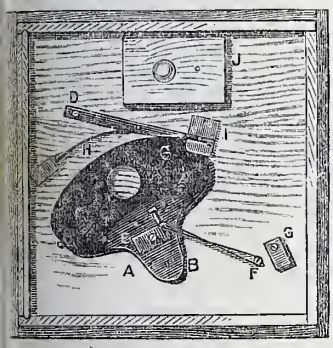


Fig. 6.—Shutter open for Exposure.

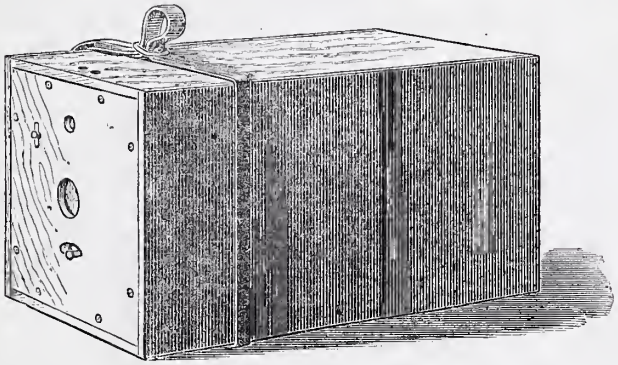


Fig. 1.—Camera ready for Carrying.

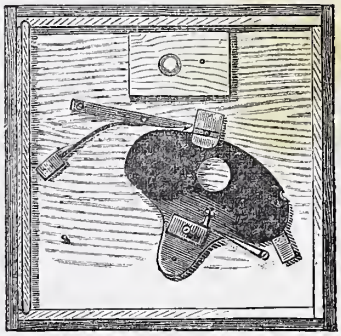


Fig. 7.—Shutter after Exposure.

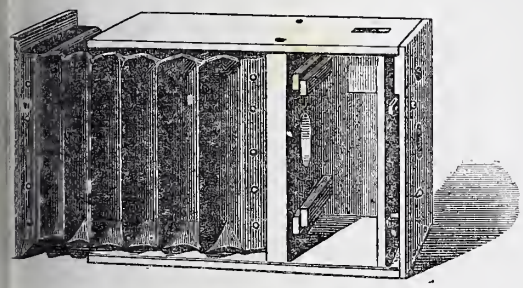


Fig. 4.—Inner Case with Side removed.

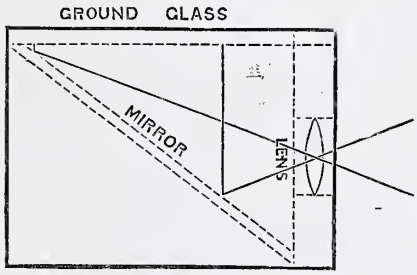


Fig. 9.—Finder.

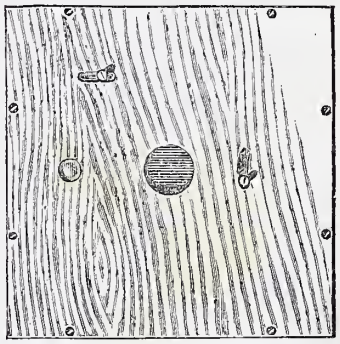


Fig. 8.—Front End of Camera.

A HOME-MADE HAND CAMERA.

BY FRANK S. MORTON, PORTLAND, MAINE, U.S.A.

EVERY amateur photographer who possesses only an ordinary tripod camera has occasion arise many times where a hand camera would be a great convenience. Some amateurs possess both, but many are not sufficiently rich in this world's goods to own more than one.

I was in the very position above named, as far as possessing but one camera, until the idea struck me to make a hand camera myself, using the lens of my tripod camera in both. This may not seem at first thought to be a very difficult undertaking, but my tripod camera was a 5 in. × 8 in., with a lens of 8 in. focus. A box to contain such a camera would be large and clumsy; and, besides, a 4 in. × 5 in. size is sufficiently large for the most uses a hand camera is put to. To make a smaller bellows and camera, and enclose it in a box, was my first thought, but the same difficulty as regards the length of the box still presented itself. To make a box long enough to allow the bellows to be extended 8 in., and then have room for all the other parts, would make an awkward affair, and such an arrangement would be decidedly hard to manage in making exposures. The notion presented itself that I might make use of the old-fashioned idea of a sliding box camera, and by combining that idea with others of later origin, I might get what I wanted. This I did, and met with the best success. My camera as finished was 12 in. in length, 7½ in. wide, and 6½ in. deep. Extended for exposure, it was three or four inches longer, according to the distance-off of the object to be photographed. Finished in oak and polished, it has a very neat appearance, and there are no working parts on the outside—the only parts visible being the screw for setting the shutter and the one for releasing the same, both being even with the surface. The only openings visible are the two slots these screws work in, and the holes for finder and lens. The arrangement is so simple, and the working of it so easy, that I will now proceed to describe it for the benefit of readers of WORK.

The camera consists of two wood cases

sliding into each other, and connected with each other by a bellows, as an extra precaution against the entrance of light. Fig. 1 shows the camera shut for carrying, and Fig. 2 shows it opened for exposure; Fig. 3 shows it with the sliding-top cover removed, and explains the method used in holding the plate-holder in place; Fig. 4 shows the inner case with the covering case and sliding-side removed.

I first made the outer case, which is 12 in. × 6½ in. × 7½ in., of ¼ in. oak, and for extra strength an additional end piece of ½ in. pine was inserted. The top was made to slide in grooves, so as to be easily opened or removed. It is immaterial whether the top or side is made to open, the style of plate-holder used governing this. In the end a small door was cut, and the piece taken out and hung on with a couple of brass hinges (Fig. 5). Next the inner case was made. This was made of wood of the same kind and thickness as the outer case, but with a double end—one set in ⅜ths of an inch from the end, and the other screwed on over the end, leaving a recess ⅜ths of an inch deep between them. Fig. 4 shows how this was arranged. In this recess the instantaneous shutter was placed. In the inner case the side was made to slide, as the top in the outer case; and the whole was made to fit closely, but not too tightly, inside the larger case. The length of the inner case was 8 in.

Next the bellows was made. It was made over a box 4 in. × 5 in. square, the inner covering being of ordinary dark cloth and the outer of black rubber cloth, such as is easily obtained of any dealer in rubber goods. Between these, pieces of cardboard with bevelled ends were placed; and when dry, the whole was folded together to form the bellows. As the bellows is entirely out of sight in the camera, no special care need be taken with it other than to make it light-tight. Two frames of ½ in. stuff were made to fit into the ends of the bellows, and were fastened there by rows of tacks. A piece of ½ in. wood was next cut the exact size of the inside of the *inner* case, and a 2 in. circular hole cut through the centre. To this, one end of the bellows was fastened, and to the other end was attached a piece of ¼ in. board, cut to fit closely inside the *outer* case, and having a 4 in. × 5 in. opening cut in it. The bellows was then put in place as in Fig. 4, the end having the round hole cut in it being pushed forward in the inner case just far enough to allow the lens attached to the lens-board of the tripod camera to be pushed in front of it on cleats fastened to it, the front of the lens-tube coming close up to the double front of the camera. It was firmly fastened in place there by screws from the outside. It is, of course, unnecessary to say that all the woodwork should be blackened carefully on the inside, either before or after it is put in place. Three inches from the end, inside of the outer covering, small strips of wood were tacked, and back of them the end of the bellows having the 4 in. × 5 in. opening was dropped in place. Fig. 3 shows how it looked after this operation. These strips were to hold bellows when inner case was pulled out.

Close against the bellows-board, but not so close but what it would slide up and down, were placed the parts for holding the plate-holder. This arrangement is very simple, and consists of a piece of ½ in. wood 1 in. wide and 5 in. long, and a piece of ¼ in. wood of the same width and length tacked on it at right angles. To the thin piece is fastened a thin brass spring, which presses the plate-holder against the bellows-board when it is pushed down in place. This is fastened to the side of the outer casing, and pushes the holder firmly in place. As an extra precaution against the entrance of light, the bellows-board is covered with thick black felt. The space back of all this will allow for two extra plate-holders. For focussing, a strip of ground glass is dropped down in slots made in the ½ in. pieces, or a frame could be made to slide in place of the plate-holder. The narrow strip is sufficient, however, as it will show the focus, and the finder will show the proportionate size of the image. Fig. 3 shows the whole arrangement for holding the slide, and also the slot for the ground glass. If the lens-board of the tripod camera is too long and large to slide in on the cleats (as shown in Fig. 4), a thin piece of soft wood with a hole cut in it will hold the lens in place all right. The lens should fit closely up to the front of the camera. For plate-holders the form used in the ordinary detective camera is best. Many of these open the broad way, and will thus fit in from the top. If these cannot be obtained, those opening at the end will do; only the outer case must have the side made to open, and not the top. Before making the camera, the dark slide should be selected, as dimensions may have to be altered to make it fit.

The instantaneous shutter was next put in place. A simple and effective shutter was made (as shown in Figs. 6 and 7). Fig. 6 shows it open, ready for exposure; and Fig. 7 after it has been made. A piece of light thin wood was cut to the shape of A, Fig 6, and one side stained as near the colour of the outside of the camera as possible. A hole was cut for the exposure, and the piece was hinged on to the inner end of the front by a small screw at B. A notch was cut in its edge at C, and a trigger of brass made to fit into it and hung in place, with a round-headed brass machine screw in its end to serve as a button to release it at D. A small block of vulcanite was screwed on to the shutter at E, and in this was fastened another screw for opening the shutter, and also one to which to fasten a rubber band. The other end of the band was fastened to a small screw at F. A stop G, a spring H, to keep the trigger in place, and a brass guide I to keep the shutter true, completed the arrangement. To set shutter, pull it back by means of the screw E, until the trigger engages in the notch C in the edge of the shutter. To release, press down on the screw D in the end of the trigger. This releases the shutter, and the rubber band pulls it quickly across. The size and strength of the rubber band determine the speed of the shutter. For time exposures, work exactly as if setting the shutter for an instantaneous view, pausing as long as necessary when the two openings are opposite each other.

When all was in place, a hole was cut in the outer covering of the end for exposure, and slots were made for the setting and releasing screws. Then after the finder was in place, it was screwed on by screws put through three sides. The sliding side of the inner case was made to slide past the inner end piece and against the outer. Fig. 8 shows openings made in the front.

The finder was the last thing made. Every dealer in photographic goods keeps, or ought to keep, small finder lenses, which can be procured at a small cost. One of these was procured, and a small three-sided box made, the front having a ½ in. hole in which the lens was fitted. A small piece of looking-glass was arranged at an angle inside the box, and on top a piece of ground glass was placed. A square hole cut in the top of the inner case, another in the inside end piece, in which to fasten the finder, and a small hole in the front piece, completed the preparation. When the finder was put in place, it threw a small reversed image of the object to be photographed upon the ground glass. A finder is so simple in construction that it seems needless, almost, to explain how it is made; but the diagram at Fig. 9 will explain how one of this style is put together. As the square hole where the ground glass is seen is likely to be cut either too large, or wrongly shaped to give an exact idea of the image on the large glass, pencil marks should be made on it to just include the image. Then snap-shots are sure to contain just what you aim at. Fig. 6 shows the front of the finder at J, and Fig. 4 shows where it projects into the camera.

After a good coat of dark filling and shellac varnish, and a good rubbing and polishing, the camera was complete, and ready for work. A trial proved that it was all that could be wished—the shutter working to a charm, and the finder locating the picture exactly. In carrying it on the street, it attracts much less attention than many of the regular cameras with their outside brass work and mysterious openings. Focus was made on objects of different distances, and marks made to indicate how far the inner case should be pulled out for different views. The door in the end allows of handy focussing, as the case shades the ground glass, and no cloth is needed. The camera can be worked as quickly and as easily as any camera using glass plates. Set the shutter, pull back the top, and remove the slide from the plate-holder, and, when a picture is wanted, slip out the inner case to the right mark, touch the trigger, slip back the case, and all is done. For an arrangement where a long focus lens has to be used, it is first-class and satisfactory.

MODERN FORGING.

BY J. H.

DRAWING DOWN.

BEFORE any examples of forging can be given, it will be necessary to describe the essential or primary methods by which forging is accomplished. After describing in some detail each of these methods, with the aid of a simple practical illustration, we shall then be in a position to take up illustrations of forged work, more or less elaborate, where each or all of these methods are employed.

Work of unequal sectional area is done either by drawing down, upsetting, or welding, or by a combination of the three methods. In a large number of cases, the choice between these three methods is not made because one is essentially superior to the other regarded simply as a question of ultimate results, but either because under given circumstances it involves less work, or economises material, or is the only way possible with material that happens to be in stock, or because there are odds and ends that it is desirable to use up; or, lastly, because it is the best method available with the tools and help at the disposal of the smith. The alternative, therefore, is commonly one of *expediency*, and as such we shall usually have to regard it.

It is often, however, a question of *relative* dimensions. If the difference between the enlarged and the reduced part is very great, neither drawing down nor upsetting would

be resorted to unless for some exceptional reason, but welding would be employed. And the same holds good in other forging; as, for example, in the case of eyes. An eye having a small hole and much metal around it, as the tie-rod of an iron roof truss, would have that end forged solid, and the hole punched through. But an eye possessing more the character of a loop, having a large hole and relatively little metal around it, would be turned round and welded. An eye of medium relations may obviously be made in either fashion.

There are large numbers of instances which might be cited where no two smiths, though similarly circumstanced, would go to work on precisely the same lines, for different men will have different ideas as to the best methods of compassing the same ultimate results.

Then the different qualities of iron will often influence a man in the choice of methods. There is some iron which will not weld easily—the hot, short variety. Some iron is dirty and scaly, and this will not weld so readily as better qualities, and these affect methods of working also.

In the later examples, therefore, which I shall give of methods of forging suitable for adoption in certain cases, it must be borne in mind that these are given from my own knowledge of work done under a given set of conditions, and that, with a change in those conditions, there would, in some cases, be alternative and more suitable methods. I shall often point out these alternative methods, but, even when I do not, it will be understood from the remarks just made that, in smiths' work more, perhaps, than in any other craft, methods of work may and do vary in different shops, and by different men in the same shops.

To draw down a piece of iron proceed as follows:—Suppose the portion marked A, Fig. 20, has to be drawn down from a bar originally of the size of B. The bar is laid across the edge of the anvil in a slightly diagonal direction and nicked with a top fuller at C, Fig. 21. If both sides of the bar have to be drawn down, then a bottom fuller (A, Fig. 22) would be inserted in the anvil in opposition to the top fuller (B, Fig. 22), and the bar would be nicked as in Fig. 23. Observe that the chisels or sets are not used in such work, for these would divide the fibres of the metal, while the round-faced fullers simply alter their direction without breaking their continuity. The preservation of the continuity of the fibre is one of the first importance in forged work, so that what may appear to be roundabout methods which give much extra trouble, will often be resorted to in order to preserve that continuity. Fibre or "grain" should never be rudely severed. Few of the tools used by the smith for shaping to outline have absolutely square edges, but they are more or less rounding. The continuity of the fibre, however it is bent and twisted, is thus preserved. How entirely fibrous is that structure is readily seen. Let a bar of iron be held in the vice and bent round until it is doubled up, then on the outside radius the torn ends will look exactly like bundles of vegetable fibre, or not unlike torn animal muscle. Or let a specimen torn asunder in a testing machine be examined, the fibrous structure will still be apparent, though not so fully as in the bending process, and the outer skin will present a most characteristic striation or shrivelling in the longitudinal direction. Yet the fibrous iron may readily be changed into a weak crystalline material by nicking with a sharp tool, or by too much hammering. Take that same bar of iron and nick it round and break it off suddenly, then the fractured surfaces are as highly crystalline as those of cast iron. This clearly shows the necessity of making fullers and other shaping or moulding tools with rounding—not keen—edges.

When the work is set down with the fuller, or fullers, the metal along A (Figs. 21 and 23) is drawn or thinned down by a succession of blows from the hand hammer or sledge, with or without previous fullering. When fullering tools are used, the top fuller would be employed singly if only the one face requires reduction, or in pairs like Fig. 22 if both faces have to be drawn down. The effect is that a succession of ridges and depressions are formed upon the surface of the spread-out work. These have then to be obliterated with the hammer.

The fullering and hammering not only elongate the bar, but also spread it out sideways. If the bar is to be equal sided, the widening has to be prevented by hammering the sides alternately with the faces. This is done very rapidly. After every three or four or half a dozen blows are given on the faces, the smith turns the bar quarter round during the brief interval between a couple of blows, and the iron receives several blows upon the edges as a corrective to those on the faces, and its equal sidedness is thus preserved simultaneously with the process of drawing down. By practice this rapid changing of the faces on the anvil is accomplished without spoiling the rectangular form. A novice is apt to develop a rhomboidal form.

Note that in this drawing down, whether done with fullering tools, or with the hammer alone, as is frequently the case where the reduction in area does not amount to much, the process of thinning down always commences at the end of the iron *farthest* from the smith, and proceeds towards himself. It is also done in sectional detail, not taking the whole surface at once. One inch and a half or two inches at a time is done, and the work is thus rendered easier than as though a larger surface were taken at a time.

When the iron is roughed down, its surface will not be perfectly smooth, yet a good smith can impart a very fair finish to a flat surface by the hammer alone. The hammers should be used in such a manner that the work should be bruised as little as possible. There is a knack in so using the hammer that its edges will not mark the work, the central rounding portion of the face striking the work. Striking fair on the middle of the hammer face, each mark serves to partly obliterate others, as a succession of cuts with an adze in the hands of a skilful carpenter leaves a very smooth and only slightly perceptible wavy surface. This "battering down" is all that a smith working single-handed can effect by way of finish. With the assistance of a hammerman the surface can be smoothed more effectually by means of a flatter (Fig. 24). This is held in the right hand of the smith and slid in turn all over the surface of the work while the hammerman strikes it with the sledge. When thus finished the work is left beautifully smooth.

In drawing down a round bar the process is the same in principle, but slightly different in detail. The rod will be nicked round with a fuller and drawn down under the hammer, beginning the drawing down as before at the end situated farthest from the hand. A fullering tool would not be used for extending the metal, but the hammer only, and the rod is rotated all the while between each hammer blow. Toward the close of the operation, finish is imparted by means of swage tools, the work lying in a bottom swage of nearly semi-circular form (Fig. 25), which shows an anvil swage fitted into the hole in the anvil, while blows are struck upon its upper surface with a hand hammer if the smith be single-handed, or with the sledge upon a top swage (Fig. 26), the counterpart in form of the bottom, if the smith has a striker.

Fig. 27 is a sectional view through top and bottom swages, A and B, with the bar of iron, C, between them; D is the anvil.

By means of spring swages, suitably rigged up (Fig. 28), a smith, working single-handed, can sometimes make use of the top as well as of the bottom tool.

Where there is a steam hammer this work of drawing down and finishing is very much simplified. It is then not even necessary to use top or bottom fullers, for, having marked the position of the shoulders on the bar, the smith lays the bar on the anvil of the steam hammer and draws down the work directly between it and the tup, turning the bar quickly round during each period of ascent of the tup. If the bar is of large size and of considerable length, the drawing down will still have to be done in detail, two or three inches from the end being drawn down first, and the bar being then thrust farther along, and the succeeding portions drawn down. But the bar is always held perfectly flat, and the hammer finishes at once if the work is flat.

If the work is circular, then top and bottom swages of the spring type are placed under the tup at the finishing stage. The bar is first drawn down roughly between the anvil and the tup, being rotated rapidly between each blow, a rudely circular form being imparted or preserved simultaneously with the process of drawing down. Before the reduction to size is quite complete, the spring swages (Fig. 28) are placed on the anvil, held by an attendant, the work inserted between them, and a few final blows of the tup on the top swage—the work still being revolved during each period of ascent of the tup—rounds and finishes the work perfectly.

The swages in Fig. 29 are two common forms used with the steam hammer. The difference in the two is that A is only made to take one diameter of iron; B will take three different sizes. The top and bottom faces of both, it will be noted, are made flat for use with the hammer, while in Fig. 28 the lower swage has a pin to fit into the anvil, and the upper swage is formed to receive sledge-hammer blows.

Simultaneously with these processes there is a matter which must not be lost sight of. Scale—*i.e.*, an oxide—forms rapidly on iron at a red heat. The larger the forging, the greater the quantity of the oxide formed. This should be brushed away at once, otherwise it will become driven into the surface of the work by the hammer blows, and form a rough scale upon the surface, which is both unsightly and a hindrance to easy tooling in the vice or lathe. A switch of brushwood is used for the purpose of brushing the scale off the forgings as fast as it forms. Where the forgings are large, a man stands by the steam hammer and brushes them away after every half dozen or so blows. At the anvil the striker or the smith knocks the scale off immediately the iron is removed from the fire, and as often as it may be required afterwards.

To judge of the length of iron to be allowed for drawing down is not difficult for a practised smith. Few go to any trouble in calculating in figures the length required. Yet in the best and most expensive qualities of iron and steel it is as well to bear in mind a rule of simple proportion. It is evident that the original section of a bar bears the same proportion to a given reduced section that the length of the latter bears to that of the former. Thus if a bar originally 3 in. square has to be reduced to an inch square for a length of nine inches, then the length of the 3 in. bar required for such reduction will be 3 in. × 3 in. = 9 in. : 1 : : 9 in. : 1 in.—that is, one inch in length of the 3 in. bar will be taken for reduction to a 9 in. length of one inch square. If the reduced portion is tapered, or of unequal and varying dimensions, then the *mean* of the various sectional areas must be taken.

Of course, additional allowance must be made for ragged and perhaps burnt ends, and a trifle for inaccuracy in cutting off. How much must be a matter for judgment. Generally practice enables a man to judge pretty accurately about these things.

There is a great difference in the time different smiths will be occupied over a given piece of work. A smart smith will, of course, try to do as much work as possible upon a forging in a single heat. Forethought is of as great, or greater, value in smiths' work than in wood or most metal work. An opportunity missed by not having the proper tools handy at the exact moment when wanted, by the neglect of some little precaution, by miscalculation, by slow movement, means another heat. While his iron is in the fire the smart smith will go mentally through the sequence of operations, and see that whatever is required is at hand, and when the iron is out, he will strike smartly while the iron is hot, and make every blow tell. Yet, as a false or too hasty movement will spoil the work, or give after trouble in rectification, everything must be performed with the most cool

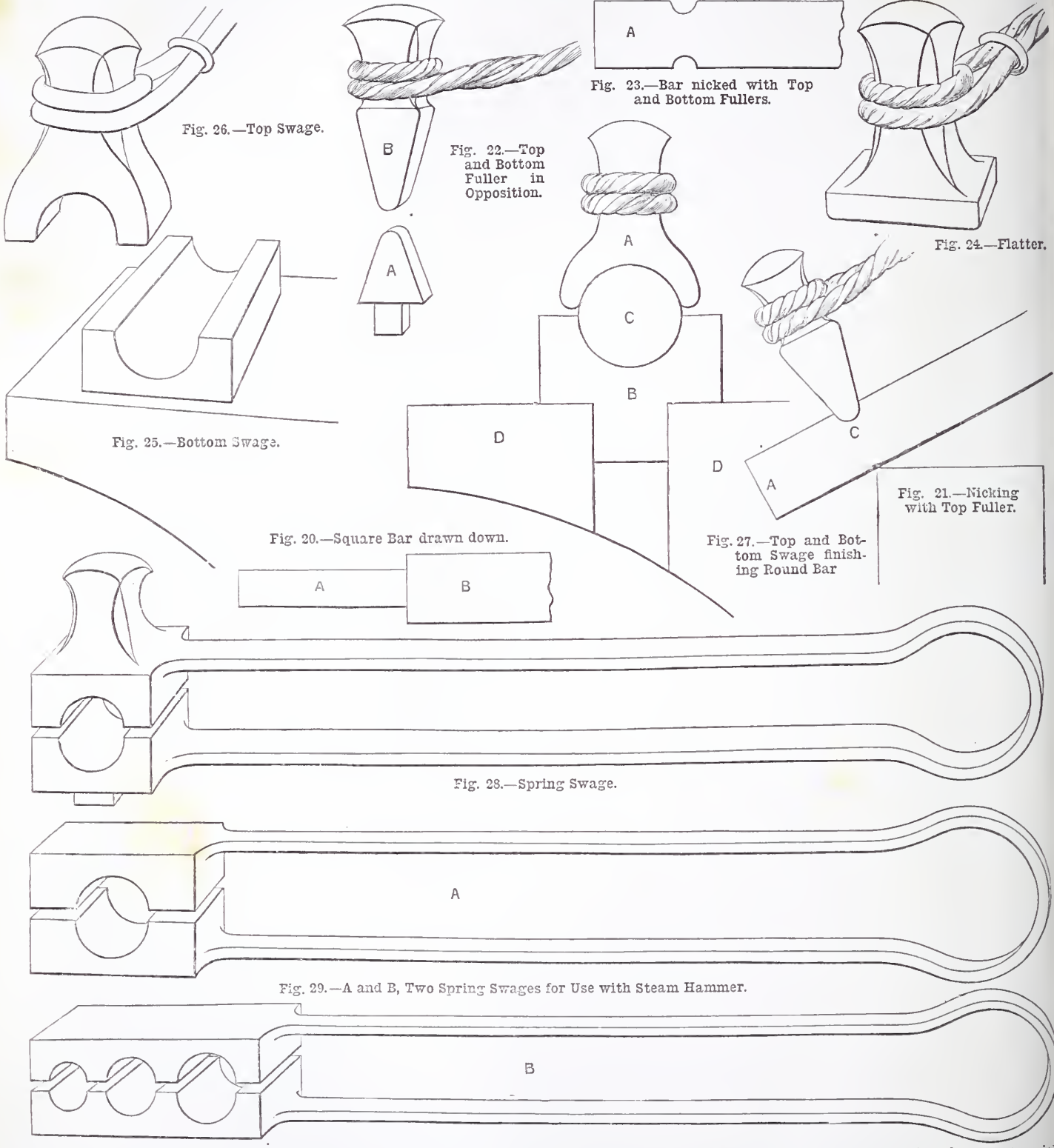


Fig. 26.—Top Swage.

Fig. 22.—Top and Bottom Fuller in Opposition.

Fig. 23.—Bar nicked with Top and Bottom Fullers.

Fig. 24.—Flatter.

Fig. 25.—Bottom Swage.

Fig. 20.—Square Bar drawn down.

Fig. 27.—Top and Bottom Swage finishing Round Bar

Fig. 21.—Nicking with Top Fuller.

Fig. 28.—Spring Swage.

Fig. 29.—A and B, Two Spring Swages for Use with Steam Hammer.

calculation and foresight of consequences. But an unskilful and slow man will quite commonly require to take two heats to the one of a good and quick man, and will produce no better, and very likely not so good, results. In some examples to be given I will state approximately the number of heats in which such work ought to be done.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

FOUNDATION—CURLIN CUTTER—WOIBLET SPUR EMBEDDER—PARKER'S FOUNDATION FIXER—ABBOTT'S FOUNDATION FIXER—CLARKE SMOKER.

THAT which has revolutionised bee keeping more than anything else, perhaps, is the invention of foundation. Without it, movable frame hives would be unknown, and the ancient bee residences would, alone, be found in our apiaries. Foundation mills would be beyond the scope of the present series of articles, as I imagine ten thousand amateurs would make hives and their belongings to the one who would attempt to make a foundation mill. I will, therefore, confine my attention to the cutting and fixing of the foundation in the frames and sections.

One of the best means of cutting the sheets of foundation is the Curlin cutter, illustrated in Fig. 1. It is very easily made, and consists of a disc of tin or steel, sharpened at the edge, and able to revolve in a handle. My cutter is of tin, two inches in diameter, and sharpened at the edge—first with a file, and then the whetstone.

The handle ought to be turned out of a piece of hard wood, and it should be, at least, six inches long, to keep the fingers well away from the revolving sharp edge. The end had better be very round, like a hemisphere, to fit comfortably into the hollow of the hand. A cut with a tenon saw will afford space for the wheel, and a thin screw or nail passed through serves as a pivot. By means of this, and a flat board, the foundation can be cut very rapidly.

When wired frames are used, the foundation is attached by means of a Woiblet spur embedder, a diagram of which I give in Fig. 2. This I made myself from the picture in Cowan's book, and it works very well. The little wheel is half an inch in diameter and an eighth thick; it has a groove turned out of its edge, as shown in Fig. 3, and is attached to a piece of wire an eighth thick, which acts as a handle. The wire is turned at right angles to itself for a quarter of an inch at one end, and the piece thus turned is filed to fit a hole drilled in the centre of the wheel. The teeth are filed out with an ordinary saw file. At the opposite end I turned the wire into a loop to serve as a temporary handle, intending afterwards to put a wooden one to it, but I have never done so since it was made, and, probably, never will. In conjunction with the spur embedder a guide is necessary. This is a board three-eighths thick, and furnished with a couple of cleats at the back. It is large enough to fit comfortably inside the frames, about thirteen inches by seven and three-quarters. To affix the foundation, the sheet is laid on the guide; the frame, which is wired—that is, has five or six No. 30 tinned wires run from the centre of the top bar to that of the bottom bar—is laid over the foundation; the embedder is heated in a spirit lamp, the groove placed on one of the wires in the frame, and the wheel runs along the wire. It melts the wax as it passes along, and sinks the wire into it. Combs thus treated are very strong. The foundation is sometimes affixed to the sections with a guide somewhat similar to that used for the frames. I give a drawing of such a guide in Fig. 4. The height should be an inch slack, for sections two inches wide. It is used by putting the section over it, the piece of foundation in its place—one edge being against the wood of the section—and running a little melted wax along the line of contact. I often use a large camel-hair pencil to lay the melted wax with, but a smelter, which I will describe later on, is the correct thing.

By far the quickest plan of attaching foundation to sections is by means of the Parker machine.

This may vary much in detail, if the general principle is observed. It is simply a lever with which the wax is pressed hard into the grain of the wood, and it then sticks to it something like putty would. Fig. 5 is a drawing of my Parker machine.

It is made of oak, of which it will require a piece twenty inches by four by one. The

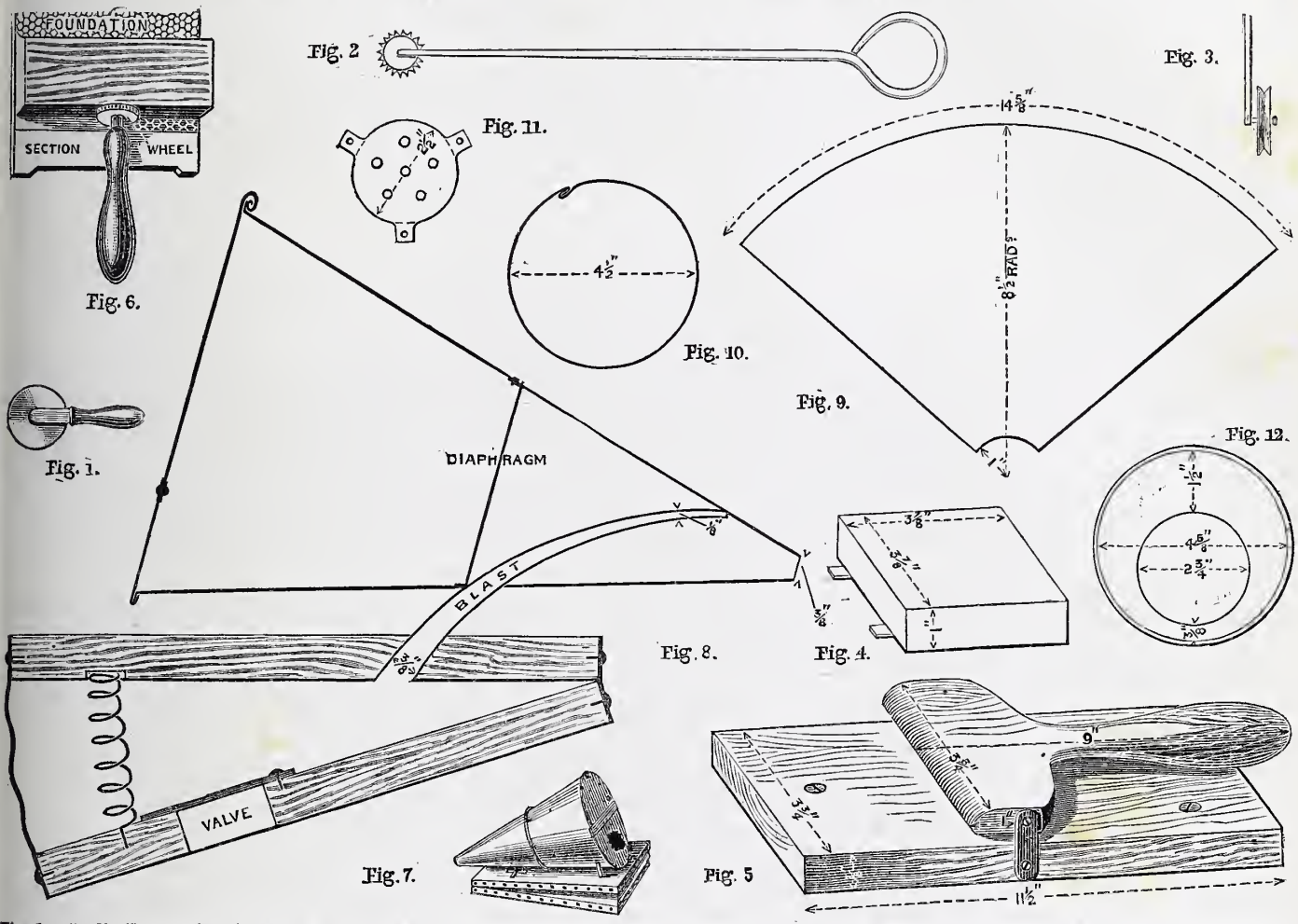


Fig. 1.—Curlin Foundation Cutter. Figs. 2, 3.—Woiblet Spur Embedder. Fig. 4.—Guide for fixing Foundations in Sections. Fig. 5.—Parker's Foundation Fixer. Fig. 6.—Abbott's Foundation Fixer. Fig. 7.—Clarke Smoker Complete. Fig. 8.—Section of Clarke Smoker. Fig. 9.—Pattern for Funnel. Fig. 10.—End of Funnel, showing Joint. Fig. 11.—Diaphragm with Tongues. Fig. 12.—Bottom of Funnel.

base is eleven inches long, and simply planed true, and two holes bored for screws to fasten it to the bench with. The handle is turned to the shape shown, the whole, including the flat part, which is three, being nine inches long. The lower part of the front of the handle has a small bevel, and the upper a good bold one, as shown. The links which connect the two together are made of inch hoop iron, the holes being an inch and an eighth apart. The screws which fasten the handle and links together are an inch and a half from the front edge of the handle, and thus an inch intervenes between the front edge of the handle and that of the link. When finished, the handle at its widest part would fit into a section, and the links would act as an efficient stop to prevent its going in farther than one inch.

To use this machine, the under bevelled edge of the lever or handle should have a little honey or butter smeared on it to prevent it from sticking. The section would then be slipped under the lever, a piece of foundation put under lever end for about an eighth of an inch, the handle raised, and with a slight drawing motion, a knife edge will be formed on the edge of the foundation, which should be raised at right angles to the section. This will fasten it very firmly if the foundation is not too hard, which it seldom will be in the summer.

The maker should not be satisfied if his machine does not work perfectly. It will usually be the under bevel, if anything, which is wrong. The point should be very slightly rounded, so as not to nip the foundation in two, and the front edge should press rather more than immediately behind it. In case the inch and a half sections are used, a stop would be tacked to the base a little in advance of the links, so as to bring the point of the lever to the centre of the section.

A machine on practically the same principle is Abbott's foundation fixer (Fig. 6). In it the foundation is fixed into the fibres of the section with a little revolving wheel, a block serving both as a guide for the wheel and for the position of the foundation. In my block a couple of pins sticking out an eighth of an inch underneath catch the edge of the section, but Mr. Abbott uses, I believe, a couple of shoulders, which prevent it from entering the section further than an inch. The handle I used for this fixer is a large bradawl handle, and the wheel a little cast iron one, which I picked up among my odds and ends. It is three-quarters of an inch in diameter, and a quarter wide, and is affixed to the handle with a wood screw passing through a hole in the centre on which it revolves. The front edge is rounded so as not to nip the foundation in two, and the entire wheel is tapered from the end next the handle. It is, in fact, a frustum of a cone. A tiny castor wheel, which I afterwards found would be just the thing—indeed, a small castor run along the guide—would affix the foundation as well as anything else almost.

I asked one of the cottagers in this neighbourhood how she fixed the foundation in her sections, and she told me that she melted a cupful of wax, and dipped the edge of the scrap of foundation in it, transferring it, while still hot and sticky, to the side of the section. I tried this plan, but found that it made an ugly smudge of wax at the line of juncture. I mention it now for the sake of those who may not have any alternative.

I now pass on to the indispensable smoker, and as the Clarke is, I think, the easiest to make, I will speak of its construction first. Fig. 7 is a general view, and Fig. 8 a sectional drawing of the Clarke, which I took asunder in order to describe it in this paper. This violent proceeding was necessary as I never use the Clarke myself, and am more intimately acquainted with the internals of the Bingham.

The bellows boards are four and a half inches by six and three-quarters, and nearly half an inch thick. An inch hole is made through one, its centre being two and a half inches from one end of the board, and midway across it. This is for the valve—which is simply a piece of stoutish leather nailed on one side and free to rise on the other, after the manner of a butterfly valve. An inch and three-quarters from the other end of the other board, a half-inch hole is bored through, sloping from the front as shown in Fig. 8. This is to take the blast pipe.

The boards are kept apart by a strong steel spiral spring, which is placed at the side of the valve, and more towards the back, just where the pressure of the hand goes. The boards at their widest part are three inches apart, and at the narrowest an inch.

The entire bellows could very easily be made by cutting out and planing the boards, boring the holes, and tacking on the valve as I said, then the points could be brought together, and a slip of leather, four inches long and an inch wide, tacked along them. The spiral spring, which could be made of hard brass wire, about eighteen gauge, could then be put in place, being affixed to the boards, either with a straight piece of wire left at both ends, or the ends of the spring could fit into holes bored partly through the boards. A bit of wire could then be bent so as to keep the boards three inches apart at the wide end while the leather was being glued and tacked on. Basil leather, which can be got for little or nothing from the saddler, would do very well, although not quite the correct thing. It should overlap the piece already tacked to the front by about an inch.

The fire box ought to be made of good stout tin. I give the pattern for it in Fig. 9. The circles there shown should be carefully scribed with a compass on the sheet of tin, and then cut out with a pair of snips. The straight edges should then be turned over a quarter of an inch, one up and the other down, and the piece bent into the shape of a funnel. The parts turned over will then catch into one another (Fig. 10), and should have a little solder run along them after they have been hammered tightly together. The solder is to hold everything tight during the process of manufacture. An eighth of an inch of the wide end of the funnel is now to be turned straight out so as to take the bottom, which is attached to it just as a tinman fines a bottom to a can, except that after it is turned over once it is left standing out from the funnel, as seen in Fig. 8. Before the bottom is fastened it would be as well to make the diaphragm and affix it to the funnel. This is two and a half inches in diameter, of tin, and punched with a number of eighth of an inch holes. In bought smokers it is fitted in a kind of bead moulded on the funnel; but in ours we would require to leave three or four projecting tongues, which could be turned over and fastened to the funnel with little rivets. Fig. 11 shows this diaphragm, as Fig. 12 does the bottom, with its fire door cut out. The outer dotted line in this figure shows the part which will be turned over to embrace the funnel end.

The door is a piece of tin large enough to cover the hole and pivot on the rivet shown in Fig. 7. Its edges are turned over so as not to cut or scratch the hand of the operator.

The blast pipe is made of tin, four and a half inches long, and tapering in size from three-eighths to a little over an eighth of an inch bore. It is bent into the shape seen in Fig. 8, and extends to within five-eighths of an inch of the front of the fire holder.

The whole thing is attached to the bellows with two screws, holes for which, two and three-quarter inches apart, must be punched within five-eighths of an inch of the base of the funnel. The blast pipe is hooked into the hole in the bellows made for its reception, and the screws are put in at the back, a couple of bits of tin tubing, an inch long, through which the screws pass, preventing the bellows and fire box coming in contact with each other.

As I have now reached the limit of this paper, I will defer the consideration of the Bingham Smoker to the next.

HINTS TO WATCH WEARERS, AMATEURS, AND OTHERS.

BY HERR SPRING.

In my last article I dwelt upon some of the qualities of the oil used in watches, and also upon the fact that every watch wearer is, to a very great extent, a law unto himself.

The hypothesis upon which I am proceeding is this: in a high-pressure state of society, exact time is a most potent factor. Without a very large degree of accuracy in timekeepers of all sorts, modern society, with its infinitude of conveniences, its swift interchanges, its rapid transitions, must cease to exist.

It would be useless to publish Bradshaw's Railway Guide if there were only sun-dials in the land; if men had to depend upon timekeepers like the old verge watch, our railway system would practically collapse. My contention, therefore, is that modern civilisation depends to the largest possible extent upon the accuracy of our timekeepers, and that even small inaccuracies, when they occur daily and hourly among millions of watch wearers, must have, in the net result, no inconsiderable influence upon the world. If by the wave of a magician's wand every clock and every watch in the world should hereafter maintain perfect accuracy and beat exact time with Greenwich, who can say what benefits would result? In the course of a single year millions of disappointments would be avoided. In commerce, in social affairs, in love, the error of a single minute is constantly altering the destiny of human life. "Time wasted is existence; used, is life," hence it is necessary that people should learn some of the simple secrets concerning watches as they know some of the simple secrets of human health.

In my former contribution I alluded to the popular fallacy concerning the cleaning of watches, and perhaps it would be well to supplement my previous remarks with a word or two of advice.

The process of cleaning is the most important and most frequent process to which a watch is subjected during its lifetime. The future of a watch is almost, if not entirely, in the hands of the man who

cleans it. A first-class watch, if cleaned but once by a common workman, is nearly certain to be irreparably damaged, while a common watch, if cleaned by a first-class workman, is nearly as certain to be improved. If a sound watch is regularly every eighteen months given for cleaning to a highly skilled mechanic, it ought practically to last for ever.

Cheap workmen and low prices are more fatal to watches than to any other form of machinery, because, obviously, watches require leisurely and delicate handling, constant vigilance, and a fairly keen sense of logical reasoning. I will give a practical illustration, drawn from actual experience, of the rough method of cleaning watches and the highly skilled method.

We will take the case of a workman who occupies private chambers, and is employed by the trade at low prices—I was nearly going to say at "sweating" prices, but that would not be accurate, because the cheap workman often earns more money than the dear one. The cheap workman regards his occupation in a purely commercial aspect. His sole object is to get as many watches as possible through his hands from Monday morning till Saturday evening. The price he is paid forbids him, even were he so inclined, to waste any time in examination or experiment. He may possibly have fifty watches on Monday to get out of hand during the week, and the instruction he receives with each is almost invariably the same: namely, "to be cleaned." He will probably employ an apprentice, or perhaps two apprentices. He takes one of the watches in hand, gives it a rapid glance, takes it hurriedly to pieces, and gives it over to an apprentice to be "brushed out." The apprentice rubs a coarse stiff brush across a piece of chalk, probably sending a cloud of dust in all directions. He picks up a piece of the watch, holding it in tissue-paper, and brushes away at it until it looks clean, renewing his application to the piece of chalk every now and again. Plenty of elbow grease, plenty of dabbing and scraping backwards and forwards, soon make all the pieces look bright and clean, and then they are handed back to the master, who puts the pieces together again, and oils the watch from an oil-pot containing oil which has been exposed to the dust of the room and to the clouds of chalk produced by the brush. Being together and once more in motion, the watch looks clean enough to the superficial eye. But it is scarcely an exaggeration to say that it is very little cleaner than it was before it was taken to pieces. It stands to reason that this process is not an efficient one. The original dirt, mixed with the thickened oil, is brushed up and down the pieces of the watch until it appears to have been removed. But is it removed? Try the same experiment on a larger scale. Take a dinner-plate covered with the fat of a mutton chop which has been allowed to go cold. Brush across the plate vigorously with chalk; then carefully examine the plate, and see how much scum you will discover, and small patches of clinging matter. Moreover, how much chalk dust remains in secret places in the watch to grind together with the oil at vital points of friction; and also, how much damage is done by the severe brushing.

Let us now take the most effective of the high-class methods of cleaning, and compare it with the other. In the first place, the skilled workman, inspired by a professional pride in his craft, carefully examines the watch before taking it to pieces, searching inductively to establish a cause for stoppage. Having made a number of observations—very trifling, perhaps, but yet important in the result—he proceeds to take the watch to pieces with great care and without undue haste. Then, having laid out all the pieces before him, he washes them in a basin of hot water, using a perfectly clean, very soft, and well-soaped brush. He does not brush backwards and forwards, and thus carry the dirt backwards and forwards with the brush, but he simply dabs at the article in his hand, and after every few dabs dips his brush into the hot water and takes more soap. Then he rinses the article well, so as to remove all soap, and drops it into a wide-necked bottle containing spirits of wine, which removes all the water, and renders even the most delicate steel pieces safe from rust. This completed, he takes the pieces out of the spirits of wine and brushes them with a fine white brush, charged—not with chalk, but with burnt bone. If a good sound beef bone is put into the fire and burnt until it becomes a white chalky substance, it will be found by far the best thing to use for this purpose. It is much finer than chalk, it does not come off in clouds under the friction of the brush, and as parts of the bone remain in a perfectly pure but cinder-like condition, any harshness in the brush is removed by contact with the grater-like points of the cinder.

A watch cleaned by the first process would be found, under inspection through a powerful magnifying-glass, to be covered with patches and scum; while in the second process it would be discovered to be absolutely pure and clean.

I have taken it for granted that the highly skilled workman has examined every pivot and every hole in the watch before beginning to wash it, and if there be any defect, or any sign of approaching defect, has repaired it. Then having carefully put the watch together, he oils it from an oil-pot which has been kept sacredly covered from all dust, and with oil which has been not longer in the pot than one or two days. The watch now going, perfectly clean, and lubricated with pure oil, is hung up for timing, and closely observed for several days, slight alterations being made here and there when thought necessary. Of course, the best process occupies a longer time than the rough one. But it is much the cheapest for all concerned in the long run. The manner in which the oil is applied is of vital importance, and therefore I shall conclude this article with a few words on that point.

The instrument used for oiling is also important. One of the best things to use

Instrument for applying Oil to Watches.

is a piece of steel of the thickness of an ordinary needle, and, say, about three inches long. Fasten a little sealing-wax round one end as a handle, and the other end file down thin, and hammer out a small blade, as in making a fine drill.

The blade should be very small, and should spread out at the extreme tip of the steel only, so as to hold the oil in a single small drop without the oil running up the neck. The point of the blade should be rounded, so as to avoid scratching. The chamfers of all the large holes should be pretty freely supplied, being fed several times with the oiler rather than at one time with a single large drop. But the most particular point is the oiling of the balance holes, which should be most carefully performed. Put a very small drop into the balance holes to commence with, and look with the glass if it runs down. Most frequently the oil does not run down the hole, but spreads out over the surface and runs down the side. To avoid this, the first drop of oil at least should be poked down the hole with a fine steel pointer, and then the hole supplied till it is full, but without overflowing the chamfer. Some workmen use a pointed peg for poking the oil down, but wood is not a reliable substance for the purpose, because it often contains a certain amount of resinous sap.

MEANS, MODES, AND METHODS.

BY VARIOUS HANDS.

I SHOULD very much like to receive more contributions than I do for this section of WORK. It is the portion set apart as a receptacle for all and any tried and approved recipes and useful wrinkles. Surely among the many thousands who read WORK there must be a considerable percentage who could thus give valuable assistance.—ED.

PAINT FOR OUTDOOR WORK.

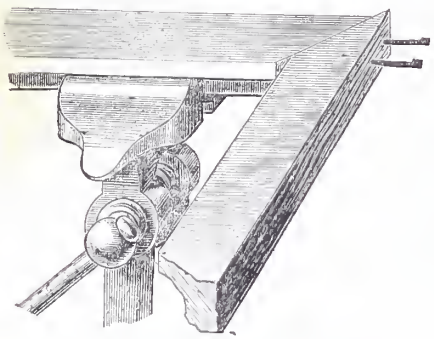
For rough outside work, paint mixed with ordinary paraffin oil will often be found very useful, as, besides the saving in expense, such paint will "take" to a rough surface much more easily than when made with boiled oil, and my experience is that it lasts for years, stands the weather well, and preserves the timber. But perhaps its best quality is, that insects of all kinds keep clear of any woodwork treated with paraffin paint; at least, this is my experience, as I have a workshop which used to be infested with wood-lice, ear-wigs, *et hoc genus omne*, but since the house was painted with paraffin, three years ago, I have not found one single insect of any kind within the four walls. It will also be found useful for garden work, such as summer-houses, flower-stakes, frames, etc. etc., and especially for trellis-work, as, owing to the insinuating and penetrating character of paraffin, this paint finds its way into the numerous joints where ordinary paint will fail. The stainers should be ground in oil in the usual way, and thinned to the proper consistency with common paraffin oil, which costs about 7d. or 8d. per gallon.—OPIFEX.

PICTURE-FRAME MAKING.

I have always looked upon picture-frame making as a very simple job. But I see by the number of different mitre cramps, corner cramps, and modes of fixing corners of picture-frames described in "Shop," that to some of the readers of WORK it must be a puzzle to make a good frame. All these means can be cast aside, for with a good vice you are able to make the best of frames, providing you have a good mitre shoot; or what is much better for amateurs is a mitre-cutting machine, for with that no one need fear that he will not make a good frame if he goes to work the right way. One great point is to cut your sides exact, measuring the two pieces by placing rabbet to rabbet. But now, here comes the most particular part: bore all four of the right-hand corners with a bradawl the size of the brads used (if left-handed, as I am unfortunately, bore the left-hand corners), bore the holes at right angles to the side of the moulding, place one piece of moulding in the vice with the rabbet towards you—an

iron vice is best for the purpose—but take care you do not damage the moulding, and to prevent this place three or four folds of paper round it, and screw it up tight in the vice; you will then have the end to the right, in which there are no holes.

Now place the piece of moulding that is to go on that side in its position, and mark with the bradawl the place for the nails; remove it, and bore straight holes in the moulding in the vice ⅛ of an inch or more away from the marks to the outside; the holes bored must be exactly parallel to the marks. Next rub a little hot glue on the end of each piece; place the nails in the first



Mode of Nailing up Picture Frames.

holes, letting them come through a little. You will now be able to place them in the holes that were made for them, and drive them in with a hammer. You can now knock them up to a perfect and strong joint, and with a little practice you will be able to dispense with all the modern inventions for cramping the corners.

There must be two nails in each corner, suiting the size of the nails to the width of the moulding, but if the holes are bored at right angles there is no fear of having them too long, it is the thickness that must be looked to. I hope the accompanying illustration will make what I have said perfectly clear to all readers.—F. H.

DESIGNS FOR A PAIR OF SEMI-DETACHED COTTAGES.

BY W. BENNETT.

INTRODUCTION.

THE designs submitted are for a pair of labourers' cottages on a gentleman's estate. It frequently occurs that when cottages are erected in the country or suburban districts they are built in pairs, which, for several reasons, is a very great advantage, and especially so in this case, as there is a saving of one flank wall, and should there be no water supply, one well will be sufficient to supply both cottages, which is often a very important item, especially when there is a great depth to be reached before a supply of water is obtainable.

In the illustrations it will be found that the cottages are both economically and comfortably arranged. The parlour (B) is about 12 ft. by 12 ft., kitchen (C) 14 ft. by 12 ft., scullery (D) 10 ft. by 8 ft., in which is provided a setpot, which is very convenient in such a dwelling.

It will be seen by referring to the chamber plan that there are provided three bedrooms (A), which are each supplied with a fireplace. The mullion windows are to be provided with sashes, which are to be hung on butt hinges, to open inwards.

It will be useful to give the references by letter in the ground plan (Fig. 3) and the chamber plan (Fig. 4) here in their proper sequence:—A, Bedrooms; B, Parlour; C, Kitchen; D, Scullery; E, Staircase; F, Entrance Door; G, Verandah; H, Pantry; I, Coal Cellar; K, Privy; L, Dust-bin; M, Yard.

The cottages are designed in the half-timber style, generally called Old English, which, when erected, would present a very picturesque appearance, with its low gables and moulded bargeboards projecting over the face of the battened and panelled wall.

SPECIFICATION OF WORKS.

Trenches for footings. Make perfectly level the bed of all trenches for footings, and consolidate the earth about the same and against all walls, drains, etc.

Concrete foundations. To make an artificial foundation to the entire buildings, the same to be composed of one part of the best fresh quick stone-lime, to six parts of unscreened coarse stone ballast, mixed thoroughly with each other.

BRICKWORK.

Brickwork, general course. The whole of the exterior brickwork to be the best red pressed bricks laid on mortar compounded of one-third well-burnt stone-lime and two-thirds of clean sharp sand; the bricks are to be properly bonded together in English bond.

Damp-proof course. Lay throughout the length and thickness of all walls, jambs, a course of pitch or asphalt ¼ in. in thickness, to prevent the damp from rising.

Gauged arches. All windows to have the best gauged arches abutting on proper skew-backs, the soffits and reveals being 4½ inches.

Brick fire-places. Properly form all fire-places with camber arches over same, and trimmer arches where required for front hearths; carefully carry and gather in the chimney throats, and carry up flues of not less than 14 in. by 9 in. in the clear.

Chimney-bars. Put chimney-bars of wrought iron, 2½ in. by ½ in., and 18 in. longer than the opening, properly caulked at the ends.

Bedding, pointing, and backing. To bed in mortar all bond timber, plates, lintels, wood-bricks, templates, stone and other work required to be set in lime-and-hair mortar; all doors and window-frames to be pointed round with ditto.

Yard paving. Pave the yard with cement laid on 6 in. of concrete.

Privy drain. Put from privy a drain of 4 in. glazed stoneware pipes, to be carried straight away to main drain.

Drains. All drains to be laid to the proper fall, and all socket joints to be well filled in with Portland cement.

STONEWORK.

Door-steps. To put to all exterior doorways two 12 in. by 6 in. plain solid tooled steps of Whitby stone.

Window-sills. To put to all windows finely-rubbed sills of Whitby stone 12 in. by 6 in., sunk, weathered, and throated. The sills to be 4 in. longer than the openings.

Chimney-stacks. The chimney-stacks to be capped with a 6 in. stone, moulded.

SLATING.

Common slating. Cover the roofs with good Countess slates on slate-boarding, to give the slate a 3 in. lap, nailed to boarding with best copper nails, two to each slate.

PLASTERERS' WORK.

Battened walls. Cover the battened walls of chamber floor with rough stucco laid on laths.

Brick walls. To cover the brick walls with simply two coats of common lime-and-hair plaster.

Ceilings. Lath, float, and set the ceilings with one coat of ditto.

CARPENTERS' WORK.

Bond lintels. Provide all necessary wood-bricks and templates of sound red pine, with every required preparation for fixing grounds, battens, and joinery; also lintels of red pine over all windows and doors, the lintels to have a vertical depth of 1¼ in. for every foot of bearing.

Ground joists. Ground joists to be of sound old pitch pine, 4½ in. by 3 in., 12 in. apart; wall-plates to be 4½ in. by 3 in.

Ceiling battens. The joists of floors to have ceiling battens 1½ in. by ¾ in. and 12 in. apart.

Roofs. The roof over buildings to be supported by trusses, as shown on drawing; these trusses to be not more than 8 ft. apart; all scantlings to be of pitch pine, properly bolted together where required.

Windows. Provide all mullions and sashes to windows, also window-boards and architraves, and fix same.

Projecting eaves. Provide and fix all carpentry necessary to form the projecting eaves.

Floors. Cover all floors except kitchens with ½ in. deal floor-boards.

Doors, etc. Provide and fix all doors, plinths, joists, lintels, walls, and bond timbers where required in the erection of the cottages.

PAINTERS' WORK.

The whole of the outside work to have three coats in oil and turps; the inside work to have two coats of ditto.

PLUMBER AND GLAZIER.

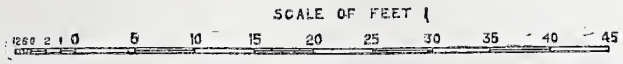
Windows. Glaze all windows with crown glass properly secured to sashes with beads.

Eaves Spout. Provide and fix 6 in. by 4 in. eaves spout securely fixed to fascia.

Fall Pipes. Provide and fix all fall pipes where necessary, with proper bands to same.

The cost of the pair of cottages, exclusive of site, will, in all probability, not exceed the sum of £400, but prices will, of course, vary in different parts of the country, owing to differences in the cost of materials and labour.

*** *Owing to the requirement of considerable space for the announcement of our coming "WORK" EXHIBITION OF JANUARY, 1891, in this number (see page 290), "Our Guide to Good Things" must of necessity be omitted.* —ED.



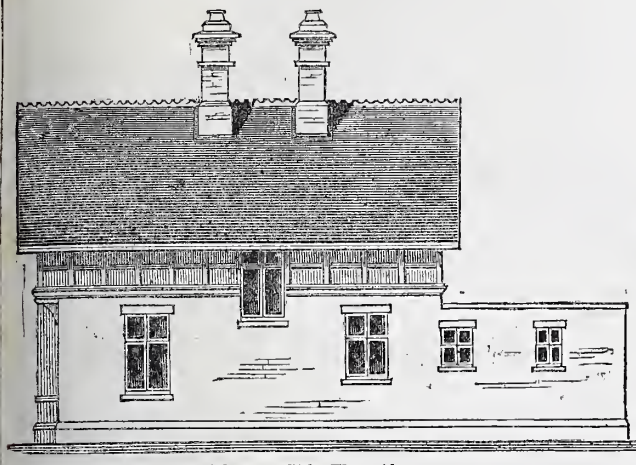


Fig. 2.—Side Elevation.

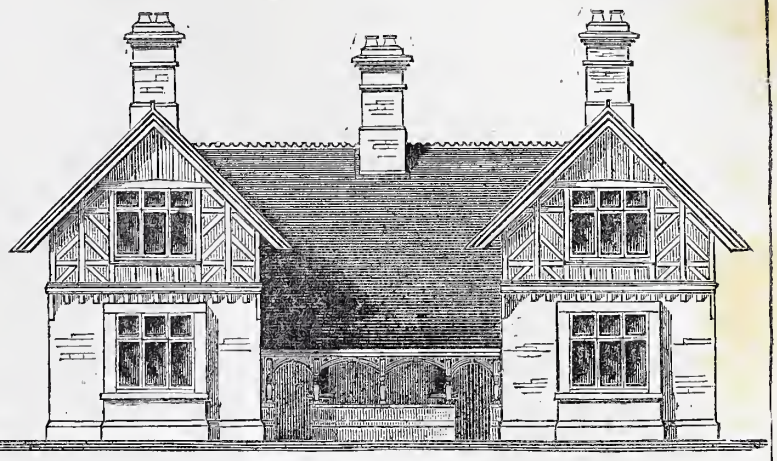


Fig. 1.—Front Elevation.

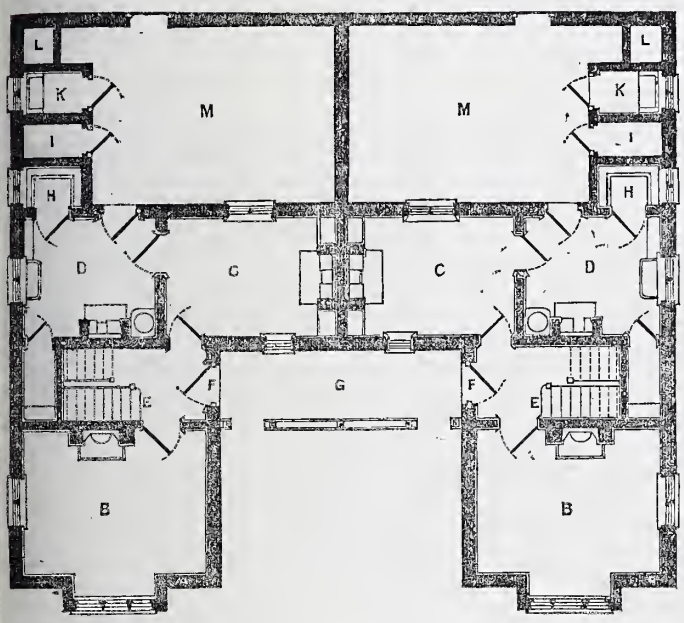


Fig. 3.—Ground Plan.

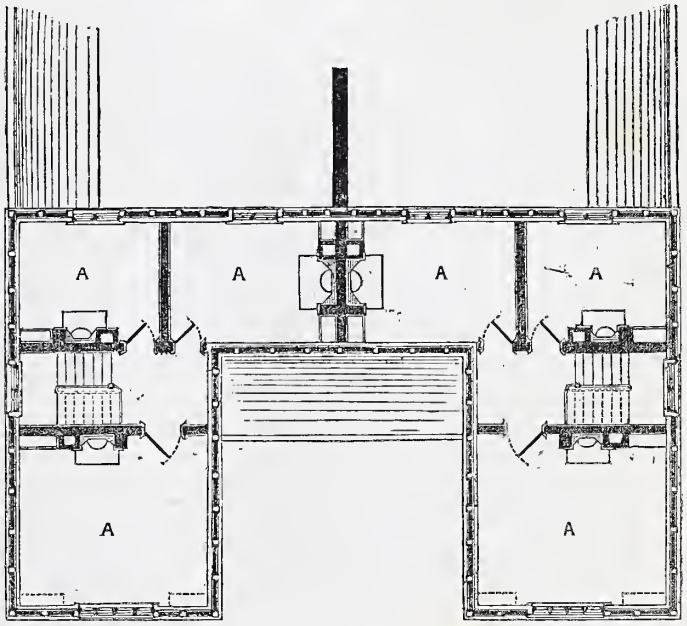


Fig. 4.—Chamber Plan.

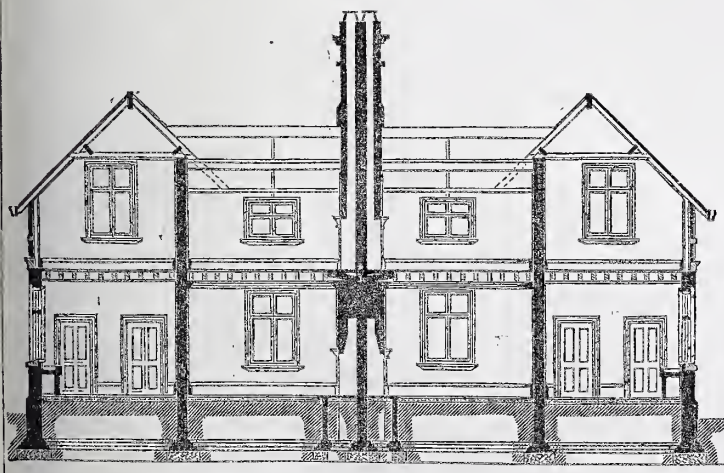


Fig. 5.—Longitudinal Section.

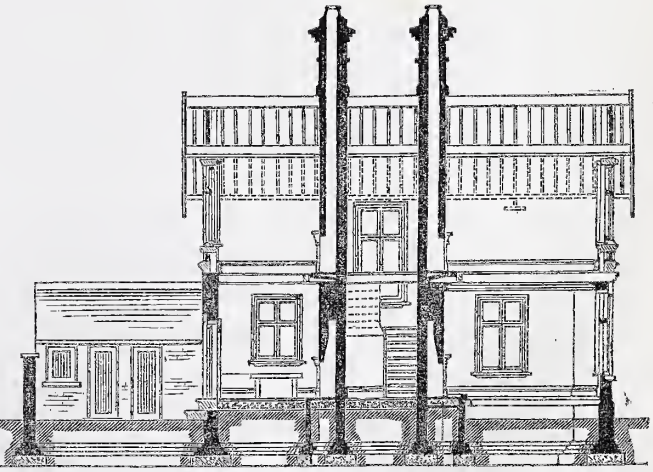


Fig. 6.—Cross Section.

DESIGNS FOR A PAIR OF COTTAGES. Drawn expressly for "WORK" by W. BENNETT.

"WORK" EXHIBITION, 1890-91.

CLASSIFICATION of Exhibits for which it is intended to offer Prizes, Medals, and other awards, to readers of WORK (the illustrated magazine of theory and practice for all workmen, professional and amateur), to be held at the Polytechnic Institute, Regent Street, from December 29th, 1890, to January 10th, 1891, inclusive.

Group I.—WORK in Wood.

Furniture, Cabinet Work, Carving, Pattern-making, Turning, Carriage and Cart Building, Wheel-making, Pulley-block-making, Carpentry, Marquetry, Parquetry.

Group II.—WORK in Metals.

Casting, Forging, Stamping, Die-sinking, Medal-striking, Finishing, Turning, Screw-cutting, Repoussé Work, Arms (Guns, Rifles, Pistols, Swords, Bayonets, Lancets, Armour), Armour Plating, Iron Ship-building, Amalgams, Mixed Metals.

Group III.—Tools for WORK.

Hand Tools, Machine Tools, Tools for Sharpening Tools, Photo-micro and Electric Apparatus (except Lighting and Telegraphy), as Cameras, Magic Lanterns, Slides, Microscopes, Surgical Instruments, Mathematical and Drawing Instruments, etc.

Group IV.—WORK in Design only. *Exhibits to take the Form of Drawings or Models.*

Designs for Decorative Purposes (including Stained Glass). For Architecture (including Ventilation). For Mechanical Purposes, such as Boilers, Engines, Machines. For Engineering, Forts, Ships, Roads, Bridges, Canals, Sewers, Railways, Trams, Balloons, Parachutes, Ambulances, Tents, etc.

Group V.—WORK in Printing.

Letterpress, Type Founding, Press-work, Machine-work, Lithography, Drawings on Transfer Paper, on Stone, on Wood, on Zinc; Engraving on Steel, Copper, and Wood; Colour Work, Photography on Stone, on Wood, Photographic Printing, Bookbinding, Music Printing, Transferring, Stereotyping, Electrotyping.

Group VI.—WORK in Domestic Appliances.

For Decorative Purposes. For Cooking (Hardware, Glass, Pottery, Faïence), Heating, Washing, Drying, Lighting, Cleaning, Sewing, Bathing, Teaching; Home Recreation, Games, Gymnastics; Hygiene; Toys, Dolls, Wax-work (Figures, Fruit, and Flowers); Telegraphy, Telephones; Watches, etc.; Basket-work.

Group VII.—WORK in Wearing Apparel.

In Tailoring, Hat-making, Boot and Shoe-making, Mantua-making, Millinery, Beading, Dress-making, Baby Linen, Lace-making, Knitting (Machine or Hand), Needle-work (Machine or Hand), Button, Cotton, Silk, and Thread-making, Hose, Gloves, Wigs, Theatrical Costumes, Court-Dresses, Uniforms, Liveries, Belts, Buckles, Fans, Feathers, Artificial Limbs, Eyes, Teeth, etc., Abdominal Belts, Trusses, Surgical Bandages and Appliances, Electric Belts and Bandages, Jewellery, Hair-dressing.

Group VIII.—WORK in Painting and Decorating.

House Painting; Decorative Painting in Oil, Distemper, Flatting and Fresco; Gilding, Graining, Marbling, Sign and Facia Writing, China Painting, Carriage Painting, Heraldic Painting, Scene Painting, Stained and Painted Glass and Imitation ditto, Plaques, Panels, Appliances for Painting and Decorating.

Group IX.—WORK in Textile Fabrics and Leather.

Curtains, Carpets, Blinds, Rugs, Upholstery, Screens, Brackets, Frames, Harness, Saddlery (Civil and Military), Bags, Trunks, Portmanteaux, Travelling Bags and Trunks, Dress Baskets, etc.

Group X.—WORK in Musical Instruments and Music.

1. Organs, Pianofortes, Harps, Violins, Banjos, Mandolins, Guitars, Cornets, Trombones, Clarinets, Oboes, Drums, Flageolets, Flutes, Piccolos, Fifes, Bagpipes, Triangles, Cymbals, Metronomes, etc. 2. Musical Compositions, Systems of Teaching, Appliances for Learning.

Group XI.—WORK in Watches, Clocks, Alarm Bells, etc.

1. Design of any of the above (including Musical Boxes and Mechanical Contrivances). 2. Actual Models or Finished Working Specimens, Clockwork for Lighthouses, Burglar Alarms, Electric Signals.

Group XII.—WORK in Building Appliances and Material for Building.

Bricks, Tiles for Floors and Mural Decoration, Stone Masonry and Carving, Terra-cotta Chimney-tops, Drain Tiles and Pipes, Sanitary Stoneware and Pottery, Mosaics, Hot and Cold Water Appliances, Baths and W.-C.'s.

Group XIII.—WORK in Chemical Processes and Products.

Stains, Dyes, Colours, Inks, Varnishes, Soaps, Cleansers, Disinfectants, Food Compounds, Drinks, Igniters, Fuels, Explosives, Manures, Detergents, Antiseptics, Anodynes, Electric Lighting, etc.

Group XIV.—WORK in the Utilisation of Waste (Novel and Original Feature).

Utilising Waste Space in crowded Cities and Towns.
" " " in Agricultural Districts.
" " Heat.
" " Water.
" " Sewage.
" " Products hitherto unused.
" " Labour, manual and mental.
" " Time.
" " Capital (including legacies not applied for by claimants).
" " Charity Funds, which have exceeded testators' expectations.
" " Power, of Combination for legal purposes, Purchasing power, Co-operation, Power of oppression by sweating.

Exhibits in this Group to take the form of Essays, Plans, Précis of Experiments, and even Suggestions.

There will be three classes of Exhibitors, viz.:—

1. **Workmen** or Workwomen actually employed and gaining their livelihood in and by the craft under whose name they exhibit.
2. **Apprentices**, *bonâ fide*, serving an apprenticeship to the craft or calling under whose name they exhibit (whether indentured or otherwise).
3. **Amateurs** or connoisseurs who either do not practise any craft as a means of subsistence, or who exhibit in any group other than their own craft.

The Exhibits will be judged in accordance with the above classification of Exhibitors.

The Jurors will judge all Exhibits in Groups I., II., III., X., according to workmanship alone, irrespective of design, which may be new or old.

The Jurors will judge all Exhibits in Groups V., VI., VII., VIII., IX., XI., XII., according to merit in design associated with meritorious *workmanship*.

The Jurors will judge Exhibits in Groups IV., XIII., and XIV., solely as to novelty, originality, and improvement upon known and existing forms, formulæ, and processes, designs, or inventions, irrespective of workmanship in their execution.

The Jurors will be practical and competent experts.

Exhibitors may declare their Exhibits as not in competition.

CONDITIONS AND REGULATIONS.

1. Any *bonâ-fide* subscriber to WORK shall be eligible to exhibit on the Conditions and under the Regulations stated below.

2. All intending Exhibitors must make the prescribed entries upon the printed form (hereto annexed) and sign the same in the presence of a reliable witness, who shall also sign and give his address and occupation. N.B.—Any false or fraudulent statement will disqualify.

3. Every Exhibitor is to pay the carriage of his Exhibit to and from the Exhibition. The Proprietors of WORK will supply printed labels for attaching to packages. It must, however, be distinctly understood that the Exhibit will be entirely at Exhibitor's risk. No package will be received unless it bears the official label.

4. Every Exhibitor must fill in, on the Application Form, the value or price he places upon his Exhibit, and of any separate portion thereof, so that in case of sale and for insurance purposes, no dispute may arise.

5. The Secretary will advise, on printed forms, the receipt of an acceptance of all Application Forms which are correctly filled up, and will return any for correction which are not filled up correctly. All correspondence must be addressed prepaid to the Secretary, "WORK" EXHIBITION, LA BELLE SAUVAGE, LUDGATE HILL, E.C. *All letters requiring an answer must be accompanied by a stamped and addressed envelope.*

6. The Awards of the Jurors shall be final and binding without appeal.

7. The Proprietors of WORK reserve the right to decline any Exhibit which they may deem unsuitable or unworthy, and the Secretary will advise the Exhibitor of such decision.

8. All Exhibits must be forwarded so as to arrive on the 19th or 20th December, and not before. Applications for space must be filled in and forwarded AT LATEST BY THE 30TH DAY OF OCTOBER, after which date they cannot be received, and no labels for carriage will be thereafter issued. It is intended to open the Exhibition on Monday, December 29th, 1890, and to keep it open till Saturday, January 10th, 1891.

9. Every Exhibitor will be entitled to a free Admission Ticket, not transferable, available during the Exhibition. Exhibitors at a distance unable to come to London, may have such ticket transferred to a London friend on nomination by previous arrangement with the Secretary. Applications for Free Tickets for Attendants should reach the Secretary not later than the 10th of November.

10. No articles must be removed till the close of the Exhibition.

11. The Proprietors of WORK reserve the right to remove the Exhibit of any one who does not conform to the regulations, and also the right to alter, add to, or cancel, any of these Rules.

12. Awards, Medals, Prizes, etc., will be forwarded, post free, to all Exhibitors who do not present themselves at the Distribution of Prizes, the date of which will be duly announced in WORK.

PRIZE LIST.

Group Prizes.—GOLD MEDALS.—A Gold Medal will be given for the best Exhibit in the whole Exhibition, together with a First Class Certificate (except Group XIV.). A Gold Medal will be awarded with a First Class certificate to the best Exhibit in Group XIV.

SILVER MEDALS.—A Silver Medal, a Money Prize of One Guinea, and a First Class Certificate, will be awarded to the best Exhibit in each of the Groups as classified above, except Group XIV., where a Gold Medal will be awarded.

Class Prizes.—BRONZE MEDALS.—A Bronze Medal, a Book Prize of Half-a-Guinea, and a Second Class Certificate, will be awarded by the Jurors to the best Exhibit in each Class or Sub-Division of Groups.

Special Prizes.—Special Prizes, of which details will be announced later on, will be given to the best Exhibit from actual Working Drawings published in "WORK."

Certificates of Merit.—A First Class Certificate and Book Prize of One Guinea will be awarded (1) To the Second Best Exhibit in the Exhibition, (2) To the Second Best Exhibit in Group XIV.; and if recommended by the Jurors, a special extra SILVER MEDAL will in either case be given. A Second Class Certificate will be awarded (1) To the Third Best Exhibit in the Exhibition, (2) To the Third Best Exhibit in Group XIV. N.B.—The Proprietors of WORK reserve to themselves the right of

Forms of Application for Space will be sent, post free, in response to letters addressed to The Secretary, "Work" Exhibition, Messrs. Cassell & Company, Limited, La Belle Sauvage, London, E.C.

publishing in the pages of that Magazine any Essay or Suggestion for which a Prize shall have been awarded.

SECOND CLASS CERTIFICATES will be awarded to the Second Best Exhibit in each Class or Sub-Division of Groups.

THIRD CLASS CERTIFICATES will be awarded to the Third Best Exhibit in each Class or Sub-Division of Groups, and if specially recommended by Jurors, Second Equal Awards in case of Ties of Merit.

Limitation.—It shall, however, be understood, that the highest Prize Medal only shall be given, in lieu of minor honours; but all honours obtained shall be recorded upon the Certificate in each case. *No Prize will be awarded except on the Jurors' recommendation as to merit.*

Exhibitor's Certificate. — Every Exhibitor, whether a Prize Winner or not, will be entitled to a separate Certificate that he has exhibited.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

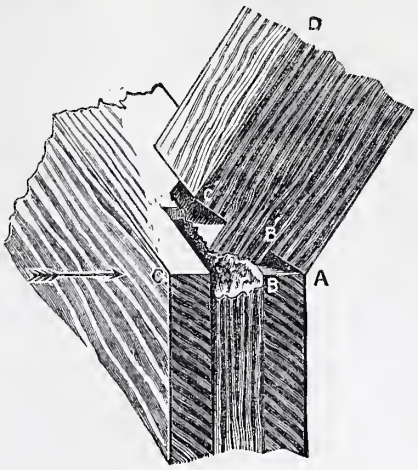
NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTER FROM A CORRESPONDENT.

Constructive Strength in Woodwork.—F. C. (*Leytonstone*) writes:—"I should like to make a few remarks about the paper published in No. 63 on 'Constructive Strength in Woodwork.' (1) In the first place, what does the author of that paper call a practical workman? A man who makes dovetails with an acute angle, and runs his tenon saw too far into a tenon, I should call decidedly unpractical. An apprentice or novice may do so, but no foreman (who is worth his salt) would pass such work. (2) The theory about the bevelled glue joint looks very nice on paper; but there are other points to be considered. It is all very well with boards faced on both sides, and gauged to a thickness, but in practice we very seldom get these. If I get a lot of boards to join, I find some twisted, some crooked, and (with hard wood) some cross grained. Now, shooting boards of this description on an inclined shoot is out of the question. Then, again, boards are often faced on one side only; in such a case one of them would have to be shot with its back downwards, which is a bad practice. (3) Passing on to the V joint, one could hardly devise a more expensive form of joint. In the first place a man would require a set of planes, say five pairs, from ⅜ in. to 1 in. These, I should think, would cost about 10s. a pair—in all, £2 10s. (4) Then there is the time required to sharpen, and keep them in order, for if one of them is in the slightest degree out, the joint is worse than the square one—in fact, it would be quite as easy to groove and tongue the joint with a pair of match planes, and would make a better job of it. (5) My own opinion, and that of older and more experienced men than myself, is that a square glue joint is strong enough for all practical purposes, for, if it is properly made, the boards will break before the joint. To ensure success the boards must be shot accurately. The *best* glue should be used; this should be melted and thinned till it will run easily from the brush, and used hot. The workshop ought to be fairly warm, and the joint slightly warmed before gluing. The glue should be well rubbed into both boards with the brush. If the joint is a long one, say 3 ft., it requires someone at each end, and, directly the glue is put on, the boards are turned one on the other, and rubbed backwards and forwards till they cannot be moved without great force. This must be done quickly, for if once the glue becomes chilled before rubbing, you cannot make a good joint. (6) Just a word about the mortise and tenon joint. In the first place the writer says, 'These joints are of two kinds, secured in two ways.' I could mention six or more secured in as many different ways. Again quoting from his paper, 'the tenoning machine cuts mortises equally true,' etc. I say the tenoning machine does *not* cut mortises, it is the mortising machine. (7) Speaking of the joint recommended, Fig. 13, No. 63, he seems to have overlooked one great principle—that is, shoulders in compression should be at right angles to the thrust upon them. Take the spoke of a wheel for illustration; this is practically a strut, the cross strain on it being very slight, and when a wheel fails at the nave it is through that part splitting. (8) Now, what could be worse than a tenon which acts like a wedge? Even with an ordinary door made in that manner, in cramping up, the tenon would have a tendency to split the style. As far as my experience goes, a tenon does not break off short at the shoulder unless improperly made, or the wood is rotten. It generally breaks as shown in the rough sketch I enclose. In



Broken Tenon.

conclusion I will venture to remark that what our friend calls 'rule of thumb' is the result of years of patient study and hard earned experience, and when a theory is advanced of practical utility, you will find none more ready to adopt it than a thoroughly practical workman."

J. W. H. writes in reply to F. C. (*Leytonstone*):—"I 'should like to make a few remarks' on the criticism on my article, and would premise my remarks by saying that I approach my refutation of F. C.'s innuendos in the kindliest spirit, and deprecate the very captious tone he adopts. My object in writing the article was to do good, if possible, to awake a train of thought, in the minds of those who as a rule believe they 'are not paid to think' but to follow their instructions 'in the same old groove.' F. C. is not compelled to accept my article, he is at perfect liberty to decline to give it a second thought, but as he has chosen openly to attack it, thereby paying me the compliment at any rate of admitting that it is to some extent worthy of notice, I claim the right of reply, which I give *seriatim*, leaving the verdict in the hands of the scores of thousands of WORK readers. (1) In the first place, *whom* (I should say, not 'what') do I call a practical workman? This is a delicate ground, but a re-reading of my opening paragraph will, I think, sufficiently show that I refer to recognised journeymen joiners who, by the rules of their Union, are not allowed, however incompetent, to take less than a minimum fixed wage, and I can prove hundreds of cases, if need be, where such men *have* made dovetails at an acute angle, *have* made carelessly cut tenons so weakened by undercutting, and that in the charge of foremen, who would be the last to admit that they were not 'worth their salt.' (2) I reply to this that the objection of F. C. falls to the ground. Of course there is bad work and good work. I only maintain that if the boards are only faced on one side, if twisted boards (unfit for use as they are), or if cross-grained hard stuff, be employed, no form of joint will render the work *good* in any sense of the term. I say deliberately that for 'best' work the boards should *invariably* be 'gauged to thickness,' all twist taken out with a 'jack-plane,' and as there is usually one direction in cross-grained stuff that planes up, if the iron is sharp, better than another, this direction can be chosen if both sides are faced. I do not say that everybody is to be compelled to do 'best' work only, but I simply point out that if they wish to do so, in my opinion, this is the best way. Let F. C., instead of saying that my method is 'out of the question' under the circumstances he instances, show me a better way, which is what all WORK readers want to know, and which would be far more to the purpose. (3) Passing on to the V joint, I do not say that this is at all a cheap joint, but I know it is a good one and well worth any extra expense. F. C. flies to the conclusion that a set of planes, 'say five pairs,' would be necessary, ⅜ in. to 1 in. I may be accused of 'fencing' this objection when I remark that the 1-in. plane will do every size of V joint downward by thicknessing the fence, F, to the proper distance from the point of the V (see Fig. 9, No. 63, WORK), and similarly thicknessing out the fence, F, in Fig. 10, which might be done by screwing pieces temporarily on, or by means of thumbscrews having a brass plate movable and adjustable like a plough-fence, which would dispense with four pairs of F. C.'s imaginative planes, all truth being assured by keeping the point of the V in the centre of the stuff. (4) 'Then there is the time of sharpening and keeping them in order, etc.' Does not the Union provide by rule that every journeyman shall have an hour per week for sharpening allowed? I have heard so. F. C. says that 'if one of them is in the slightest degree out, the joint is worse than the square.' Let me ask whose fault would it be if the plane was out with its fellow? I provide a quadrant C, and thumbscrew S, and hinges H, H (see Fig. 10), to correct any inaccurate sharpening of the first plane, Fig. 9; I give two ordinary rebate plane blades G, G, one set slightly in advance of the other to cut the reverse A, with the means of adjustment, overlapping each other at the intersecting point. Of course any man can foil, if he likes, another's invention, but who is the loser I should like to know? Again, F. C. ought to know that matching planes should be used only for uniting end grain and side grain, and *never* as in matched boarding, for side grain to side grain. Did F. C. ever put up a single square of matched lining, in which the tongues were not split off in every other board? Therefore I deny that any match-plane joint would '*make a better job of it.*' (5) The province of WORK is to deal with facts not 'opinions.' I was taught to believe that a good square joint would hold against all time, and the board would very kindly agree to break anywhere else rather than at the joint. Experience, however, has rudely brushed away this dogma. I find that out of more than 5,000 boards which in the last thirty-five years I have had made 30 in. by 40 in. I never knew *one* to come apart anywhere else but the joint! I have had these boards made (30 in. only in length by 40 in. wide) in England, North and South, in London, for seven years, in France and Belgium, in New York, and have made them myself with a like result. I, therefore, logically conclude that, from some obscure cause or other, probably the effect of light or actinism, the cohesive power is insufficient to neutralise the physical force of the timber acted upon by natural causes. Therefore I suggest the V joint, which, from its own formation, precludes the action of light, gives nearly half as much again of cohesive adhesion in its area, and is therefore worth at least half as much again as the old square joint in labour, where *good, i.e.*, '*best*,' work is demanded. I perfectly agree with F. C. in his lucid description of the making of a good joint, and only omitted this myself from my article because I thought that 'everybody knew that!' (6) F. C. says, 'The writer says, "These (*i.e.*, mortise and tenon joints) are of two kinds, secured in two ways,'" and adds that he can 'mention six or more, secured in six or more different ways.' If F. C. can show me anything in the way of mortises and tenons beyond the *two* kinds my article points out, I shall be much surprised. I say, page 167, No. 63, 'tenons passing through,' and those where the tenons only 'go part through.' (7) I deny utterly the false principle enunciated by F. C. My reason is that in all strains there are several forces at work at the same time, and it is one of the primary laws of mechanics that 'the diagonal of the forces,' *i.e.*, the *mean resultant* is the direction of the breaking point, as F. C.'s own drawing shows (the reference letters are, it is only fair to add, my own). Follow this: A is the fulcrum of a leverage, in breaking a well-made tenon, mind! B parts with B^1, and C with C^1, because the force necessary to break the tenon is applied at D. If a force acts square at C in the direction of the arrow, the neck of the tenon would break off square, even in a well-made tenon. But if A be the fulcrum, A C and A C^1 being the leverage, a tearing process, *in the diagonal* (*i.e.*, the mean) of two forces acting in different directions, comes into play, and the result is that the tenon breaks *below* the neck. In the case of a wheel spoke F. C. says 'the cross strain is very slight.' Does F. C. know that the life of a London omnibus wheel is *under ten weeks* on an average? In America the writer has seen hickory buggy spokes housed ½ in. by ½ in., and mortised half their thickness into the nave in mortises tapered inwardly to allow of the tenons being spread by *iron* 'fox' wedges to ¼ in. bigger at their inside end! Here let me say that F. C. seems to be 'fogged' a bit. The wedges, whether 'fox' or otherwise, referred to in my article do *not* act in the splitting direction of wood, but against the end grain of the respective mortises. (8) A tenon never acts 'like a wedge' unless the wedges are moved; once home, the wedges are stationary and never move; the tenon is thereafter merely a dovetail. In my article I simply say that the weakest part of a tenon is at the neck or shoulder, and suggest extra strength at that point, especially *bad* tenons. I admit, however, that a tenoning machine does not always cut mortises, and that it would have been more explicit to have said mortising machines; but F. C. must have seen machines which cut both the tenons and the mortises also, which, thirty years ago, were termed, as I named them, 'tenoning machines.' In conclusion I shall be glad to see 'the result of years of (a so-called) experience and patient study,' as epitomised in 'rule of thumb,' exploded when theories of practical utility are advanced to English

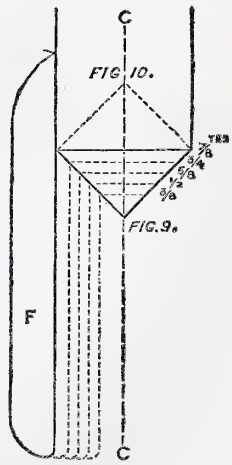


Diagram showing different thicknesses of Fence F (see Figs. 9 and 10, No. 63), C C centre line.

working men. I long to see that day dawn. I give a diagram showing in dotted lines how, by thicknessing out the fence, F, the one plane or its counterpart, any stuff can be V jointed up to inch, *i.e.*, ⅞ finished; but F. C. can see the planes and shooting-board at Moseley & Sons, 323, High Holborn, and will be better able then to judge. By-the-bye, I am glad to correct a palpable mistake in Fig. 1 (which, however, appears to have escaped my critic's notice). 'Angle of 30°' should, of course, read 'angle of 60°' (see No. 63). In conclusion F. C. has never tried a V joint, or he would have said so; I have. An ounce of example and experiment is worth a ton of precept and prejudice."

II.—Questions Answered by Editor and Staff.

Oak Stain.—G. H. (*Congleton*).—If you had read the back numbers of Work you would not have put this question. The simplest stain for the purpose of making new oak antique is composed of vandyke brown, ammonia, and water.—D. D.

Bookbinding Work.—W. T. (*Blaydon-on-Tyne*).—I am very sorry that I cannot recommend a good book on bookbinding, as, strange as though it may appear, there is not such a book in existence, looking from a practical point of view. There are, however, a good many books on the subject, most of them too old to be of any use at the present day, and rather difficult to be obtained. I may mention one or two. "Bookbinding," by J. B. Nicholson, cloth, 9s. "The Art of Bookbinding," by Zaehnsdorf, 10s. 6d. Both these books are published by J. Zaehnsdorf, 14, York Street, Covent Garden, W.C. I cannot recommend them, for there is too much of the British Museum about them for the taste of a practical man. There is, by the way, another book which has been thrown in my teeth by a correspondent to Work. It is entitled "Amateur Bookbinding," and is published by L. Upcott Gill, 170, Strand, at 2s. 6d. I suppose the correspondent referred to thought he was giving me a bit of information; well, I just take the opportunity of informing him that "I know all about these things," and still I say there is no reliable book on bookbinding suitable for the practical man of the present day. Wait for more articles in Work.—G. C.

Book Plough.—H. J. J. (*Birmingham*).—Passing over the first part of your letter, I will at once answer the question which you desire the Editor to ask me, *i.e.*, what it cost me to make my machine. If you mean by this the plough described by me on page 716 of Work, I have only one answer: I never made a plough, and, what is better, I would not think of trying; because, in the first instance, I do not think I could, and, in the second, I could buy one cheaper. I hope you do not think that we make all the things we describe. If we did, we would want a British Museum to store our curiosities in. I gave the description of the plough to a correspondent who asked for it; and the sizes, etc., were taken of those which are in every-day use in the binding shops. To prove that my instructions were sufficient to enable a person of ordinary intelligence to make a plough, before sending my description to Work (in fact, when I was writing it), I showed it to a friend, who is a joiner by trade, and who had never been in a binding shop, and consequently had never seen a plough, and so thoroughly did he grasp the idea that he offered to make the drawings for me, an offer which I gladly accepted, as it gave me time to devote to something else. And, moreover, I asked a bookbinder what he thought of the description, and his answer was, "Anybody could make one from that." You had better read the portion again relating to the pin to keep the wooden screw in position, and study the figure carefully which gives details of the wooden screw. I need not write it over again, for I cannot make it plainer. No one can turn a thing round if it is fastened with an iron pin, but such is not the case; it is your understanding that is at fault. The knife fastens in the groove in the bottom of the bolt, and is tightened against the edge of the cheek by the thumbscrew on the top. The breadth and thickness of the knife depend upon the groove in the knife bolt; the length may be anything between 1 ft. and 1 in.; it is generally about 6 in. when new, but with continual grinding it soon becomes less. The plough, if well made, would cut not only Work, but anything in the book line that ever was published. You seem to think a great lot of your money; 2s. 6d. is a small sum to make such a noise about. By the way, I have bought ploughs; the price of one complete is about 8s. 6d.; the knives sell at 24s. per dozen.—G. C. [Our correspondents are not to blame for the delay in answers appearing in "Shop." They return the questions answered at once, but the great pressure upon this part of the paper since the starting of Work causes the delay. Enough "Shop" is in hand to fill many numbers of Work. Your letter was couched altogether in a wrong strain.—Ed.]

Bell Receiver.—A. F. (*Sheffield*).—The cost of materials for making such an instrument as described in Work for September 28th would be approximately 2s. 6d.; viz., mahogany for body, 6d.; magnet, 5 in. by ⅝ in., 10d.; wire, ¼ oz., No. 36, silk-covered, 3d.; two binding screws, 6d.; small wooden bobbin for coil, 2d.; ferrotype plate for diaphragm, 2d.; total, 2s. 5d. And this multiplied by four would give you the price of four instruments. If you intend making them yourself, and find any difficulty in getting magnets, wire, etc., if you write to Messrs. King, Mendham, & Co., Western Electrical Works, Bristol, you will get suited at above prices.—W. D.

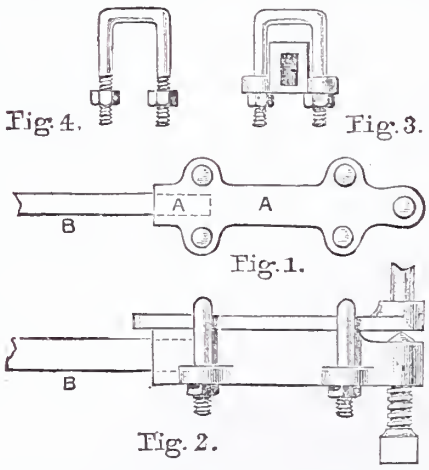
Procuring a Patent.—X. W. (*Crowle*) wishes to know the best and cheapest method of obtaining a patent for a small article which he has invented. The *best* method, and that which will give least trouble to himself, if strict economy is not an essential, will be to place the matter in the hands of a respectable patent agent. The *cheapest* method will be to act as his own agent. If he follows this latter course, he is advised to write to the Comptroller, Patent Office, 25, Southampton Buildings, Chancery Lane, London, E.C., for the "Official Circular of Information," which will be sent him gratis and post free. After carefully perusing this, and our article, "Taking Out a Patent," Vol. I., page 545, he ought to find no difficulty in getting his patent without professional help.—C. C. C.

Bicycle Repairs.—W. H. C. (*Clifton*).—(1) By broken tyre I suppose W. H. C. means the rubber. The rubber should be loosened from the rim half round or more, and a clean cut splice made with a thin knife dipped in water. A splice 2 in. long will do, as in annexed diagram. Smear the splice on both cuts with "Octopus" rubber cement, and let them remain, without joining, for an hour or two, then join the two splayed ends evenly and carefully, and press together; it will hold at once, and you may proceed to melt the cement in the rim; pour on more if necessary, and place the rubber in, heating with a gas flame on the under side of the

Tyre Splice.

rim till the rubber rolls freely, and the cement oozes out at the edges. The "Octopus," cement is made of rubber dissolved in naphtha, and can be had of all cycle dealers. (2) W. H. C. is right in supposing the head has to be made on the spoke after it passes through the rim. In a former number of Work I showed an instrument for doing this. If W. H. C. will look it up, he will see that it consists of two steel plates with pins passing through; they are each grooved to hold the spoke, and have to be gripped tightly in a vice with the spoke between; the head is then hammered up cold into a countersink in the ends of the two plates, half each; after this, screw up into in hub. (3) I have no good recipe for tyre cement, and never tried to procure one, as a very good cement can be had from any of the cycle dealers at 1s. per pound. It would not be worth the trouble for any one to make it for his own use.—A. S. P.

Safety Cycle Crank.—S. B. (*Exmouth*).—Bicycle cranks keyed on are a great trouble; the easiest way to get them to come off is to get on the machine and go several miles from home. This is the time



Safety Cycle Crank. Fig. 1.—Back or Outer Face of Bracket. Fig. 2.—Side View, showing Crank in position. Fig. 3.—End View, showing Socket for Lever. Fig. 4.—The Gland with Nuts.

they generally come off—when they are not wanted to. In the workshop it is sometimes next to impossible to get a keyed crank off without damaging or even breaking the axle. I have an instrument, however, that will start the most obstinate crank. It is made by a Mr. Loosley, of Brighton, and costs 8s. 6d. Here is a short description of it: In the accompanying diagrams, Fig. 1 is a malleable iron bracket having a sectional area at A A of 1½ in. by 1 in.; it has four legs, bored to admit the ends of two glands made of ½ in. round bar steel; these glands are rectangular as shown in Fig. 4. The right-hand end of Fig. 1 has a hole screwed to admit a ⅝ in. square threaded screw, shown in Fig. 2 with the head downwards; this head is square to receive the wrench with which it is turned. The point of this screw is conical, and when in operation, the cone point enters the countersink that usually exists in the end of the shaft. Fig. 2 shows the instrument with the crank in place ready to be operated upon. The two glands, Fig. 4, are made wide enough to allow the slotted end of the crank to pass through. In the left-hand end of Figs. 1 and 2 a rectangular recess is made, shown by dotted lines, to receive a lever bar, B, about 20 in. long; this bar is 1½ in. by ⅝ in. in section; this lever is used to counteract the pressure of the screw, which has a tendency to bend the outer end of the crank towards the wheel, and to bend the shaft as well. To use this instrument, you wind back the screw till only the point is visible, then place it on the crank, placing the point of the screw in the centre of the shaft. Then screw up the four nuts on the two glands till the crank is bound firmly in; now place the lever in the socket, then apply the wrench, and at the same time pull the lever with the left hand sufficient to keep the crank from bending; if this does not bring away the crank, it means to stay on.—A. S. P.

Indiarubber.—Waterproof.—Your failure arises from the use of gutta-percha instead of indiarubber solution. If you will try again, using a solution of indiarubber in naphtha, you will probably succeed in waterproofing your socks in a satisfactory manner. Gutta-percha is naturally hard and brittle; hence the splitting of which you complain.—Qui Vive.

How to Fret a Banjo.—C. T.—Mark carefully the exact distance from the nut to the extreme diameter of hoop on a piece of wood or cardboard; then mark the exact place where the bridge will stand—about 3½ in. or 4 in. from edge of hoop, according to the size of banjo. Take a pair of compasses, or spring dividers, and divide the distance from nut to bridge into 18 equal parts. Work your compasses along, commencing exactly at the nut, and count the parts until you come to the bridge. If the point of the compasses at the 18th part comes exactly on the bridge mark, the distance between the points of the compasses will be the exact distance from the nut to the first fret. If you come short or over the bridge mark, alter the compasses either way required, and try again, until you get it right. Having marked off the first fret, close the compasses a trifle. Now commence at the first fret and divide the distance between that and the bridge into 18 equal parts; having done so correctly, you will again have the exact distance from the first to the second fret; mark off, close the compasses a little more, this time starting from the second fret to the bridge, dividing the distance into 18 equal parts, and so on, until you get all your frets marked, each time dividing the distance from the last fret marked to the bridge into 18 parts. Providing that you have divided with the compasses correctly, you will now have a fretting gauge practically correct, from which you could mark off any number of banjos of that particular size. This system of fretting banjos will do for any sized instrument. You could work the divisions out mathematically if you like, but you will find the method I give the simplest. If you want frets across the finger board, run a series of saw cuts across, glue in thin strips of sycamore or other light-coloured wood, and dress off level. Or you could have pearl dots along the side of handle, which look much neater than frets across the finger-board.—J. G. W.

Raising Water.—A Would-be Inventor.—There certainly are no means of artificially raising water above its level without the use of mechanical appliances of some sort or other.—F. C.

Rack and Pinion.—Blair Athole.—You can get work of the kind you require from Messrs. Grimshaw and Baxter, 33 and 35, Goswell Road, London, E.C.—F. C.

Ventilators.—Young Tinsmith.—To do this, lead your pipe into a box and stretch across the box a piece of green baize, fastened all round so that the entering air passes through, and the dust is thus filtered off. You can get the baize at any respectable draper's.—F. C.

Gas Burner Patent.—W. W. (*Lambeth*).—I do not wish to discourage you, but to judge from your sketch I do not think your burner would be a success. As far as I can see, you have made no provision for air, and there is no regulator. The market is already flooded with gas burners, good, bad, and indifferent. Full instructions for taking out a patent have already been given in Work.—T. W.

Hot Water Supply.—Vulcan.—Messrs. E. and F. N. Spon, 125, Strand, London, publish a book entitled "Hot Water Supply," by F. Dye, price 3s. 6d., which I can thoroughly recommend as a practical and well-written treatise on this subject. I only know of one book on gas fitting; it is by John Black, and published by Crosby Lockwood & Co., price 3s. It would do very well for amateurs and apprentices, but would be of no use whatever to a practical man.—T. W.

Oak Stain.—Goldrill.—Without an opportunity of seeing a piece of the stained oak to which you refer, I cannot possibly say what stain has been used to give it a green colour. The only way for you to manage is to obtain a few specimens of green dyes or pigments and try them on waste wood. You should have no difficulty in getting materials in Newcastle, and very likely if you were to send a piece of the wood to any good colourman's he would be able to supply you with something suitable.—D. D.

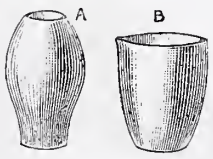
Veneering. — G. B. (*Oxon*). — Yes, of course; weights would do instead of handscrews when laying veneers with cauls. They are not so convenient in practical use as the screws, but as long as you get sufficient pressure to squeeze out superfluous glue, nothing more is absolutely necessary. I cannot tell you what weight per square foot would be sufficient, but you ought to have no difficulty in determining this roughly according to circumstances. You might almost as well ask what pressure, in pounds weight, is to be applied by the handscrews. Your question looks rather absurd when looked at in this way, does it not? No, the roughness left by the saw on the veneer is not so suitable as that made by the tooth plane. A good deal depends on the nature of the saw marks, but with the plane you will be quite safe. For small and occasional work, you might substitute a flat file for the plane. Thanks for good wishes.—D. D.

Microscope Mounting. — F. P. (*Brighouse*).—The small metal caps referred to in my last article in WORK, page 746, Vol. I., should be obtained without difficulty from any of the leading London or provincial opticians. I have always obtained all I have needed for my own use from Messrs. Thompson & Capper, 4, Lord Street, Liverpool.—A. T. S.

Book on Ship Joinery. — SHIP. — Apply to Messrs. Norie & Wilson, nautical booksellers, 156, Minories, London, who, perhaps, may advise you of some book containing this with other subjects.

Ascertaining whether an Article has been already Patented.—F. B. (*Swanscombe*), whilst he appreciates the light thrown by WORK on patent matters, is of opinion that the means by which an intending patentee may learn whether his invention has or has not been forestalled, have not been made sufficiently clear. In our answer to A. H. (*Portsmouth*) we pointed out that in most large towns a library of specifications is to be found where every facility is given to the inventor to satisfy himself on this point, free of cost. There is another way open to those out of reach of such a library, which will be known to all those inventors who have followed our often-given advice of obtaining from the Patent Office the "Official Circular of Information." This circular contains a list of abridgments of specifications; they are divided into 103 classes. Our inventor has, we will say, invented some new painting material; and from the list of abridgments he will select No. 50, which includes "paints, colours, and varnishes." It will cost him 1s. 10d. (by post 2s. 1½d.). From this he will judge whether he has the field to himself; and if not, he will see from the abridgments what specifications he ought to examine at length, and will send to the Patent Office for copies of them. The prices of specifications vary, but they are not costly, being published for public information, and not for profit.—C. C. C.

To Melt Gold Dust.—G. W. (*London, W.C.*).—Before commencing this reply, I shall indulge in a growl. Why do the people who write and expect us to give them a clear answer, I repeat, why do they not think about what they want to know, and give some indication of the quantity to be dealt with? Nearly every other question has some careless haziness of this sort, and, as it is one that could be obviated by a moment's thought, it is no wonder that I and others feel a bit savage. Everybody knows that to say a thing is as big as a piece of chalk, or as a lump of wood, conveys no idea at all of definite size, and these are very clear definitions to some I get hold of. For example, I am asked, "Can I melt gold dust in a large kitchener?" It is, of course, possible, if the chimneys are clean and clear, and the dampers open, to get sufficient heat for a few ounces, particularly if good coke and some charcoal are used; but if the quantity is great, how, by St. Dunstan, the patron saint of goldsmiths, can I reply in any but a general way, which will, most probably, not meet the particular case in point! However, here goes, and as there are two sorts of gold dust, namely, gold dust as found in a natural state, and secondly, that made by the file or other tools, scorpers, gravers, etc.—this latter being known in trade parlance as lemel—it follows that two descriptions must be given, as the inquirer does not take the trouble to say what he wants. First, for the pots employed; they are either the ordinary crucible or else the plumbago pot. The plumbago pots are far and away the best, but the others are generally used, for they are much cheaper, and, with care, can be used for almost all work. Both sorts should be annealed before use, for if they are to split it is better that they should be empty. When they split and let the gold down into the ashes, the pounding, grinding, sifting, and washing necessary to get it all back is no agreeable task, and will soon teach the advantage of a little previous care; and all that trouble leaves out of consideration the loss which is bound to take place after an accident of this sort. Morgan's, Battersea, is the firm that makes most of the pots used in London, and they can be bought at any jewellers' material shop, and there are plenty in or near Clerkenwell Green for G. W. to go to. Now for the fire. Do not have it too large or too hot when the pot is first inserted; it is much better to apply the heat gradually. Therefore, fill up your furnace with fresh coke, and let it burn slowly for a short time; then open your dampers and get all the heat you can. On no account omit to see that you have a good base of almost solid fuel for your pot to rest on, to avoid a capsize, which may occur if the fire be hollow. So much for pot and for furnace; now we will proceed to "run down" the gold dust. Put it in the pot with some pieces of borax and fix it in the fire. If it melts clear and bright, pour it as it is into a "skillet," previously warmed and slightly greased. If the molten metal spits, or makes a kind of eruption in the centre, or races round and round, then there is something impure in it, which we can probably remove by stirring up with a stick of charcoal, or by putting a layer of powdered charcoal on top. If that fails to clear the metal—for it should be as bright and clear as burnished silver—I should introduce a small piece of sal-ammoniac, or stir it with a piece held in the tongs. Failing a good result from that, a piece of corrosive sublimate (bichloride of mercury) should be put on the metal. During this time the molten state must be maintained, and the pot must be kept in the fire until the fumes are completely driven off. Put in some more borax, and pour the gold in when the borax has become completely liquefied; but do not get any of the fumes of either of these into your lungs. Should these have failed to give a bright and sound ingot, the method which follows will have to be used. It is the simplest I know of, but it is only one of the several ways used for the purpose of melting lemel, which we have previously defined as the gold dust produced while working the metal. In the first place the lemel has to be burnt, to get rid of all the organic impurities as far as possible. The way to do this is by placing a piece of brown paper in a clean ladle; then put the lemel on it and give it heat until it ceases to smoke, stirring it as it approaches red heat to prevent it melting and attaching itself to the ladle. Secondly, pound it in a mortar and remove all the steel and iron by means of a magnet. It is now ready for mixing with the flux; in this case we shall use pearlash, and an equal quantity of lemel and powdered pearlash should be taken and mixed together. Then place it in a melting pot (the skittle shape, A, is better than the usual shape, B), and do not fill it nearer than an inch or two from the top. If all will not go in at once—and it is not necessary that it should—the surplus can be added as room is made in the pot by the mixture sinking. As before written, heat it gradually and glance at it occasionally, for it may want to boil over; if it looks as if it will, it is only necessary to throw in a little powdered dry common salt, and that will quiet it down. We will now suppose that all has been put in and melted for some time, so we will take off a little of the flux with the poker, and if it is quite clear from metal, and is of a very dark green or dark brown colour — all through alike—the chances are that it will be ready for pouring into a warm greased skillet, or it can be left in the pot and the pot broken to extract the nugget. Lemel melted is rarely good to re-alloy for use, so the best way will be to have it assayed and fine gold obtained to value. Any refiner will manage that, or you could send a piece weighing twelve grains to Johnson, Matthey, & Co., Assay Office, Hatton Garden, and obtain a parting assay for 1s. 6d. That gives the exact quantities of fine gold and fine silver in a pound, troy; so it is easy to calculate the value of any size ingot. A plumbago pot is recommended, for sometimes the crucible gets eaten through by the boiling flux, and a spill may result. In both cases the ingot or nugget will have to be remelted—that is, if you are going to use it yourself; but my advice is, don't attempt to work lemel gold—you will be sorry if you do. Should you only want to melt such stuff once or twice, it would be better to get a refiner to do the whole affair, for he has furnaces specially built, and he would doubtless allow you to remain during the process, if the amount in question is worth the supervision. In conclusion, I feel as though the answer, long as it is, is unsatisfactory, for there are several other things that are in my mind, but no good end will be gained in writing them down in this reply, which, I trust, gives a clear account of how to melt gold dust.—H. S. G.



Crucibles.

Refracting Telescope — Huyghen's Achromatic Eye-piece—Magnifying Powers.—J. T. S. (*New Brompton*).—Your letter has interested me very much, because of its genuineness. Persevere with your experiment. If, as you say, your object lens is forty-eight inches in focus, and you use for eye-piece your half-inch plano convex lens, then the magnifying power must be $\frac{48}{\frac{1}{2}} = 96$; it cannot be anything else. If you use the ¼-inch for eye-piece, then the power is $\frac{48}{\frac{1}{4}} = 192$. But, in either case, you will not get a satisfactory result, for your object glass, being common, is non-achromatic, *i.e.*, uncorrected, and the using a single lense for eye-piece increases the error. I presume that you do not see your way clear to buy an achromatic object glass in place of your common one (an ordinary achromatic object lens, 2⅛th inches in diameter and thirty-six inches in focus, costs, at a good London house, 18s.), and, therefore, the best thing that you can do is to make for yourself a proper eye-piece. To do this proceed as follows:—Procure two plano convex lenses, having their respective focal lengths in the proportion of one to three, thus—¼ inch and ¾ inch or ½ inch and 1½ inches. Place these at a distance apart equal to one-half their joint focal lengths $(\frac{1}{4} + \frac{3}{4}) \div 2 = \frac{1}{2}$ inch in the first case; $\frac{1}{2} + \frac{1}{2}$ $1\frac{1}{2} = 1$ inch in the second case. The plane sides should be toward the eye, to which, of course, the smaller lens should be the nearer. Between the two lenses and in the focus of the first should be placed a stop, as shown. The central hole, which defines the field of view, will need to be slightly smaller in diameter than the smaller of the two lenses used. The magnifying power of this combination will be about twice as great as the power which the larger of the lenses, used alone, would have. Thus you may calculate easily what lenses will give you a fixed power. For example. With lenses ¼ inch and ¾ inch placed half-inch apart, the power would be with your 48 inch focus object glass

Stop.

$$: \frac{48}{\frac{3}{4}} \times 2 = \frac{48 \times 4}{3} \times 2 = 64 \times 2 = 128.$$

This is quite high enough for you to attempt to use. The better plan, indeed, would be for you to get a plano convex 1½ inch, and with this and the half inch that you have, to make an eye-piece of power

$$\frac{48}{1\frac{1}{2}} \times 2 = \frac{48 \times 2}{3} \times 2 = 32 \times 2 = 64.$$

This power would show you the belts and moons of Jupiter, and even the rings of Saturn. Your idea that the power you have so far obtained is only ten is perhaps due to over-strained expectation. A telescope is always disappointing to a beginner. Get used to it, and learn all its faults, and then you will be able to see a great deal more. As for Venus, it is the most trying object of them all. Many a good telescope shows faults when it is turned on to Venus. She is so bright and so dazzling. When you would observe her, first stop your object glass down to about one inch, and then you will see her phases. Do not aim at high magnifying power. As a young student lay this to heart, that more pleasure and profit can be obtained with a telescope firmly mounted (how important is this!) and armed with a low power than with a loosely-mounted instrument armed with a higher power. Experienced astronomers, as a rule, use low powers, except for very special work. I should not advise you to attempt to make an achromatic object glass for yourself, and, if you were to attempt it, a lathe would have very little to do with it. Lenses are not made on lathes. But you might make a reflecting telescope; and when this 48 inch of yours is in working order and satisfies you, if you write to the Editor again, he will send your letter to me, and I will tell you more about it.—E. A. F.

A Complaint.—C. H. (*Bloomsbury*).—My contributor who writes upon the bench, plane, and kindred subjects declines to notice criticism couched in the tone of your letters.—ED.

Black Lead.—P. B. (*Ashford*). — Black lead, emery, and all kinds of polishing materials can be procured at the under-mentioned addresses: Messrs. Acton & Borman, 72, Shoe Lane, London, and H. S. Hannah, the British Emery Mills, Bermondsey Wall, London, S.E.—R. A.

Gold Transfers.—J. J. (*Bristol*).—You can obtain gold transfers for japanning from the following: H. M. Stevenson, 6, Edmund Street, Birmingham, and W. Gay, 115, Holloway Head, Birmingham.—R. A.

Springs.—W. H. D. (*Plymouth*).—I cannot tell you the price. You should write and enclose sketch to Messrs. Gillett & Co., clock-makers, Croydon, Surrey.—F. C.

Superficial Measurement.—E. C. (*Stepney*).—The old-fashioned duodecimal method is probably the quickest way when you become accustomed to it; it is worked as follows:—The total superficial area will be equal to twice the sum of the height and breadth multiplied by the length, plus twice the breadth multiplied by the height. For example, let the dimensions of a case be — length, 5 ft. 7 in.; breadth, 3 ft. 4 in.; and height, 2 ft. 6 in.

Height ..	2 ft.	6 in.		
Breadth ..	3 ,,	4 ,,		
	5 ,,	10 ,,		
		2 ,,		
	11 ,,	8 ,,		
Length ..	5 ,,	7 ,		
	58 ,,	4 ,,		
	6 ,,	9 ,,	8	
	65 ,,	1 ,,	8	for sides, top, and bottom.
Breadth ..	3 ft.	4 in.		
		2 ,,		
	6 ,,	8 ,,		
Height ..	2 ,,	6 ,,		
	13 ,,	4 ,,		
	3 ,,	4 ,,	0	
	16 ,,	8 ,,	0	for ends.
	65 ,,	1 ,,	8	
Total ..	81 ,,	9 ,,	8	

The result is $81\frac{9}{12}$ square feet, that is, $81\frac{3}{4}$ square feet. The third figure, which represents $\frac{8}{144}$ of a square foot, may be neglected, or the sum may be called $81\frac{11}{12}$ according to practice. As the

duodecimal system is scarcely known out of some few trades, it may be well to describe the mode of working it. In multiplying 11 ft. 8 in. by 5 ft. 7 in. we have $5 \times 8 = 40$; dividing by 12 we put down 4 and carry 3; then $5 \times 11 = 55$ and $3 = 58$; then $7 \times 8 = 56$, 8 and carry 4; $7 \times 11 = 77$ and $4 = 81$, 9 and carry 6. The remainder, 8, is put one remove further to the right, because its units are one-twelfth the value of those in the second column. The first figures of the product (65) are square feet, the second (1) represent strips one foot long by one inch wide, and the third (8) square inches.—F. C.

Sword Warping.—SWORD.—From the statement furnished it is clear the blade is badly made, and straightening it will not change it into a well-made blade. There cannot be a more delusive notion than the fault is in the hardening. The evil is inherent, and the act of hardening reveals it. A well forged blade would not warp if the plan of hardening be adopted as described in the article on "Swords," No. 19, WORK. They may be made too hard or too soft, but they will not warp for either of those reasons, if properly forged. The fault may be remedied by again heating and hardening and tempering the blade, but if the blade warp, it is of no use to expect to make it true and finish it; as a sword it will he ever a faulty weapon. It should be thrown with the "busbel-iron" as waste, and most careful supervision kept over the man who turned out the faulty blades. Note well the men who turn out the blades that do not warp. Pay them extra for the better workmanship they display. Or, better still, if you are an employer, set to, and examine into the various workings of a blade up to the time of hardening. It will be a confirmation of success. To attempt to set a warped blade true will be a mental fraud on your common sense, and a practical fraud on those who pay for the sword and rely upon it. We hear much of technical education, competitive examinations, and exhibition prizes for highly finished swords. Why not distinguish the most successful blade forger and blade temperer? Of course the men should not be scourged to their tasks by piece-work prices, but paid well, though the time taken over the jobs might be twice as long as allotted for piece-work earnings. It would not be much more on the total cost of a finished sword.—J. C. K.

Freezing Liquids. — INQUIRER (*Yeovil*). — A liquid can be cooled down or frozen by surrounding the vessel containing it with any of the following mixtures:—

Freezing Mixtures.	*Number of parts of each Constituent.*	*The Temperature (Fahr.) obtained.*
Ammonium nitrate	1	7°
Sodium carbonate	1	
Water	1	
Sodium sulphate	6	10°
Ammonium chloride ...	4	
Potassium nitrate	2	
Dilute nitrous acid	4	
Sodium sulphate	8	0°
Hydrochloric acid	5	
Sodium sulphate	3	3°
Dilute nitrous acid	2	
Sodium sulphate	6	14°
Ammonium nitrate	5	
Dilute nitrous acid	4	
Sodium phosphate	9	12°
Dilute nitrous acid	4	
Sodium phosphate	9	21°
Ammonium nitrate	6	
Dilute nitrous acid	4	

The nitrous acid can be made by warming strong nitric acid with white arsenic or starch, and conducting the fumes evolved into water. In ice-making the fresh water is placed in large wooden tanks divided longitudinally by metallic slabs, placed vertically, forming internal passages through which cold brine from refrigerating machines is pumped. As the cold brine circulates through between the plates forming the slabs, the ice is formed on their outside, and gets thicker and thicker until the two sides approach to about three or four inches from each other when the ice is taken out. But as this requires refrigerating machinery, I should think that a freezing mixture as described would suit your purpose better; unless, of course, you wish to cool liquid wholesale.—F. B. C.

Scarf Pin. — A. S. H. (*London, S.E.*). — The making of this will be included in the jewellery papers now appearing in WORK.

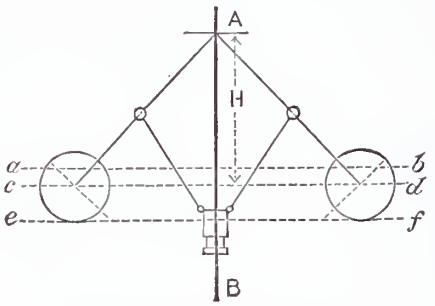
Ceiling Whitening.—W. H. B.—The paper on "Distemper or Tempered Painting"—published in WORK, No. 50, a few days after your query was sent—gives every information upon the above subject, and doubtless you have ere now availed yourself of its contents.—F. P.

Book on Metal Working.—GOLDRILL.—I am not aware of any book on art wrought iron work, though several articles have appeared in periodicals, on bent iron work, but I do not think they were of much value.—G.

Pine Wood. — E. H. (*Clerkenwell*).—If E. H. will write to me through the Editor I can supply him with first quality Quebec pine $\frac{1}{12}$ in. by 11 in., but he should be able to get it at most of the timber yards in his neighbourhood. Have you tried Snewin's, Hatton Garden, E.C.?—A. J. H.

Curing Rabbit Skins.—W. K. (*Leeds*).—There are various methods of curing small skins. One receipt is: Take $\frac{2}{3}$ saltpetre and $\frac{1}{3}$ alum, both in powder, and well sprinkle the flesh side with the mixture; fold the skin together flesh side inwards, and roll it up as tightly as possible, winding twine round the roll to keep it tight. Hang in a dry place for some days; then unroll and scrape clean with a blunt knife. Another way is to stretch and tack the skin, fur downwards, on a board, and spread the dressing over it. A good dressing would be, burnt alum, $\frac{1}{4}$; camphor, in powder, $\frac{1}{4}$; nutgalls, coarsely powdered, $\frac{2}{4}$; ground oak bark would do instead of the nutgalls. Burnt alum alone, however, makes a very good dressing, as it is drying, preservative, and obnoxious to insects. I have, indeed, cured many skins, in the absence of other dressings, with wood ashes, merely. If skins are hard and stiff when cured, they can be softened by well working some mellowing ingredient into the pores, such as soft soap, grease, etc. The beautiful softness of kid gloves (for which the skins are cured with alum alone) is gained by thoroughly impregnating the skin with yolk of egg, and then drawing it backwards and forwards over a blunt knife fixed upright till the rigidity of the fibres is overcome.—M. M.

Governor for Half Horse-power Engine.—W. W. (*Glasgow*).—To tell you how to make a governor for your engine in the "Shop" columns is impossible. 'Tis an intricate subject requiring an article to itself; I have dealt with it shortly in an article, in the Editor's hands, on "How to make a Quarter Horse-power Engine;" but cannot tell when you will see it appear. You must have seen cuts of the old form of Watt governor, with its long arms and slow motion, in all text-books on the



Governor and Parts for Engine.

steam engine, accompanied by the butterfly equilibrium valve; I suppose you do not wish to be told how that is made, but only to know about what size would suit your engine. Supposing, then, you have your throttle valve carefully packed so that it does not take much power to move it, you may do with balls of 2 in. diameter, arms 5 in. long, and at 100 revolutions per minute they will fly out to an angle of 45 degrees with the centre of revolution. Should the speed increase to 105 revolutions the plane in which the balls revolve will rise $\frac{1}{4}$ in.; should the speed drop to 95 revolutions the balls will fall till they revolve in a plane $\frac{1}{2}$ in. lower than the mean position. The figure will make this quite plain; the point A is the point of suspension, the lines *a b*, c *d*, *e f*, the three planes of revolution; with the arms 5 in. long, for 105 revolutions, H will be $3\frac{1}{4}$ in.; at 100 revolutions, H will will be $3\frac{1}{2}$ in.; at 95 revolutions, H will be 4 in. Now you can set out your governor for yourself and arrange that the movement of the balls from the top plane to the bottom one shall open the valve from "shut" to "wide." The difficulty with these governors is, that their power is so small that the slightest stiffness of the valve will be too much for them to overcome; that is why I recommend you to have yours so large; many such governors do not control the valve, but are simply ornamental. If you make yours as described, you need never have a variation of speed of more than from 105 to 95 revolutions. I am supposing the governor will run at the same rate as the engine. If you wish the engine to run at any other speed, you can easily arrange it by sizing the pulleys that drive the governor; for instance, if you wish the engine to make 200 revolutions, you would have to make the pulley on engine half the size of that on governor, etc.—F. A. M.

Gold Blocking.—C. D. (*London*). — Although personally familiar with the uses of gold leaf in most matters appertaining to embellishment, I must confess your inquiry is not sufficiently explicit to enable me to answer with any degree of confidence. I would here ask all who can, to send a small sample of any article they ask information on, when such is of a convenient nature to send by post. Gold leaf can be affixed to a surface in a variety of ways. By contact with a hard, but slightly sticky, film or surface, such as oil gold size; by being placed upon a gelatinous coated surface, such as in glass gilding, etc., when the water evaporates and leaves the gold cemented to the substance; and by pressure only, such as the gilding process of bookbinding, and that, once greatly used, but now almost out of date, of gilding wall papers with genuine gold leaf. If the work you refer to is of a printed and ornamental nature, I should think the block is pressed on to a *size* of either isinglass solution, albumen or japanners' gold size, and then the leaf laid over it; the nature of the material would allow the little time required to lay the leaf ere the satin would absorb the size; when dry the superfluous gold could be dusted off.—F. P.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—A STAINER (*Glasgow*); G. P. (*Elgin*); P. F. W. (*Dover*); INDEX; F. C. (*Leytonstone, E.*); W. V. C. (*Dublin*); JAY DEE; C. B. G. (*Sheffield*); A. E. D. (*Westcombe Park*); HYDROSTATIC; J. P.; MANUAL; C. B. (*Sheffield*); A. L.; C. H. G. (*Liverpool*); G. R. R. (*West Calder*); X. Y. Z.; J. B. (*Welling*); W. H. B. (*Leicester*); J. F. B. (*New Cross*); AN INQUIRER; G. M. (*Cheadle*); J. H. (*Pemberton*); E. H. T. (*Birmingham*); M. D. C. (*Liverpool*); J. B. (*Rawtenstall*); T. D. (*Oldham*); HARRY; A. R. (*Doncaster*); J. H. (*Glasgow*); R. J. C. (*Deptford*); TEHRANI (*Persia*); MACHINE GUN; A. R. (*Hexthorpe*); R. T. (*London, N.*); W. R. (*Oswestry*); G. C. (*Huddersfield*); A FRENCH POLISHER; W. D. (*Belfast*); A. J. (*Faversham*); E. D. C. (*Leytonstone*); E. J. P. (*Chesterfield*); N. MCK (*Oswestry*); O. R.; R. N.; J. W. (*Newcastle-on-Tyne*); O. S. (*Durham*); P. B. (*Weymouth*); A CONSTANT READER; J. S. (*Winchester*); R. N. (*London, S.W.*); B. L. (*York*); P. A. (*Birmingham*); W. R. (*Manchester*); G. K. (*London, N.*).

Trade Note.

IN accordance with instructions, the R. W. Hunt & Co. Inspection Bureau recently inspected 10,000 car wheels made by A. Witnery & Sons for the Savannah, Florida, and Western Railroad. For size, each wheel was measured around the tread by a brass tape divided into spaces of $\frac{1}{8}$ in. each. The record shows that 4,325 wheels were exactly the same circumference; 4,365 were but $\frac{1}{8}$ in. less; 881 were but $\frac{1}{8}$ in. over, while 429 were varied over $\frac{1}{8}$ in. either way. That is, the extreme variation in 8,690 of these wheels was $\frac{1}{24}$ in. in diameter, and in 881 it was only $\frac{1}{12}$. For roundness the wheels were tested by a true ring resting on the cone of the wheel, and none was found with a variation of more that $\frac{1}{32}$ in. at any point. For strength, 105 of the wheels were broken under the drop test, by a weight of 140 lbs. falling 12 ft. The specifications required that they should stand five blows. Two wheels broke at nine blows, while 50 required from 50 to 118 each. To start the first crack the average number of blows was 13·26; to break the wheel in two, the average number of blows was 49·56. The average depth of the chill at the root of the flange in the 105 wheels broken was $\frac{7}{16}$ in., and the depth did not vary in any case more than $\frac{1}{8}$ in. round the wheels. None of the wheels inspected were rejected because of chill cracks, blow holes, or other imperfections, and none needed to be ground or in any other way made smooth or true.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [9 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [4 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

Machinery and Tools.—Largest Stock in London. BRITANNIA Co., 100, Houndsditch. Cash or Hire Purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks and Dies, Forges, etc. Catalogue of new, 6d.; second-hand, 2d.—BRITANNIA CO., Colchester.

Best Book on Lathe, Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [7 R

Few sound Clock Movements.—Fixing, alterations, repairs, new pieces, cheap.—L., 2, Leighton Grove, London, N.W. [R

Photography.—500 Dodges, Receipts, Entertaining Experiments, etc., with beautifully illustrated Frontispiece. 160 pages. 14 stamps.—W. INGLES ROGERS, St. Germans, Cornwall. [1 S

On the First of Every Month, **4d.**

Cassell's Time Tables

AND

Through-Route Glance-Guide.

A SUBSCRIBER *writes*:—"I always buy 'CASSELL'S TIME TABLES,' and although I travel almost every day have never yet found any mistake in it, and I consider it more useful and at the same time more simple than any other book of the kind."

"'**Cassell's Time Tables**' may be safely recommended to all intent upon a railway journey, as the clearly-tabulated routes and the useful maps of the suburban and provincial railway systems which they contain will enable the passenger to select the train required without the slightest difficulty or uncertainty."—*Morning Post.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

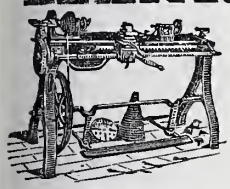
Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets, containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

New and Enlarged Edition. Cloth, 3s. 6d.

COLOUR. A Scientific and Technical Manual treating of the Optical Principles, Artistic Laws, and Technical Details governing the use of Colours in Various Arts. By A. H. CHURCH, Professor of Chemistry in the Royal Academy of Arts, London. With *Six Coloured Plates.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

MANUALS OF

TECHNOLOGY.

Edited by Prof. AYRTON, F.R.S., and RICHARD WORMELL, D.Sc., M.A.

THE DYEING OF TEXTILE FABRICS. By J. J. HUMMEL, F.C.S. *With Numerous Diagrams. Seventh Thousand.* 5s.

STEEL AND IRON. By WILLIAM HENRY GREENWOOD, F.C.S., M.I.M.E., &c. *With 97 Diagrams. Fourth Edition.* 5s.

SPINNING WOOLLEN AND WORSTED. By W. S. BRIGHT MCLAREN, M.P. *With 69 Diagrams. Second Edition.* 4s. 6d.

CUTTING TOOLS. By Prof. H. R. SMITH. With 14 Folding Plates and 51 Woodcuts. *Third Edition.* 3s. 6d.

PRACTICAL MECHANICS. By J. PERRY, M.E. With numerous Illustrations. *Third Edition.* 3s. 6d.

DESIGN IN TEXTILE FABRICS. By T. R. ASHENHURST. *With 10 Coloured Plates and 106 Diagrams. Third Edition.* 4s. 6d.

WATCH AND CLOCK MAKING. By D. GLASGOW. 4s. 6d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

INVALIDS

May be speedily restored to health by wearing one of

HARNESS'

ELECTROPATHIC BELTS.

Though they are guaranteed to generate continuous Electric currents, strong enough to cure almost all disorders of the **Nerves, Stomach, Liver, Kidneys,** &c., they do not cause the least discomfort to the wearer; but, on the contrary, they give support to the various organs of the body, and

INVIGORATE

the entire frame. They also effectually prevent **Rheumatism,** and kindred ailments. *Thousands of Testimonials* from all classes of society may be seen at the **Electropathic and Zander Institute** of the **Medical Battery Co., Limited,**

52, OXFORD ST. LONDON, W.

(Corner of Rathbone Place.)

Pamphlet, consultation, and advice, **Free on application.**

CASSELL'S

TECHNICAL MANUALS.

Illustrated throughout with Drawings and Working Diagrams, bound in cloth.

Applied Mechanics. By Sir R. S. BALL, LL.D., F.R.S. Cloth, 2s.

Bricklayers, Drawing for. 3s.

Building Construction. 2s.

Cabinet Makers, Drawing for. 3s.

Carpenters and Joiners, Drawing for. 3s. 6d.

Gothic Stonework. 3s.

Handrailing and Staircasing. 3s. 6d.

Linear Drawing and Practical Geometry. 2s.

Linear Drawing and Projection. The Two Vols. in One, 3s. 6d.

Machinists and Engineers, Drawing for. 4s. 6d.

Metal Plate Workers, Drawing for. 3s.

Model Drawing. 3s.

Orthographical and Isometrical Projection. 2s.

Practical Perspective. 3s.

Stonemasons, Drawing for. Cloth, 3s.

Systematic Drawing and Shading. 2s.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

C. BRANDAUER & Co's

CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT

SAMPLE BOX 6d. OR FOR 7 STAMPS **BIRMINGHAM.** [33

London Warehouse: 124, NEWGATE STREET.

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,
TOOL MAKERS,
DUBLIN.

How to Beguile the Tedium of a Railway Journey.

"These Official Guides afford a very simple and effective way of depriving a railway journey of its tedium. They are well arranged, full of interesting information about the places passed, with a profusion of pictures and useful large-scale maps and diagrams."—THE TIMES.

JUST READY, price **1s.**; cloth, **2s.**

The Official Illustrated Guide

TO THE

Great Western Railway.

With Maps, Plans, and Illustrations on nearly every page.

UNIFORM WITH THE ABOVE.

London & North Western Railway. *Enlarged.*
Midland Railway. *Revised.*
Great Northern Railway.
London, Brighton & South Coast Railway.
London & South Western Railway.
South Eastern Railway.

*** Ask for the Official Illustrated Railway Guides published by CASSELL & COMPANY.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers.*

For Young People in Town and Country, or at the Sea-side.

JUST PUBLISHED. Boards, **3s. 6d.**; cloth gilt, gilt edges, **5s.**

"Little Folks" Midsummer Volume,

containing **432 Pages of Letterpress**, with ILLUSTRATIONS ON NEARLY EVERY PAGE, Two Pictures in several Colours, and Four Plates in Colour, and comprising a treasury of bright and attractive reading for Children of all ages.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NOW READY, price **1s.**; post free, **1s. 2d.**

The New "Little Folks" Painting Book,

Containing nearly

350 Outline Illustrations

Suitable for Colouring.

*** In connection with this Work a large number of PRIZES in BOOKS and SILVER and BRONZE MEDALS are offered, full particulars of which appear in the July Part of "Little Folks" Magazine, now ready, price ***6d.***

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 71.] SATURDAY, JULY 26, 1890. [PRICE ONE PENNY.

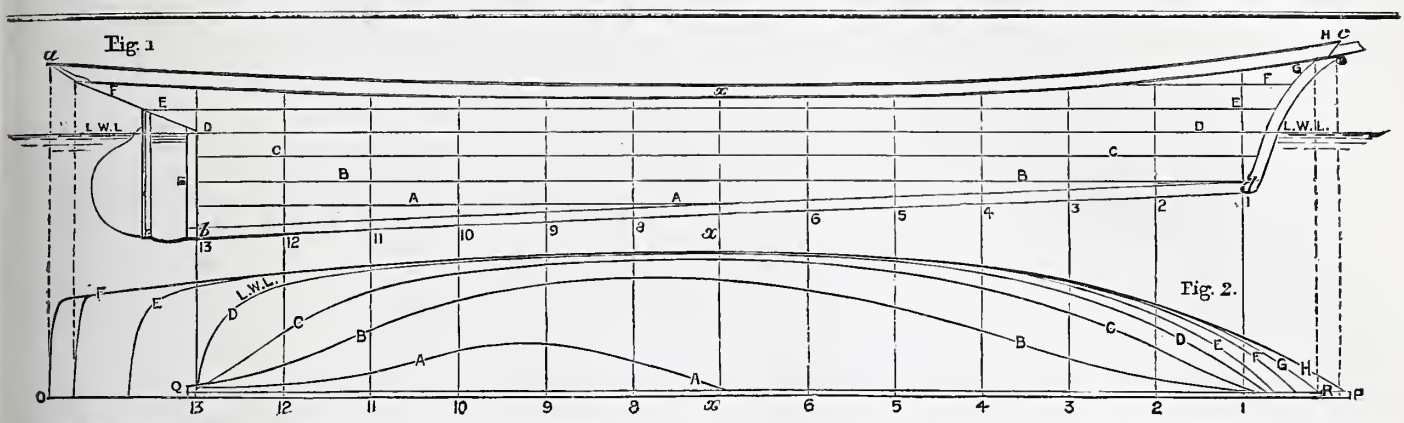


Fig. 1.—Sheer Plan of Steam Launch—*a c*, Gunwale; *a b*, Rebate of Stern; *c d*, Rebate of Stem; *b d*, Rebate of Keel; *x x*, Midship Section. Fig. 2.—Half-Breadth Plan. (Scale, ¼ in. to 1 ft.)

A SIMPLE METHOD OF BOAT DESIGNING.

BY EXPERTO CREDE.

If it is true that a hare must be caught before being cooked, it is certainly true a boat must be designed before being built; and as there have been frequent requests already in WORK for directions as to boat building, it is evident that a few remarks on designing will not be out of place.

Boat designing and building will be found thoroughly interesting and all-absorbing hobbies. Winter is by no means the slack season of the year for the boating man. It is then he must design and build his craft, and it is then he scrapes his spars, splices and serves his ropes, and does many other little odds and ends about his boat. The cabin too has to be aired, and often and often does he camp with boon companions during the long winter evenings round the boat-house or cabin fire with the social pipe, when each in turn spins his yarns of past adventure, and the summer gone is brought back with more than life's reality. It is then one begins to think of summer weather

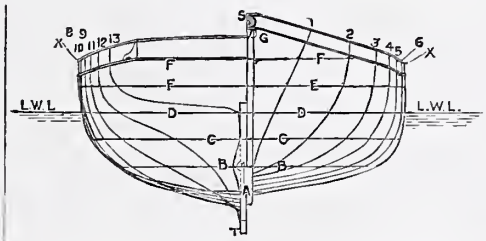


Fig. 3.—Body Plan of Steam Launch. (Scale, ¼ in. to 1 ft.)

and summer cruises to come, and one's mind naturally turns to the subject of the new craft. What will she be like? She has only

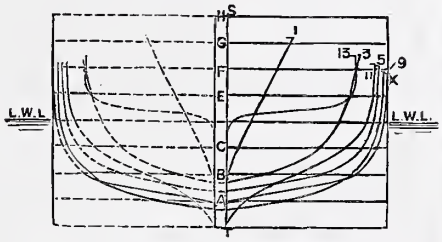
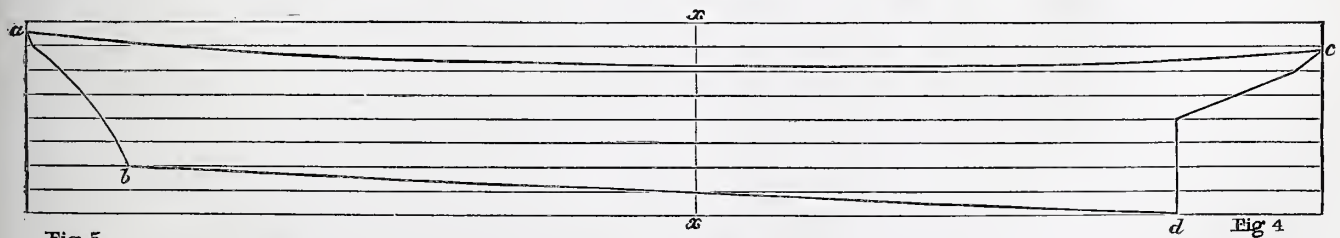


Fig. 6.—Body Plan of Model of Small Boat.

to be mentioned to be roundly discussed, and advice comes in on every hand; but we have our own opinions, and to carry them into execution is now the task before us.

In submitting the following suggestions, it must be noted at the outset that they are addressed to amateurs only, and as professed builders would not ask for assistance, it is assumed the requests before mentioned come from the former class of readers. Boat designing as well as boat building are matters about which there need be no real difficulty, and the reader may be encouraged when he is told that the methods here indicated have been successfully adopted by the writer in actual practice.

It is not intended to plunge into shipbuilding with all the science of a modern naval architect, nor, on the other hand, shall we, like the builders of old, follow the "blind rule of thumb," trusting to the "rack of the eye"; but by steering a middle course and preparing a model of our own, we shall hope—without making the study wearisome or the work laborious—to enable the reader to turn out a presentable craft for his own pleasure and recreation.



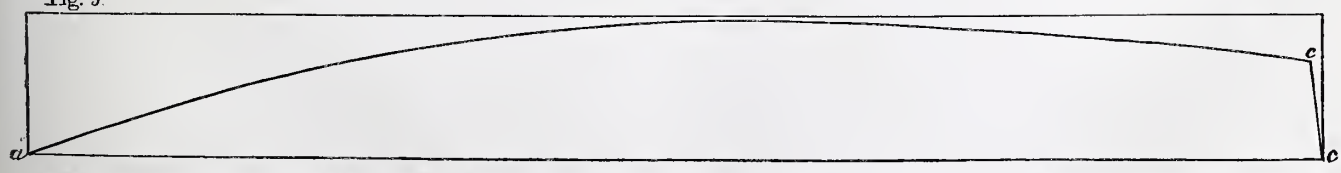


Fig. 4.—Sheer Plan of Model formed of Pieces of Wood glued together, showing Rebate of Stem (*a b*), Gunwale (*a c*), Rebate of Stern (*c d*), Rebate of Keel (*b d*), and Midship Section (*x x*). Fig. 5.—Half-Breadth Plan of Model, showing Gunwale (*a c*) and Stern (*c c'*). (Scale, ¼ in. to 1 ft.)

In the following remarks, therefore, and by the aid of diagrams, it is intended to lay before the reader a simple and ready method of preparing a design for any class of boat he may desire to have built; and for our present purpose a small steam launch of about 27 ft. has been selected.

Then to work: The design for a boat is properly shown in three separate plans or drawings: the sheer plan, the half-breadth plan, and the body plan, as set forth in Figs. 1, 2, and 3; and these are drawn on a scale of ¼ in. to the foot to bring them into the limits of the page of Work; but readers can easily enlarge them, and enlargement to a scale of 1 in. to 1 ft. is strongly recommended both for clearness' and practice' sake.

The sheer plan gives the length and depth of the intended boat; the half-breadth gives length and breadth; while the body plan gives breadth and depth; so that, as will readily be seen, we have the length given in two plans, viz., in the sheer and half-breadth; the breadth given in two plans, viz., in the half-breadth and body plans; and the depth in two plans, viz., in the sheer and body plans.

Take the sheer plan first:—Here the straight line marked L W L is the load water line or surface of the water when the boat is floating, and the straight lines parallel to this both above and below are called water lines. These water lines are shown in the same way in the body plan; but in the half-breadth they are represented by curved lines. The water lines constitute, in fact, a number of horizontal sections whose shapes are shown by the curved lines in the half-breadth plan. In the sheer plan a general side view of the boat is given, showing the outlines of the stem, the stern, keel, and gunwale; while the vertical straight lines drawn square, or at right angles to the L W L, represent the sections, which are shown also as straight lines in the half-breadth, and as curved in the body plan.

In the half-breadth plan half the intended boat is shown, overturned or bottom side up. The long straight line at the lower part of the plan represents the centre of the keel, while the curved lines are the water lines which represent the form of the boat along certain given points parallel to the L W L in the sheer plan, and show how the water will be divided at the bow, and closed again at the stern as the boat moves along. As before stated, these water lines are common to all the plans, and while curved in the half-breadth, they are straight and parallel to the L W L in the other two plans. It is upon the formation of these water lines that a boat depends for its sailing qualities. The boat *must* divide the water with nice easy curves forward, and allow it to close in again aft as she moves, or else, if too full or blunt forward, the boat will be difficult to drive at any great speed, and even then will push an ugly wave in front of her: and if too full aft the same difficulty in propulsion will be experienced, and an ugly wave will be dragged along in the wake or rear of the boat.

And in the body plan the intended boat is represented upright, looking "end on," as to one half looking from the bow, and as to the other half looking from the stern. Here the sections are shown as curved lines, and give the form of the boat vertically, while the water lines are shown as straight lines, as in the sheer plan, and are here used for the purpose of assisting in ascertaining the curves of the sections.

Naval architects would design their boat from these plans, and would afterwards, if need be, prepare a model from them, but for the amateur with a fairly correct eye the method about to be described will be found by far the most workable.

Following, then, the method here proposed, the first step will be to make a model of the boat intended to be built. This is made to represent half the boat, and of course it is easy to build the other half from it. The model must be made to scale, and the larger the scale used the less liability is there to inaccuracies, because the boat is an enlarged edition of the model, and errors in the model are magnified in the boat ever so many times, according to the scale used. It is therefore of no little importance to get the model right and fair in the first instance. For a boat of the size given in the plate, the scale of 1 in. will be found convenient and most suitable to work from.

First, then, procure a sufficient number of pieces of wood, according to the number of water lines considered necessary. In the design before us these water lines are ½ in. apart. They should not be further apart for a small boat, and for a beginner, perhaps ¼ in. apart would be found an advantage. To follow the method shown in Figs. 1, 2, and 3, take eight pieces of clean dry yellow pine, free from knots and shakes, 27 in. long for the length of the model, by 3 in. wide for the half-breadth, and planed accurately to ½ in. thick. Fasten these pieces together with thin glue, and leave them under weights to dry. A builder making his model might peg the pieces together, but gluing will be found more satisfactory. These eight pieces of wood fastened together form a block 27 in. by 3 in. by 4 in., out of which we are to make the model, and from the model to prepare our plans, and so obtain our moulds to build from. The seams ½ in. apart in the block represent the water lines the same distance apart, and corresponding with the water lines in the sheer plan.

Models are invariably made showing the starboard or right-hand side of the boat, as in the plate, and as we have to work and cut away the wood on this side, it is necessary to make our pencil marks on the back of the model.

When the glue is dry, plane up the back of the block, keeping the surface square to the top and bottom (and of course to the water lines). Then mark the back in pencil, showing the rabbets of the stem, *a b*, stern, *c d*, keel, *b d*, and gunwale, *a c*, and also the midship section *x x* (as in Fig. 4), or according to reader's fancy, and cut away the wood to these marks, taking care to keep all the surfaces (for the present) square to the back, and frequent use of the square should be made for this purpose. Next turning the block over so as to stand upright, mark in pencil and cut away the wood along the gunwale and stern (as in Fig. 5), keeping these surfaces square to the top and bottom in the first instance. Then plane the bilge round, and the rest of the model must be shaped out with gouge and spokeshave to suit the eye of the designer, strict watch during this process being kept over the seams between the eight pieces of wood forming the block, to see that they form nice easy curves, without any lumps or flat places anywhere, remembering (in the case of a steamer) to leave a small swelling half-way up the stern post for the screw shaft. If the glue used is mixed with a little dark colouring matter, the seams will be more visible.

Of course the reader will have his own idea to carry out in his design, according to the particular purpose for which he requires the boat, but in the case of a small launch of the dimensions given, the model should be kept tolerably flat in the middle, with the floor rising only slightly towards the bilge. Round off the bilge fairly well, especially if the reader intends being his own builder, so as to facilitate the bending and fitting of the ribs; but do not cut away the ends of the boat much, or they will be too hollow. For a launch, the stern must be tolerably fine to admit of the water passing freely to the propeller, but where the launch is small the bow should be fuller, to carry the weight of the machinery, and to this latter desirable end and the stability of the boat a flat floor amidships will greatly tend.

Next take a clean piece of yellow pine a little larger than the model every way; plane it down to such a thickness as will represent half the thickness of the keel—in our case ⅛ of an inch. Glue this thin piece (which we will call the back-board) on the back of the model, and with a pencil mark thereon the keel, stem, and stern post and rudder, and cut away the wood to these marks.

Sand-paper all smooth, mark the L W L on the back-board, and the model is finished so far as is required for building purposes; directions will be given later on for polishing and mounting.

Having got the model to his satisfaction, the reader must next proceed to take the lines from it. This is accomplished by treating the model to a bath of hot water until all the pieces are persuaded to separate, first taking the precaution to see that the midship section is clearly marked across the back of the model square to the L W L as *x x*, shown in Fig. 4, and that there are such other distinguishing marks on the back edge of the smaller pieces as will show their positions when in proper order.

Wash all the glue off the pieces, and when they are thoroughly dry we may proceed with the plans. Take a piece of drawing paper of sufficient size, and draw the straight line L W L, as in the sheer plan in Fig. 1, and mark it L W L at each end, and placing the back-board with its L W L exactly over the L W L on the paper, draw all round it with pencil or compass pen, and this will give the elevation or side view of the intended boat. Parallel to the L W L draw the requisite number of water lines according to the number of seams in the model, as A, B, C, etc.; and at right angles to these draw the sections 1, 2, 3, etc., as many as may be thought advisable, marking the midship section with an *x* instead of a number, to distinguish it from the others. Then take all the pieces of wood forming the model (except the back-board) firmly in the left hand in their proper order and position, and placing them on the paper with the L W L of the model exactly over the L W L on the paper, draw with pencil or compass pen along the lower side and the two ends, and this will give the rabbets of the keel, stem, and stern, and the sheer plan is completed as far as is requisite for building purposes.

The half-breadth plan must next be proceeded with, and for this purpose draw the straight line O P, Fig. 2, at a sufficient distance below the sheer plan as on the plate, and parallel to this draw the straight line Q R for half the breadth of the keel, and at right angles to these draw the same number of sections as are in the sheer plan.

ndeed, it is the best to continue the sections the sheer plan right across the half-readth plan, as in plate, and mark them 2, 3, etc., to agree with the sheer plan. hen take the loose pieces of wood forming ne model, one at a time, beginning say ith the upper or larger one, and place it n the paper with its straight edge along ne line Q R, and with its midship section ark *x* exactly over the midship section *x* n the paper, and draw round the piece of ood on its curved side with pencil or com-ass pen; and the curved line so drawn ill, when completed with the addition of ne small loose piece of wood from the bow nd of the model, give the water line which epresents the upper edge of the gunwale of ne boat. Then take all the other pieces of ood in turn and draw round them as on late, distinguishing them with A, B, C, etc., s shown, and the plan is complete.

The body plan next requires our attention, nd its preparation will be found very in-eresting, as it brings out the result of all ur previous work. First draw the L W L, hich, for simplicity, is generally drawn as a ontinuation of the L W L in the sheer plan. t right angles to this draw the vertical traight line S T, Fig. 3, to represent the ertical centre line of the boat, and to the ight and left of this, and parallel to it, raw the two straight lines shown on plate o represent half the breadth of the stem on he right, and half the breadth of the stern ost on the left, and then put in the water ncs parallel to the L W L. Next take a air of sharp pointed dividers or compasses, nd with these the measurements of the urved water lines of the half-breadth plan re to be pricked on the body plan in order o ascertain and form the curves of the ections in the latter plan, proceeding in his way:—Take the midship section first, nd place one point of the compasses at *x* n the half-breadth plan, and adjust the ther point to where the water line A is in-ersected by the midship section on the ame plan, and then removing the compasses o the body plan, place one point on the ertical centre line S T, where it is inter-ected by the A water line, and prick that vater line with the other point. Then oing back to the half-breadth plan, place ne point of the compasses again at *x*, and djust the other point to where the water ine B is intersected by the midship section n the same plan, and then removing the ompasses to the body plan as before, lace one point on the vertical centre ine S T, where it is intersected by the B vater line, and prick that water line with he other point. Proceed in this way until he measurements of all the water lines at he midship section in the half-breadth plan re transferred to the body plan; and then vith a pencil sketch in the midship section n the body plan, drawing from point to oint, as pricked on the water lines. The lepth and height of the midship section, nd of the other sections, below and above the L W L as here represented, must be ascertained with the compasses by measur-ing the distance below and above the L W L on the sheer plan, and pricking the measure-ments on the body plan. The section as sketched should then be inked in.

In the same way proceed to transfer the measurements of the sections 6, 5, 4, 3, 2, and 1, from the half-breadth plan to the body plan, sketching and inking them in as before mentioned. These sections should be sketched in the right-hand half of the body plan, and show the sections of the bow or forward portion of the boat; and the sections 8, 9, 10, 11, 12, and 13 should be transferred to and sketched in the left-hand half of the body plan and show the sections of the stern or after-end of the boat. The midship section may be put in both the right and left hand sides of the body plan.

The plans are now completed, so far as necessary for present purposes, though there are other methods of checking the lines as by bow and buttock lines and diagonals, but there is no need to go into such matters here; suffice it to say that if the designer has made any mistakes in his model (*i.e.*, made any flat or hollow places, or left any lumps upon it), the construction of the body plan will speedily bring to light his error, and to correct such error the process of "fairing" must be resorted to, but for all practical purposes this fairing can well enough be done in the building yard later on.

We must now proceed to turn our past labours to account and enlarge our plans to "life size," and for this purpose we must have resort to the "mould loft," which in our case will be a room with a large table in it, or a room where the floor space can be utilised.

Procure a large piece of stout paper—say rough brown paper—about 4 ft. square, and on this we are to draw a number of the sections of the body plan to their full size, from which the moulds are made for building. It is not necessary to draw all the sections, but a sufficient number must be drawn to enable the builder to follow the design, and in the boat under consideration it is suggested that it will be sufficient and necessary to take, say, the midship section and two of each side of it in addition to No. 13, for the stern board which must always be used; or say we take No. 13, and every alternate section. This will give us seven to work from.

On this paper draw the vertical straight line S T, near one side (as in Fig. 6), and at right angles to this line draw the L W L, and the other water lines 6 in. apart and parallel to one another, and proceed to transfer the seven sections which have been selected from the body plan to the brown paper, and if all the measurements in the body plan are multiplied by twelve (assuming the 1 in. scale to have been adopted), the result will be a drawing of the sections full size on the brown paper. As seven sections only are being drawn on this paper, both the forward and after sections may be drawn on the one piece (as in Fig. 6), and if distinguished as in that figure there will be no confusion.

It will now be an easy matter to lay the brown paper drawing over the pieces of wood out of which the moulds for building are to be made, and with a sprigbit to stab or prick the sections through on to the wood, and by reversing the paper the other half of the sections is obtained.

It only remains to be said that when the moulds are made and placed in position on the keel in the building yard, the application of long thin strips of wood used as battens, and bent along the moulds at several points, will readily show to the builder how and where (if at all) the model is in error, and by this simple fairing process he will quickly alter his moulds where necessary.

In conclusion, it is suggested that by carefully gluing the model together again, blacking the portion above the water line, and mounting on a mahogany or other dark wood background, and French polishing the whole, a very presentable workshop ornament is obtained, and if another set of lines have been previously taken from the model, and are framed to hang on the wall alongside of it, the result will be at least a pleasant reminiscence of a first attempt in boat designing.

A GOOD RAT-TRAP.

BY FRED CARRE.

WHETHER the ancient rats who lived with Noah in the ark were as clever and as hard to circumvent as their present descendants, I do not know. I suppose scientists have some explanation—heredity, or a growing acquaintance with the deceitful ways of men—still, it is a fact, explain it as we may, the present race of rats is no more to be caught with chaff than the proverbial "old bird."

Chaff is no doubt a very useful auxiliary in rat-catching; but there are some positions in which it is not possible to use it in conjunction with the ordinary style of traps; *e.g.*, if the hole is in the floor, or at the bottom of a door, or in some place where the rats have not a run in which the trap can be laid and covered up with chaff.

The baiting of traps for old rats, at least, I have never found anything but vexation of spirit; for no matter how done, if touched at all by the old rat, he generally succeeds in taking it away night after night without catching himself. And if he cannot do this, he is quite wise enough to leave the most tempting morsels untouched.

The common gin-trap is, I believe, the one almost exclusively used by the professional rat-catcher; but except as set by the professional or hidden in chaff, in a run, it is vain to expect to catch a knowing old rat who has taken up his abode in a house, and who has become familiar with the owner's ways and means.

It is this single, bachelor rat who regards your house as his own, and who, not unjustly, I believe, is credited with warning off all poachers on his domain. It is this gentleman whom it is so hard to catch off his guard, or induce to put his foot into any ordinary trap. If you would get the better of him, something out of the usual run must be secured.

Now as such a trap was a short time ago shown to me, and as I have successfully made one for myself, it may interest some readers if I describe it and give a few hints as to how it can be made by any one with a moderate amount of mechanical skill.

The trap is specially designed for being placed over the hole through which the rat enters the room. If this hole be in the door the trap can be attached, and the door opened and shut without in any way interfering with it. If in the surbase, it is screwed to it, is quite free from danger and out of the way, and though it may not catch the rat, as long as it remains over the hole there is no possibility of his entering without being immediately impaled.

It can be so delicately adjusted that a *touch* will snap it, and by half a turn of the small regulating screw, made so heavy, that while still set, the rats may pass and repass till they lose all fear, when by turning the screw back it is made to go off on the first attempt to pass.

These seem to be all points in its favour.

It will be seen on looking at Fig. 1, which represents the trap as it is when set, that the framework consists of a brass or iron flanged ring of such a size as will just allow a rat to pass, and almost necessitate his filling the hole and rubbing the sides with

his skin as he passes through. This hole may be from $1\frac{1}{2}$ in. to $1\frac{3}{4}$ in. diameter.

This ring is not an absolute necessity, as a hole of the requisite size may be bored in the board, on which the spring and daggers are to be fastened, and a little bar of iron or brass screwed on to it to form the guide for the daggers and make a support for the trigger, and the rod on which the spiral spring works.

In some ways the wood has the advantage over the metal, as I have found that rats are not so timorous of wood as they are of metal. The object of the metal ring is to secure that the rats will not gnaw the hole so big as to allow themselves to pass without risk of touching the trigger; but really I think there is very little fear of this. If there is, it can easily be lined with tin, which will make all safe.

Moreover, there may be some little difficulty in getting a ring of the right form, unless you make a model and get it cast; or if you can, cast it in brass as I did myself. It is not a very difficult job, and I shall give one or two hints which will be helpful to anyone making the attempt to do all the work himself.

But let me resume my description. It will be seen that on the left-hand side of the ring there is a boss, through which are drilled three holes; the central one is diametrical, and the other two are parallel with it, and in them the two daggers slide. The daggers are attached to a movable piece B, into which they are riveted or screwed at their upper ends, and this piece slides on the central rod, which is screwed into the central hole of the ring at one end, and attached to the base-board at the other.

On this rod is a spiral spring of hard brass wire about eighteen to twenty gauge, which drives the daggers down, on the trigger being pressed by a rat attempting to pass through. It does not need that this spring be very strong. No rat, once it descends upon him, can ever escape, even though the dagger did not penetrate completely through his body. He can only pull backwards or forwards, and this does not affect the spring. The softer the spring can be made while still having sufficient power to hold its own, the better, because the trigger can then be made so much lighter in touch.

The trigger is the only thing remaining to be noticed, and it will be seen that it is made of two links, one straight and the other prolonged beyond its joint, and bent as shown to form the touch-piece. The bend must be sunk so as to cause it to come when set within about $\frac{1}{2}$ in. or $\frac{3}{8}$ in. of the bottom of the hole; and when in that position, the three pivots should be in line, but with the centre pivot just the smallest degree possible on the lower side of the straight line joining the two end pivots.

The amount of this deflection is regulated by the small screw S, which passes through a small projection of the sliding piece, and presses against the edge of the upper link.

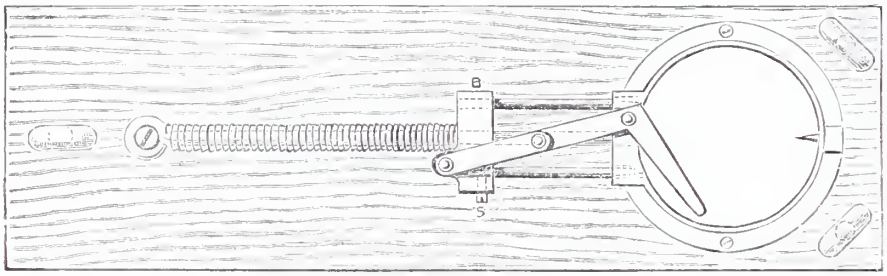


Fig. 1.—Plan showing Trap Set.

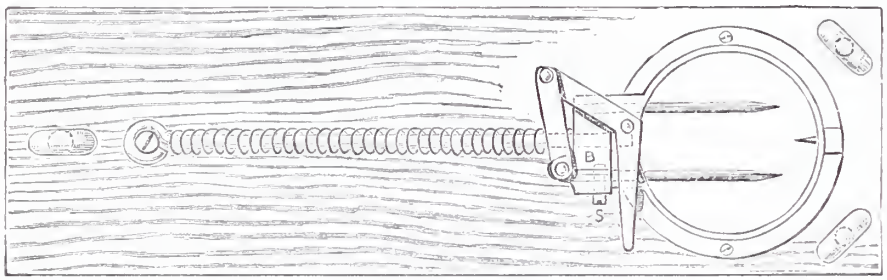


Fig. 2.—Plan showing Trap Sprung.

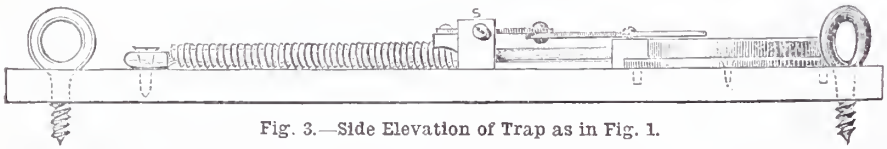


Fig. 3.—Side Elevation of Trap as in Fig. 1.

By this the touch can be regulated to the greatest nicety.

Fig. 2 shows the trap when snapped.

In the trap from which mine was copied there was a sharp spike passing through the ring as shown between the daggers; of course this gives greater security that the rat will not escape, but I think it wholly unnecessary, and I have omitted it in mine, as my object has been to make the hole as innocent-looking as possible. Rats are very sharp to notice anything that is suspicious-looking.

Now, one or two hints as to construction. If you make a pattern and have a casting made from it, you have merely to turn, in some hard wood, a ring to the size mentioned; this will be ⊣ shape in section.

On both sides of the ⊣ you will glue or sprig on two little pieces of wood to make the boss for the dagger-holes and the spring rod.

And as there may be some little difficulty in securing that the three holes in the sliding piece are parallel and coincide exactly with the three holes in the ring, let the sliding piece be cast all in one with the ring just in the position in which it is shown in Fig. 2. Bore the three holes through to the inside of the ring, and then cut off the sliding piece with a hack saw, and file to shape. You are then sure to have your holes to correspond.

One other point is to be noticed: in making the trigger links you must be most careful to have the end pivots equally distant from the centre one. The best way to secure this is to put in and rivet the central pivot first, then bore the other two holes together, *i.e.*, with the links folded on top of one another.

You may make these links out of sheet brass, $\frac{1}{16}$ in. thick and $\frac{3}{16}$ in. broad. Both arms of the bent link are the same in length, but if greater sensitiveness is required the touch part of the link may be longer.

A slight channel will be cut in the base-board to allow the spiral spring to have free play. This spring is made by simply rolling the hard brass wire on a straight rod or wire of the same or a slightly larger diameter than the rod on which it is to work. It is slipped on before the rod is screwed into the ring.

The trap is most easily attached to the door, or floor, by two or three screws with eye-heads, to be got at any hardware shop. These can be screwed in with the fingers, if a gimlet-hole be first made.

SHEET METAL WORK.

BY R. ALEXANDER.

DESCRIPTION OF MACHINES AND TOOLS (*continued*)—THE PANING DOWN MACHINE—THE CIRCLE CUTTER—BENCH TOOLS—STAKES—HAND TOOLS, ETC.—MATERIAL USED IN THE TRADE: TIN, ZINC, IRON, THEIR VARIOUS SIZES, THICKNESSES, AND PRICES—REPAIRS (*continued*)—HOW TO RE-BOTTOM ARTICLES.

Two machines in addition to those described in my last article are all I think it necessary to mention at present; when farther advanced with the subject it may be advisable to give drawings and particulars of other machines, of which there are many, but at present I think these will suffice. There are, in fact, few shops (except factories) that possess all the half-dozen or so described in this and the preceding article.

The paning down machine (Fig. 11) is a machine that closes the bottoms of articles after they have been taken up in the jenny, or otherwise the bottoms are tapped round with a light hammer and run round in this machine, once to close the edge, and then once more to bend the edge of the bottom up a little, ready for the bottom closing machine. Price, No. 1, £2 7s. 6d.; No. 2, £3.

Figs. 12 and 13 show the circle cutters in two forms. Fig. 12 is for tin work: it is very easy to understand and to use; it is fixed to the bench by a bolt and nut; the piece of tin to be cut has the circle described on it first by means of a pair of compasses; it is then placed on the machine, the screw A being placed on the centre mark, and the bow drawn along the frame of the machine till the two cutters are just on the line required to be cut; the screw B is then screwed down tight enough, the handle turned, and the circle cut. The reader will see that by this machine, where many bottoms, or covers, or anything circular in form have to be cut, absolute uniformity of size and truth of circle is secured. Fig. 13 is a similar machine, though differing in detail: it is for heavy work, such as sheet iron, thick copper, etc. The prices of these machines are, Fig. 12, to cut from $2\frac{1}{2}$ in. to 14 in. diameter, £2 15s.;

to cut from 3 in. to 18 in., £4 10s. Fig. 13, to cut circles from 5 in. to 36 in. diameter, £10. Larger sizes are made, but I need not particularise them here, as they are too large and expensive for any but manufacturers.

We will now deal with the stakes or large tools that fit in the holes or mortises in the bench. Fig. 14 is the creasing stake, or crease iron, as it is usually called: it is used for many purposes; the grooved part is for sinking wire, creasing top of bottles, and when there is no jenny the plain part can be used for paning down on, for wiring on, and various other things. Fig. 15 shows the hatchet stake, called for shortness the hatchet: it is used for the edges of tinware, etc., where there is no folding machine, and for folding sheet iron and zinc work, and for preparing the bottoms of articles that have to be "knocked up," or "closed" in a machine. Fig. 16 is the side stake, the tool on which most of the seaming of bodies of saucepans and such goods is done, also for knocking up bottoms upon. Fig. 17, the pipe stake, is a somewhat similar tool, but shorter in the stem and longer in the part that is worked upon, and without a square end, like the side stake, used for sheet iron stove-pipe seaming, and knocking up of large articles can also be done on it. Fig. 18 shows the funnel stake, used for bending into shape such things as funnels, bottle taps oval and round, and for grooving or seaming them. Fig. 19 is a bick or beak iron; two or three of these are required in a tinman's outfit to turn the various sizes of saucepan handles, waterpot spouts, and such like. Fig. 20 is an extinguisher stake, somewhat similar in shape to the bick iron, but much smaller. Fig. 21 is a saucepan belly stake for working on hollowed body saucepans. Fig. 22 is the tinman's "horse," though why it should have gained that name I am at a loss to imagine, as it in no way that I can see resembles that equine quadruped. The holes at either end are for the horses' heads (of which he has several) to fit in. (See Figs. 23, 24, 25). Fig. 26 shows the kettle top swage, used for making the beading that forms the seat of the kettle cover; there are also the colander swage and the three-thread swage, which are the same in action, only differing in the shape of the dies.

I think at this part it will be as well to defer the consideration of the remaining tools till the next article, and to now give

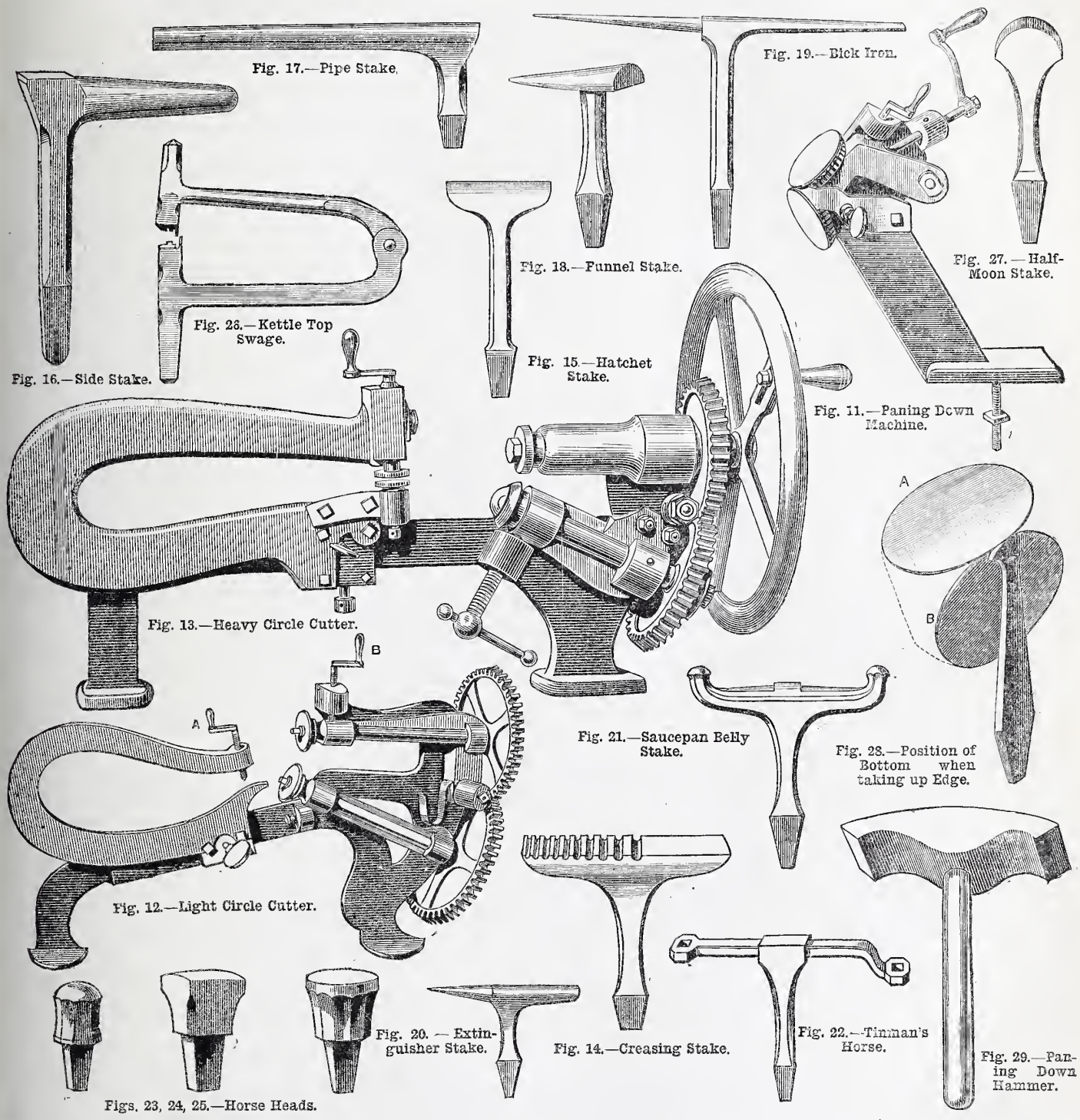


Fig. 17.—Pipe Stake.
Fig. 19.—Bick Iron.
Fig. 18.—Funnel Stake.
Fig. 27.—Half-Moon Stake.
Fig. 26.—Kettle Top Swage.
Fig. 16.—Side Stake.
Fig. 15.—Hatchet Stake.
Fig. 11.—Paning Down Machine.
Fig. 13.—Heavy Circle Cutter.
Fig. 21.—Saucepan Belly Stake.
Fig. 28.—Position of Bottom when taking up Edge.
Fig. 12.—Light Circle Cutter.
Fig. 20.—Extinguisher Stake.
Fig. 14.—Creasing Stake.
Fig. 22.—Tinman's Horse.
Fig. 29.—Paning Down Hammer.
Figs. 23, 24, 25.—Horse Heads.

some information and advice respecting the various materials used in the repairing and making of the various articles that I hope to describe. We will first of all take tin, or, more properly speaking, tin plates. These are made in various sizes.

The following are those most in use: 14 in. × 10 in., known as singles, 15 in. × 11 in., middles or small doubles, 17 in. × 12½ in., doubles, 20 in. × 14 in., large doubles or twenties. The other sizes are generally called by their dimensions, such as 28 in. × 20 in., 30 in. × 22 in., 40 in. × 20 in., and various other sizes. The thickness of these plates is denoted by the number of crosses on the box: thus we speak of one cross single, two cross double, and so on; it is written thus: 1 × s, one cross single; 1 × × s, two cross single; the 1 is always prefixed, no matter how many crosses there are: thus, 1 × × × × D is 4 cross double, and is a 4 × plate 17 in. × 12½ in.; the word double has no relation whatever to thickness, it is merely a size. Some people have got a notion in their heads that an article to be good must be made of double block tin. Well, there is no such thing; there is block or ingot tin, which I have before mentioned, but that is of course not suitable for making teapots, etc., and there is double tin, which, as I have just explained, simply means the size plate used, and is not to be taken as meaning anything else, the strength or thickness being denoted by the No. of ×; there is also a thinner tin than 1 ×, known as 1c. There are also two qualities of tin, termed, from the process of annealing, charcoal and coke. Charcoal plates are the best, and I never use any other if I can help it, except for such work as packing-case lining or any work that there is no wiring or turning of edges, as coke plate will not stand it, though some makers advertise their coke plates as nearly equal to charcoal: a statement which I have never found verified by experience. These two kinds are again subdivided into what are termed perfect and wasters; the only difference between these is that the perfect, or prime, as some term them, are the selected sheets, and are supposed to be perfectly flat, evenly coated with tin, and free from flaws of any kind; the wasters are just as good in their working qualities as the perfect, but they have slight faults in them, such as a little spot badly tinned, a notch or two on the edge, a corner dog-eared, and other similar little faults: some that would never be noticed by an inexperienced person; for all ordinary work they will do as well as the perfect, which are only used for best work. There is another class of plates called "terne" plates: these are coated with a mixture of tin and lead, and are chiefly used for painted goods, and not always for that.

Larger sheets than the sizes I have mentioned are also made as follows: 6 ft. long by 2 ft., 2 ft. 6 in., and 3 ft. wide: this is called tinned sheet iron, and is very useful for large work.

Sheet Iron, Black and Galvanised.—This is made in the sizes given above, and the quality is denoted by the same words as the tin plates: viz., charcoal and coke; but the thickness is determined by the wire gauge; the sizes mostly in use in ordinary general shops are 26, 24, 22, 20, 18, and 16, and of these more of 24, 22, and 20 than of the others. There is used now, in place of charcoal, iron to a very great extent, a material called soft or mild steel: it is equal in its working qualities to charcoal iron, and has the advantage of being somewhat cheaper. A lot of tin plates are now made of this mild steel: in fact, I believe most of them are, though they still retain the name of charcoal tin. This is sold in sheets, ordinary size 3 ft. wide and 7 and 8 ft. long; its thickness is denoted by numbers, and they run the reverse way to those of sheet iron; thus No. 8 zinc would be very thin, about the thickness of 1c tin, while No. 8 iron is very thick; the sizes in general use are 9, 10, 11, and 12, and for very stout work, roofing, etc., No. 14. As to quality, the brand known as Vielle Montaigne Liège is considered the best, but I have seldom had to complain of zinc, of whatever make it may have been.

Prices.—These vary according to the market, so that the prices I give below must only be taken as approximate; the prices of the day may be obtained from all metal merchants and ironmongers.

Charcoal Tin Plates (per box).

	112 in box.		225 in box.	Perfect.	Waster.
1c	14 × 20	or	14 × 10	20s.	18s.
1 ×	,,		,,	25s.	23s.
1 × ×	,,		,,	30s.	28s.
1 × × ×	,,		,,	35s.	31s.
DC	17 × 12½		100 in box	18s.	16s.
D ×	,,		,,	22s.	19s.
D × ×	,,		,,	27s.	23s.
D × × ×	,,		,,	32s.	26s.

Coke plate about 3s. per box less; other sizes of tin plates in proportion.

Sheet Iron (Galvanised).

Common	per cwt.	11s.	to	12s.
Best	,,	17s.	,,	18s.
Best Best	,,	18s.	,,	20s.
Charcoal	,,	20s.	,,	22s.
Soft Steel	,,	18s.	,,	20s.

Sheet Iron (Black).

Common	per cwt.	8s. 6d.	to	9s. 6d.
Best	,,	11s. 0d.	,,	12s. 0d.
Best Best	,,	12s. 6d.	,,	13s. 6d.
Charcoal	,,	14s. 6d.	,,	15s. 6d.
Soft Steel	,,	11s. 0d.	,,	12s. 0d.

Tinned iron sheets about 10 per cent. dearer than galvanised. Zinc, 17s. to 18s. per cwt.

These are wholesale prices, only to be obtained by the trade; buyers through retail dealers will have to pay 20 to 30 per cent. more.

Presuming the reader of these articles to be ready to receive some instruction as to the use of these tools and materials, I will now proceed with the subject of repairs. We will first take the re-bottoming of articles, that being about 10 per cent. of the repairing in a general shop. There are several ways of doing this, and to illustrate them, let us suppose, for example, that we have a gallon saucepan, a coffee-pot, and a tin tea-pot. Taking the tin tea-pot first: if the bottom be examined, we shall find that the bottom has a narrow edge turned up and slipped on to the body, and soldered round. This method of putting the bottoms on is called capping, or slipping on; the old bottom must be got off either by holding it over the gas till the bottom is hot enough to melt the solder and allow you to knock it off, or by cutting it off with a thin chisel, holding the chisel as nearly parallel to the sides as possible. When the bottom is off, trim up the rough edges with the snips, and as you will probably have got it out of shape somewhat, true it up on the side stake with a mallet. The bottom can now be marked out by placing the pot on a piece of tin and marking round with a scoring awl, which is nothing more than an ordinary bradawl ground to a point.

Another way of marking out is to mark it before cutting off the bottom, by marking round it with a punch about ¼ in. or $\frac{5}{16}$ in. in diameter. By this method the shape is not altered: this allows for the turn up; it is a very good way to mark toilet can, fish kettle, and other oval bottoms, as they alter in shape when the bottom is off, and it is not easy for a novice to get them true; if the bottoms are marked out in this way, it is advisable not to cut them out till you have offered the article on it and seen if it is too small or too large, which can then be regulated in the cutting. If a shade too large, cut inside the mark; if too small, cut outside: a very little will make the difference; it should show for the job we have in hand ⅛ in. clear cut all round, larger articles more, in proportion to their size. To turn the bottom up, place the half-moon stake (Fig. 27) in the bench, and commence to turn up the bottom; you will find it rather difficult at first to keep the bottom on the tool and to "take up" an equal amount all round. Do not try and turn it up all at once; go round it several times, turning it from you and holding it lightly in the hand; use a mallet, and do not strike too hard. The position of the bottom on the tool at start and finish is shown at Fig. 28, A and B. When you have been twice round, the bottom will be out of shape, or rather out of the flat; lay it on the crease iron or some flat tool, and rap round on the edge lightly with a small hammer: this will bring it right again. Then go round once more on the half-moon to finish it. The tea-pot body must now be scraped clean for about ⅛ in. up the sides, and the bottom slipped on, taking care not to put it on askew: should it happen to be a little too tight to go on, lay it on a tool, and rap it round on the edge with a slight drawing motion of the hammer, take out any puckers that you may put in it by doing this, and you will then find it go on all right—that is, presuming that it was not a great deal too small. Should the bottom be too large, a little more edge may be taken up; the bottom is then soldered round. This method of putting on bottoms is suitable for tea-pots, canisters, hot-water cans, common bachelor's kettles, etc., and many workmen put toilet-can bottoms on in the same way, and though in some shops it would not be considered good workmanship, yet it is plenty good enough for a lot of them. With the coffee-pot we will illustrate the second method of putting on bottoms, called "paning down." In this case, the body has an edge thrown off the body, and the edge of the bottom is hammered down on to it and then soldered: this, as the reader will see, is a degree stronger than the preceding method, as if the bottom were to get hot enough to melt the solder the bottom could not drop off, although it might leak. To resume: knock the bottom off as previously described, scrape clean ½ in. up the sides, turn up the edges, and throw off a fresh edge for the new bottom; this can be done either on the hatchet or with the jenny. The way to edge in the jenny is as follows:—Turn the guide screw so that the guide bar comes about ⅛ in. back from the edge of the bottom wheel, or whatever the amount of edge you require: for large things more will be necessary; place the coffee-pot edge close to the guide, screw down the top wheel middling light, and pressing the coffee-pot slightly away from you, and holding it by the top with thumb and finger, turn the handle of the

machine, raising the coffee-pot as it revolves till the edge is at a right angle with the sides. The bottom in this case being round, will be struck out with the compasses; $\frac{1}{8}$ in. larger all round than the outside of the edge should be enough for small articles like this, but the beginner will most likely require a shade more, as novices generally are rather prone to take up too much edge on the bottoms at first. The edge may be turned up on the half-moon as first described in the case of the tea-pot or in the jenny. If in the jenny, reduce the size a little smaller than it was set for taking up the edge on the body; nip the bottom between the two wheels by means of the screw on top, rest the palm of the hand against the spring that projects from the machine, place the thumb on the top of the bottom and the fingers spread underneath it, press the bottom well away from you, and toward the machine, so as to keep it firmly against the guide bar: if not, it will run out; turn slowly at first, and gradually raise the bottom as you turn, and tighten up the top screw a little after you have been round once or twice. Keep it firm between the thumb and finger. You will be able to turn quicker after it has been round a time or two. When turned up sufficiently, remove and try on; if the bottom should prove too small, rap it back a little, and if too large, take up a little more edge on the half-moon, as it is not very practicable to take more up in the jenny. To be a good fit, it should just spring on with a click when the body is pressed into it. The next thing is to pane down the edge: this can be done on the crease iron, side stake, or any flat tool; hold the pot firmly in the left hand, and with the paning hammer (Fig. 29) close down the bottom: this requires a little practice before you get the knack of hitting the edge without injuring the side of the article on the one hand, or the tool you are working on on the other; though if you err at all, it is best to strike the tool a time or two than the article. After paning down, put up a bick iron, and turning the pot bottom upward, run round the bottom with a square face hammer—on the flat part of the tool, of course: this will smooth it off; all that then remains is to solder it round and try it. I find my space is gone, and shall, therefore, have to defer the third method till the next article.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

MODELLING FROM NATURE.

MODELLING FROM THE "LIFE"—LIFE SCHOOLS AND LIFE STUDIES—PORTRAIT MODELLING—MEDALLIONS — BUSTS — CABINET BUSTS — STATUES AND GROUPS—IDEAL SCULPTURE—SMALL SKETCHES IN DRIED CLAY—TERRA-COTTAS.

IN modelling from "the life," to use the technical expression, two things are apt to bother the beginner—the forms before him are constantly changing, more or less, and colour (which was absent in the cast) is apt to mislead him as to the real nature of form. It is, therefore, well that he should not come to this work till eye and hand have been somewhat practised. It is not usual to admit students to the "life" classes attached to schools of art till they have gained considerable technical skill. To enter these at the Royal Academy, it is the rule (or was in the writer's day) that the pupil should be able to finish a model from one of the antique statues in twenty-four hours, beside giving other proofs of proficiency. In such "life" schools, the work of the modeller consists chiefly in making reliefs and statuettes from the nude figure, and is very much a repetition of that in the antique schools, with the exception that the figure copied is now alive. Little needs to be said about them here. For our purpose it will be more desirable to speak of portrait and ideal work.

It should, however, be observed that modelling from a living person is far harder and more exhaustive work than mere copying from a cast. Living flesh and bone cannot retain the same pose for an unlimited period, like a lump of plaster; and the modeller, knowing this, has to put forth all his energies to make the best use of his time. With the strain put upon brain and eye and nerve, he tires before long. The sitter, too, grows weary, and falls into attitudes or assumes an expression which it is not desirable to copy. Hence it is generally allowed that, whether for the purposes of portrait or for mere study, the length of a sitting ought not to be for more than about two hours. Half a dozen such sittings will commonly suffice for a medallion portrait, and frequently for a bust. By this, it is not intended to be implied that such a portrait should be modelled in twelve hours—far from it, for much must be done between sittings, in completing what has then only been roughly sketched. Photographs may also be made use of in off-times; and after the sittings are over, much finishing will be required to fit the model for casting.

With the public, perhaps the most popular form of portrait sculpture is the medallion. It is also a favourite with modellers; for amateurs, and what one may call "small sculptors," it has peculiar advantages—it offers no technical difficulties, it can be modelled in an ordinary room, and it can be easily and safely cast.

It may be said that, as a rule, a medallion looks best on a flat circular ground, with the head in profile and somewhere about 4 in. high, and with a projection of perhaps some $\frac{3}{4}$ in. For such a head, with so much of the bust as it is necessary to show, a background of some 14 in. in diameter suffices. Medallions in which the head is more than 5 in. high, but less than life-size, are rarely satisfactory. Life-sized medallions in middle relief are better suited for large galleries and monumental purposes than for moderate rooms, in which they are apt to look clumsy; whilst in very low relief, and especially on concave grounds, they are best adapted for decorative purposes, and are far more difficult to manage than when in the style recommended.

Most modellers find that they can model a profile with greatest facility when it looks to the spectator's left, but it is not well to fall into the mannerism of working from one side of the face only. Practice should be made from both sides—a pair of medallions should look towards each other.

For reasons already discussed, a clay ground is to be preferred if the medallion is to be of the kind and size indicated. It is well to form a square slab on the modelling-board of greater breadth than the proposed diameter. The modeller will not then be obliged to waste care in bringing the head scrupulously to the centre. Striking a circle round the head, and leaving a proper space on every side, can be far more easily arranged in the process of casting; and will be mentioned when we come to speak of casting.

A small matter like the present is best modelled on an easel, which will permit of its being readily raised and lowered. The sitter should be placed for the light to fall somewhat from above and somewhat from behind him; this will best bring out the features. The model should be placed in much the same light, *i.e.*, with the back of the head towards the window; but as the work goes on, the easel will need turning occasionally to different lights, that errors may be corrected.

In works of this nature, which will be brought near to the eye and closely scrutinised in every part, perhaps the thing to be desired, next to a faithful likeness, is delicate and conscientious finish. In a female head, especially, all harsh and crude modelling is to be avoided; slightly lower relief than in the male subject is also desirable; and what has been said on softness of outline in low reliefs ought particularly to be borne in mind. The male head calls for more vigorous and decided work. The exact flow of the curved line in which a medallion portrait usually terminates a little below the neck is very much a matter of fancy, though some hold that by the management of its curves may be indicated whether the sitter is stout or thin.

In its completed state, a medallion shows best when hung in much the same light as that in which it was modelled, namely, with the back of the head turned in the direction of the window; and it should be hung as much on a level with the eye as possible. Comparatively few of the many medallions modelled are ever carried out in marble, for, unlike larger works in sculpture, they can readily be preserved in their original brilliancy, and made decorative in simple plaster. They should have gold frames, and the protection of convex glasses.

A more serious undertaking is the modelling of a life-sized portrait bust, and one for which such simple arrangements as the above will scarcely serve. As it will take somewhere about half a hundredweight of clay, it will hardly be the thing to do in a drawing-room. Most modellers are satisfied with a bust-frame such as that figured on a previous page, but some prefer one with only a short upright of iron or wood which does not reach to the neck, and to which they lash such a strength of gas-piping as will bear the weight of the head. The object of this is to allow of the head being turned and its position readjusted, if desired, up to a comparatively late stage of the work. The "pose," to use the technical term, of the head is always a matter of high importance in a bust. The way of carrying the head—whether erect, stooped, or inclined to either side—is often highly characteristic of the individual, and must be reproduced if the bust is to be a striking likeness. The flexible support gives special facilities for doing this.

The modeller ought, however, to be able to satisfy himself on this point during his first sitting, whilst his clay can still be moved freely on the wooden upright.

It is usual to build up a bust two or three days before the first sitting, but in a rough way, and so as rather to make it resemble a barber's block than anything human. When the sitting begins, care should be taken that the three heads—those of sitter, bust, and modeller — are upon the same level, and below that at which the light enters. The turn-table modelling-stool will be indispensable.

The pose is the first thing to be decided. For ordinary portraits it is not usual to

make the face look directly to the front. By turning it to one side or the other, however slightly, a more life-like appearance is gained. Only in quite a stiff and formal bust should the head be kept rigidly to the central line. And attention must be paid to that characteristic carriage of the head, spoken of above. Chantrey, whose portrait busts have maintained the highest reputation in this country, is recorded to have had a way of settling this point before the first sitting by making a rule of inviting his sitter to breakfast, and of thus observing him when he was not aware that he was observed. Sir Francis showed wisdom in his generation. The knowledge that he is sitting for a portrait makes every one more or less constrained, and thus some part of the natural attitude and expression is lost. All who work at portraiture know this, and try, by drawing their sitters into interesting conversation, to make them forget their self-consciousness.

In the first sitting the general proportions ought to be well massed in, and however much the modeller may have trained his eye, it is prudent to take two or three of the main measurements with the callipers. He will thus have some certain standard by which to judge minor matters. It is not pleasant if, after several sittings and much labour, he finds that he has made some important error as to size—that he has too much width in the head from ear to ear, or too much length from back to face. Still, there are "dodges" by which such errors may be corrected without sacrificing any great amount of work. A clean cut may be made into the head with a wire, and a slice taken out, or in like manner clay may be put in to increase width, etc., so fertile is the art of modelling in resources!

In this, and indeed in all modelling from the life, a hand looking-glass will be found of great use. The model seen reflected in this is seen, so to speak, with a new eye, and faults are detected which had escaped notice when looked at in the ordinary way.

The power of rapid sketching will be found of especial value when roughing-in a portrait bust. It goes far towards securing a vigorous, as well as a faithful, likeness: worth consideration also is the greater satisfaction which it enables one to give to the sitter by getting some sort of resemblance early, for sitters are apt to take some disgust at the uncouth and often ridiculous appearance of a bust in its first stages.

The unaccustomed modeller is liable to find trouble in the hair. He may carefully sketch-in its arrangement at one sitting, and at the next find it altogether changed, and his labour lost. There is no certainty about it. The only sure thing with regard to it is that it will never be precisely the same at two consecutive sittings. His best plan is therefore to content himself in the first instance with merely indicating its general character with as few touches as possible, and leaving all detail to a sitting to be devoted to hair especially.

In most of the antique statues the difficulties connected with hair appear to have been avoided by treating it in a very conventional manner; but modern sculptors seek to be more naturalistic, and often with satisfactory results. Without the clay before one, with which to give a demonstration, it is not easy to explain how hair may be modelled. It has to be done with tools, and its texture is expressed by curved lines drawn with a tolerably sharp point, more flowing and continuous for smooth, and more abrupt and broken for curly, hair. Unless just at the parting line, or on those parts of a female head where it is brushed smooth, hair needs no softening down, but best shows its character by being left crisp from the tool. The little ragged fragments of clay which stick along the edges of the tool-marks aid the effect, and should be left untouched. Something even of colour may be indicated in modelling, if by bold touches the shadows are kept deep and strong in reproducing dark, and softer markings are used to bespeak light, hair.

If the locks are long, wavy, or massive, especially in the male sitter, they should be dealt with whilst the clay is still so plastic as to admit of free and bold handling. If smooth or closely cropped, the hair is better worked upon when the clay is in a harder state.

The best way of draping a bust is a point which admits of much discussion. The likeness is increased by giving the ordinary dress, but modern costume is generally allowed to be inartistic. It is, however, possible to take off much of its stiffness and ugliness by large and broad treatment, as, for example, has been done in Mr. Woolner's well-known bust of Lord Tennyson; and this compromise between taste and reason is now frequently resorted to. The Roman togas in which the sculptors of a century ago thought it necessary to make their sitters masquerade would scarcely be tolerated in the present day.

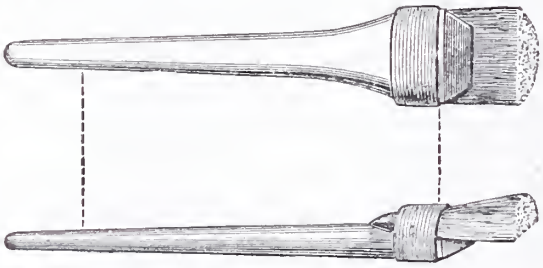


Fig. 17.—Brush for levelling Drapery.

Variety and artistic effect are also to be got without absurdity by making use of an academic or official robe, if the sitter is entitled to wear one, by a cloak, by a dressing-gown, etc. Sometimes we see the difficulty met by a mere piece of loose drapery thrown round the figure—which expedient admits of good artistic, if not of specially consistent, results. And sometimes an excellent effect is produced, particularly with a male subject, when the bust is of the stiff and formal terminal type, by leaving so much as is given of the chest wholly nude.

Sitting for a portrait is an occupation of which people soon grow weary. Few care to give more sittings than are absolutely necessary. The modeller therefore studies to do all that can then be done in the absence of his sitter. Should he resolve on some artistic treatment of the person's actual dress, he will find that he can do so as well with the help of a photograph as if the sitter were present. If he uses a piece of mere fancy drapery, all he needs is to throw a plaid round a plaster cast or a lay-figure, and to copy it at leisure. Drapery for such a purpose, however, needs to be arranged in good and effective folds, and must not be taken at random. A lay-figure, it may be observed, is a life-sized doll with movable joints, used by artists for the arrangement of drapery; and if academic or other loose robes are employed as drapery on a bust, they are best disposed for modelling from upon such a figure.

Drapery on a large scale, though laid in with the thumbs, needs to be shaped and worked up with flat toothed tools, and afterwards levelled (roughly) with a brush to be provided for that purpose. Such a brush is shown at half size in Fig. 17. This is a tool which the modeller can best make for himself. It is of stiff shoemaker's bristles securely lashed to a bit of wood for a handle. Being cut short and level, these bristles cut well into the clay, and bring the folds to level and uniformity; and an amount of finish can afterwards be given by dabbing with the sponge. But in most cases it is in parts only that the modeller cares to give a smooth surface to drapery. He thinks it more artistic if left in many places with the marks of tool and brush.

Good photographs are no small help in carrying out that work which has to be done between sittings, but without them there is much that may then be advanced. During sittings the modeller has to content himself with getting in what he sees roughly, and most of the smoothing and polishing he leaves till off-times. After the last sitting, also, a great deal of finishing will have to be done before the bust is fit for casting.

A word or two should be said about the small portrait busts known as "cabinet busts." In busts, as in medallions, the size should either be that of life, or else very considerably beneath it. A bust a little below life-size looks ridiculous. It suggests, not that the scale is a small one, but that the sitter had a preternaturally small head. In a cabinet bust the height of the head should never exceed four or five inches. Kept within these limits, however, this is a pretty and convenient style of portraiture; such a bust occupies little space, and is more easily accommodated with a good light than one of full size; and if not carried out in marble, the plaster cast can readily be protected from dust by a glass shade.

When the sculptor sets about a portrait statue, or an ideal group, or statue of life-size or larger, he first makes a small clay sketch of the proposed work. This small sketch he is able to play about—to try experiments with—to shape and bend and alter—till he has made every limb and every line compose to his mind. When he feels assured that it is in every respect satisfactory, he has a framework or skeleton of the required size and strength set up, and on this he proceeds to carry out the sketch in the actual proportions. On the large scale it is difficult to make alterations, and he therefore takes these preliminary precautions to avoid them, but they are not always to be avoided. Faults which in the small sketch were imperceptible may become offensive when they come to be magnified. This is said to be the cause why Flaxman's large statues are so inferior to his small figures. He did not make full-sized models. Being more at home in small work, he contented himself with modelling his statues to half-size only; and when all measurements came to be doubled in the marble, there was a doubling of all errors and shortcomings.

Whether his statue, or the figures in his group, as the case may be, are or are not to be draped eventually, the sculptor first models them nude, that the due proportions and proper action of each part may be correctly expressed; and to aid him in doing this he commonly has a living model before him to which to refer—the living models being men and women who hire

themselves out for the purpose at so much per hour.

Small sketches in the round, in which the amount of clay is insignificant, will commonly bear their own weight without needing supports of any foreign substance, and may then be preserved without casting. Clay models in general fall to pieces in drying, chiefly because the wooden or metal supports embedded in them do not shrink with the clay, which consequently cracks. These small sketches may be dried, and, if carefully handled, kept for an unlimited length of time. Dusting them over with Venetian red before they are quite dry will give them something the look of terra-cotta. All dried and unburnt clay is, however, exceedingly fragile.

Such, and indeed any, models composed of clay only can be converted by burning into actual terra-cottas. Some sculptors have kilns on their premises for this process, but this is not within the reach of every one, and there are places where one can get the "firing" done for a moderate charge. If the sculptor desires to have a plaster model reproduced in terra-cotta, he can get this also done by the terra-cotta makers.

Works for terra-cotta, however, demand somewhat special treatment. A sketchy style, bold and free handling, and crisp and decided modeling, seem better suited to it than delicacy. It is a material well fitted to convey force and vigour, and not, as is marble, to embody softness and high finish. Modelling for terra-cotta is hardly suited to a beginner in the art, and therefore it may be as well to abstain from making more than a mere passing allusion to it here, which will be sufficient for my purpose.

Carved Panel for Hanging Cabinet—The Poppy as a Motif.

CARVED PANELS FOR HANGING CABINET.

BY FRED MILLER.

The Poppy as a Motif.

It will be remembered that I gave in page 270 (No. 69) a representation of the chrysanthemum treated for carving, and promised another of the poppy, which I now give. In my notes on the treatment of the chrysanthemum I said that the remarks which I then made upon it would apply equally to that of the poppy, and that what I should say here would bear as much on the chrysanthemum as on that of the well known garden flower now under consideration.

The drawing of a plant from nature does this for one, that it makes one see for the first time what is in the plant that gives it its individuality. We may have looked at a poppy a hundred times, and we may think because we can always recognise a poppy that we know the plant. But let such an

one who has only looked at the plant in a general way attempt to make a sketch from memory, and for the first time in his life his ignorance will be the chief thing he is conscious of, so little does he remember what the growth of the poppy is. I would go so far as to say we see nothing correctly until we have drawn it, and not then in many cases. In my own experience it has only been when I have made several studies of the same plant that I have grasped the peculiarities of its growth—its character. Once drawing it has impressed it generally upon my mind, but every time I have drawn it I have learnt something fresh about it. The designer wants to be constantly sketching from nature to sharpen his perception and to keep himself fresh.

In working from your studies don't think of details at all, let these come of their own accord. Place down the chief forms, such as the principal leaves, and in these panels you naturally start with the chief object, the flower. Work with freedom and with some free implement—charcoal or a brush and colour. Think of the panel as a whole all the time you are blocking out your work, for, by so doing, you will get the leaves to fall agreeably from the stem, making pleasing angles and occupying the space without crowding it. I have watched amateurs attempt to design, and they start by dwelling upon some one feature, or, beginning at the top, work downwards without regard to what else is coming. You cannot get proportion or balance in this way.

Don't be too neat in designing. Knock it about well. Brown paper and Chinese white and lamp-black are the best materials to use. Put in the forms boldly, for with white and black you can soon get an effect on brown paper. Put in and put out until you get the design to come well. These directions may sound truisms, but there is a good deal in the way one sets about one's work. I constantly find in myself a tendency to dwell too much on mere details, instead of going for the general effect and thinking of details afterwards: consequently, the freer the medium is you work in, and the bolder you work, the nearer will you come to success.

Those who want to refer to some good work on plant form, should consult such a book as G. C. Haité's work on plant form for designers, in which some fifty or sixty highly decorative plants are figured, with details of the various parts of the plants.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

41.—Reid's Lightning Brace.

To save time, space, and repetition, let me commence by saying that the tools and appliances noticed, and numbered from 41 to 45 inclusive, have been sent to me by Messrs. Richard Melhuish & Sons, 84, 85, and 87, Fetter Lane, London, E.C., and are supplied by them if they cannot be procured from or through any local dealer in tools. The appliance represented in Fig. 1 is Reid's Lightning Brace. It is of American origin, having been patented in the United States in 1882; but it has only been introduced into the tool market here in the present year, as far as I am aware. It is, as may be clearly seen from the illustration, an adaptation of the twist drill. The shaft which carries the tool at the lower end is fluted with spiral grooves throughout its length. It is fitted at the bottom, or lower end, into a steel cylinder, most of which is hidden within a loose piece of wood turned with two grooves, so that it may be held the more readily by the operator. The cylinder is recessed at its extremity with a square hole, into which is inserted the square shank of the tool used for screwdriving or boring, for there are two tools for these purposes supplied with the brace. The tool is held in place by a pin actuated by a spring that encircles the cylinder, and when pressed by the thumb and finger withdraws the pin, releasing the tool. The head of the shaft is secured within the long, steel, nickel-plated casing

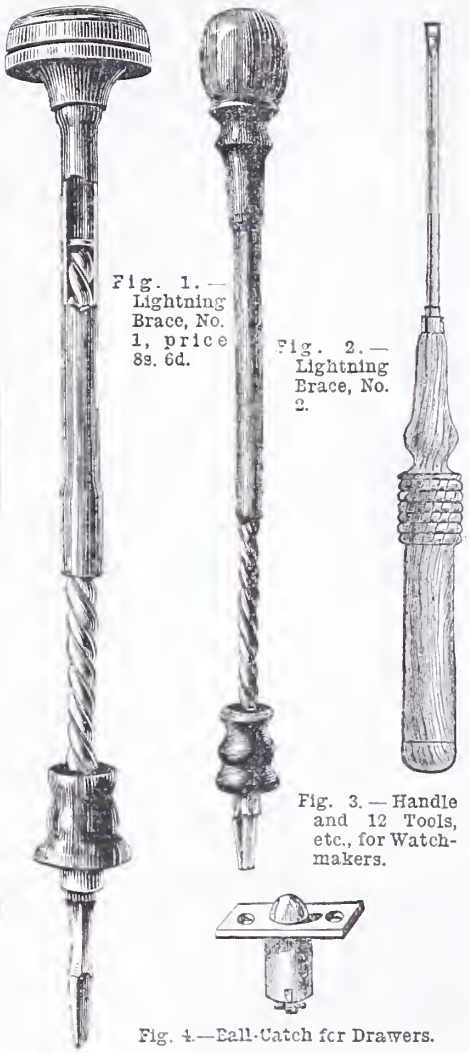


Fig. 1.—Lightning Brace, No. 1, price 8s. 6d.

Fig. 2.—Lightning Brace, No. 2.

Fig. 3.—Handle and 12 Tools, etc., for Watchmakers.

Fig. 4.—Ball-Catch for Drawers.

to which the fixed head is attached, having below it a loose head. The divided head acts as a fast and loose pulley; and by taking hold of the loose part, the case may be drawn to the top of the shaft without removing the tool from screw or hole, as the case may be, and the work of screwing or boring can then be continued by pressure on the fast head. The shaft is actuated by four projections at the end of the casing, which work in the flutings of the shaft. The price of the brace, as shown in Fig. 1, with two tools, is 8s. 6d. Another pattern is shown in Fig. 2, which is supplied with three tools. I do not know the price, but I believe it to be somewhat less than the larger one.

42.—Automatic Screwdriver.

The Automatic Screwdriver is a tool somewhat similar in principle to that which has just been described—that is to say, the blade of the screwdriver, which is cylindrical throughout its length except for about an inch at the top, where it is cut away on both sides so as to enter the notch in the top of any screw, works in a hollow handle partly of brass and partly of wood. In using it the blade must be drawn out to its full length, and inserted in the nick of the screw, which is then driven home by the rapid revolution of the blade, actuated by pressure on the top of the handle. It is a useful tool when rapidity in driving home a number of screws is a *sine quâ non*. When the blade is buried as far as may be in its handle, the tool may be used as any ordinary screwdriver—namely, by turning it either forwards or backwards, as the case may be. Its price is 5s. 6d. It is of American origin, being manufactured by the Decatur Coffin Company, Decatur, Illinois. It was patented in the United States in 1884.

43.—Handle and Twelve Tools, including Files, Broaches, and Saw.

This is a very handy collection of small tools, designed for the use of watchmakers, and equally well calculated to do good service to amateurs and others who require small, fine tools for delicate work. The handle is something like that which is shown in Fig. 3, but differs from that figured in the illustration by the wooden portion being enclosed for nearly half its length in a steel casing, and fitted at the upper end with a small thumbscrew to hold the tools in place. The tools include a remarkably fine saw, used by means of a brass handle, in which it is held throughout its entire length, both edges being available for sawing; eight files of various sections; and three broaches or reamers. The tools are enclosed in a wooden box. They appear to be of German manufacture. The price of handle and tools is 4s.

44.—Parallel Double-Action Screw-Vice.

The Parallel Double-Action Screw-Vice is one that can be recommended to all who require a handy iron bench-vice for small purposes. The body of the vice consists of what I may describe as an L-shaped bit of iron 4 in. in length, having a projecting piece parallel to the lower member of the L-piece, $1\frac{3}{8}$ in. long, whose lower surface is just $1\frac{5}{8}$ in. below the top of the piece. Fig. 5 will give a fair idea of its shape, and assist the reader to understand its action. At A it is pierced for a thumbscrew, capped with a revolving disc, nearly $\frac{5}{8}$ in. in diameter, armed with points projecting upwards. The surface B is also furnished with points knocked up from the metal. The distance between A and B is nearly 2 in., so that the vice may be readily fitted on to a bench of the thickness of $1\frac{1}{2}$ in. At C and D are two holes. Through C passes a shaft, screw-cut from the centre, or nearly so, in opposite directions, and actuated by a small bar passing through the outer end. Through D is a bar. The jaws of the vice travel along the bar through D, being moved backwards and forwards by the action of the double screw. Thus complete parallelism of the upright jaws of the vice is preserved. The jaws open to the extent of $\frac{7}{8}$ in. It is manufactured by Messrs. Peugeot Frères, of Paris, and is supplied at 5s. 6d.

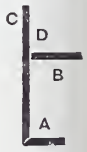


Fig. 5.—Shape of Body of Vice.

45.—Ball-Catch for Drawers.

This little appliance, shown in Fig. 4, will be found useful by those who do not care to put on a lock to a drawer, but yet wish to have a fastening of a less secure description which will act without a key. The lower part, or catch, is shown in Fig. 4, which gives the general form fairly enough, although in the sample before me there is nothing at the bottom as in the engraving, the lower part being a brass casing, shaped like a thimble. This and the plate are let into the upper edge of the drawer; and in the rail above a plate is let in, having a round hole in the centre, into which the ball-catch springs when the hole is directly over it. On pulling the drawer open, the catch is depressed by the plate and the drawer is opened. On pushing the drawer back to its place, the catch springs into the hole as the plate passes over it. The price ranges from 6d. to 1s. 6d., according to size.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letter from a Correspondent.

Cigarette Maker.—Thomaso writes in reply to C. W. B. (*Plymouth*) (see page 191, Vol. II.):—"It is pretty clear to me that you are trying to make an invisible hinge with an imperceptible joint, and that, too, whether the tube is open or shut. The only person able to help you in that would be the local conjurer. Get him to make two or three passes over it with his wand. Just look at Fig. 1 herewith. How does the "knuckle" of the hinge prevent it being soldered close to the tube; and why does it want "letting in?" I said use the small hinges sold for mounting fretwork because they are made of sheet metal, and can be readily bent to fit the curve of the tube. I also said make the tube about 6 in. long. Why do you suppose it is made so much longer than the cigarette if it is not to get over your very difficulty—the tobacco getting shut in the hinge? Open the tube wide and lay it on the table. Then lay tobacco in *one half of the tube*, as shown by the shaded portion of Fig. 2. Now if you

Fig. 1.

Fig. 2.

Cigarette Machine.

mean to tell me that you cannot pass your finger along the hinge and clear out straggling ends of tobacco, you must be a most remarkable young man—far more so than many who have been exhibited. If the tube was short the tobacco would have to be heaped up, as shown by the dotted line in Fig. 2, in order to get sufficient into the tube to make the cigarette, and would then be very likely to get in the hinge. But with the long tube the same amount of tobacco is spread over its whole length, and does not therefore need to be heaped up. When the tube is shut and the stick forced in, the tobacco gets pressed together and finally pushed out of the tube. What if a few shreds of tobacco are shut in the hinge! Can you not push the stick in with sufficient force to tear asunder two or three fragments of tobacco? The girls who make cigarettes with these tubes can. They often have to rest the end of the stick on the table and press the tube down on it with both hands; but that only happens when they have been careless in filling the tube. Making cigarettes is like most other things, it wants practice. I cannot make matters plainer if I write for a week. The answers given to questions in 'Shop' are necessarily brief, and a certain amount of common sense and perseverance in the querist is assumed. If you want to go deeper into the theory of cigarette making, you must continue the correspondence with someone who takes more interest in the subject than I do. *Au revoir!*"

II.—Questions Answered by Editor and Staff.

Paint for Coal Box.—A Veritable Tyro.—I assume that your handsome coal box, which you have covered with a blue enamel, has no carving or enriched work in relief. If this is the case I think you had better well rub it down with ordinary pumice-stone and very weak soda-water. This will be the only way to get rid of the rough brush markings, unless you clean all of it off down to the wood with a strong alkaline solution. As you think to paint upon it some artistic design or floral subject, a properly painted surface would be a very suitable ground. Having cut down the old surface to a good smooth face, as directed, you should make a little quick-drying white lead paint, and stain it to the colour you think most suitable (directions for which see "Plain and Decorative House Painting," Vol. I.). Two or three bare coats carefully spread will then make a solid surface; you can then paint your flowers; varnish afterwards with two or three coats of finest white copal, or maple will do. Varnishing last thing will protect your decorative painting. I hope this will enable you to make your coal box—Aspinall notwithstanding—"a thing of beauty," etc. If there are enriched portions to the article, the only way to clean them off is to "pickle" as above mentioned.—F. P.

Modelling and Casting Bust. — Stucco.—You should first read the articles now printing in Work on the "Mechanical Processes of Sculpture." A cast is made *hollow* by pouring a small quantity of liquid plaster into the mould, which is then turned about so that an equal thickness of the plaster may be deposited over every part.—M. M.

Rusty Boiler.—W. P. (*Blackburn*).—The way to prevent a washing boiler from going rusty is to dry it out carefully after using, and to keep it to the purpose for which it is intended, viz., washing clothes. But if your boiler has, as you state, a ¼ inch of rust on it, it is in a hopeless state, and I can only advise you to throw it away and procure a new one. Galvanised iron boilers, or, to speak properly, galvanised furnace pans, are used for cheapness, and are not to be compared to copper ones.—R. A.

Future Subjects.—Young Reader.—A paper on the subject to which you refer to suit you and all readers is in preparation.

Storage Battery Plates.—Wharmly.—The lead plates you refer to are perforated with very small holes, and these are filled up with a paste made of red lead mixed with dilute sulphuric acid, applied with a wooden spatula until each plate is well coated with the paste. Instructions have been given in "Shop" in Vol. I. Further details will be given in my coming articles on "Model Electric Lights."—G. E. B.

Armature of Model Dynamo.—J. N. (*Glasgow*).—If you do not find what you require in my forthcoming articles on "Model Electric Lights" in the sections devoted to dynamos, write again and give a rough sketch of your machine, together with dimensions of the parts. I must have full details if correspondents wish me to help them.—G. E. B.

Cheap Battery for Electric Light.—W. S. G. (*London*).—Read my coming articles on "Model Electric Lights." You will learn in them how to fit up a battery for the electric light.—G. E. B.

Flux for Soldering.—A. T. E. (*Norwich*).—If you have read the articles on "Soldering" in No. 17, you would have seen that for wrought iron use killed spirits of salts; I know of nothing better. I cannot imagine what kind of flux you mean that has a sandy sediment; I prefer to keep mine as free from any foreign matter as possible. With regard to steel, it is not a suitable metal for soldering, partaking as it does of the nature of cast iron, but the ordinary killed spirits will answer as well as anything in this case also; I have very frequently soldered broken files and used them for a long time without breaking, using spirits as a flux. There are many nostrums sold as fluxes for soldering, but the one to beat spirits of salts for general work has yet to be discovered.—R. A.

Finishing Brazed Work.—F. B. (*Great Horton*).—Without knowing precisely the form and shape of the things that you want to finish up, I can only give you advice of a general character. You will have to get off all the superfluous metal and borax with a coarse file, then use a finer cut file, then a smooth ditto, and lastly go over with emery cloth, of different degrees of coarseness; the shape of the files depends on what you are finishing up; for a fit up for ordinary work I should get a 10 in. flat bastard file, ½ round ditto, 8 in. ½ round ditto, 10 in. flat smooth and 10 in. ½ round; the flat smooth are called hand files, and have what is called a "safe" edge, that is an edge that has no cut on it; this is useful to place against parts that do not require filing whilst you are filing adjacent parts. The emery cloth will sometimes require to be used like a file by wrapping it round a piece of stick to get at different parts of the article. After the articles have been got as smooth as possible, they are burnished—sometimes all over, sometimes only in places; this latter is then called relieving; it is done with steel tools highly polished and of various shapes, called burnishers; and sometimes they are "dead" finished by "dipping" in nitric acid, and after these processes the articles, to preserve the polish given to them, are lacquered. I would advise you not to attempt to make your own lacquer, you can buy it in small quantities cheaper and better than you could make it. You should be able to get it of any good colourman or Italian warehouseman, or you can get it from Messrs. Kirton & Co., Vincent Wharf, Dod Street, Limehouse, E. The method of applying it is, briefly, as follows: The goods to be lacquered are placed on a hot plate or in an oven to get the requisite degree of heat, which is about as hot as you can bear with the back of the hand; have a small tin pot to put the lacquer in, with a wire across it to drain the lacquer off the brush; use a camel-hair brush and take up only a small quantity at a time; apply it to the work in even strokes, going only once over any part of it at a time; if the lacquer gives off a hissing noise the things are too hot; and if the lacquer turns white on the things, they are not hot enough. The art of lacquering seems, and is, simple enough, but it requires a good deal of practice, and I may add a good deal of patience also. I trust these hints may be of some service to you.—R. A.

Lobster Back Cowl and Angles.—F. J. B. (*Slade*).—I send you herewith a diagram of a lobster back cowl section, Fig. 1.; it is often made in two pieces for convenience in hollowing and for economy in cutting out. If you want to strike it out geometrically you cannot do better than take the instructions given for setting out elbows, which you will find in the "Shop" column in No. 45 of Work; these cowl sections being cut on exactly the same principle, though the angle formed by the joining of two cowl sections is a very obtuse one, still the rule applies. Thus you will have to proceed as follows: Describe your circle 10 in. in diameter, and produce through the centre the line A B, and draw also the two perpendicular lines C D and E F; draw both these lines exactly the same length, and then from the top of line E F draw a diagonal line to a point on line C D, just 1¾ in. from the top. This gives the right bevel for section of cowl; the remainder of the directions apply just the same, and you will find this will give you a pattern of the curve for your cowl of 10 in. diameter; larger or smaller are done in the same way; I presume you understand the putting together. I shall be able to write more fully on cowls when I arrive at that portion of sheet metal work which treats of zinc work. For your half-round angles I must again refer you to the diagram just mentioned. If you look carefully at it for a moment or two you will see that if the curved line X X X will, when turned round, form a round pipe, bevelled at an angle of 90°, it would, if cut in halves, form a half-circular trough or half-round gutter of the same angle, but you would, of course, have to allow a little on each side for the wire or beading, say ½ in. There is a rule of thumb method of getting at patterns for angles both in pipes and half rounds that is sometimes adopted, and I have nothing to say against it as it answers the purpose very well, and that is to dip the piece of pipe or gutter into water, holding it at the exact angle required by means of a bevel or bent rule; the watermark round the pipe shows

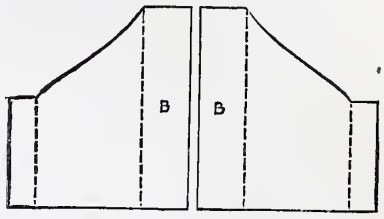


Fig. 2. Fig. 3.

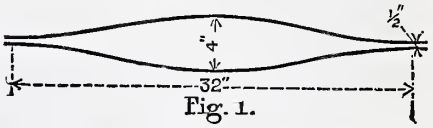


Fig. 1.

Fig. 1.—Lobster Back Cowl Section. Figs. 2, 3.—Ogee Gutter Angle (internal).

where to cut it. Respecting ogee angles, you ask for a simple method of striking out patterns for same. Of any angle I think you will find that you will seldom require any other angles than 90° and 120°, 90° for square work, and 120° for angles of bay-windows, and as ogees vary so much in shape, any method of striking them out to suit all appears to me impracticable. The simplest plan I can give you is to set your bevel to the angle required, place one arm against the back of a piece of ogee gutter, and let the other arm rest on the front edge; take a long scriber, and, holding it quite upright, mark the gutter across (inside of course), flatten it and cut to the line, and you have your pattern for as many as you require of that angle; of course you will remember in bending the pieces to the ogee shape that ogee angles are what is termed "handed," and you must bend them in pairs; thus Figs. 2 and 3 represent two pieces of zinc cut for an ogee internal angle. Supposing they were lying on the bench, just as you look at them on the paper, you would have in bending down the back, which is the part marked B, to take each piece just as it lay, and, placing it on the hatchet stake, bend B downward. I think this will render all clear to you; if in doubt on any point write again. Sheet metal work is continued in this number.—R. A.

Leakage through Slide Valve.—Ch. G. D. (*Brixton*).—You find there is a large leakage when slide valve covers all three parts. I suppose you mean that the escape is seen at the exhaust, and that it occurs when the valve is in the middle of its stroke, at which time the piston would be at one end or other of its stroke. Supposing the valve and face are properly faced up, and do not leak at any other part of stroke of valve, it is hard to see how the steam can get under it when in the middle of its stroke, unless the edge of the slide valve were narrower than the width of the port (negative lap). Surely you would not arrange it so. Perhaps, then, the piston fits badly at one or both ends of the cylinder, so that steam can pass from the steam side to the exhaust side of the piston and so escape. In any failure of this sort, try to test one thing at a time—*e.g.*, test the piston, by taking off the cylinder cover while steam is up; then, while holding the wheel, let the steam drive the piston from the close end to the open end of the cylinder while you watch the amount of leakage; if piston is properly fitted there need be but the merest whiff of steam passing. Test the slide valve in a similar way by taking off both covers, and, while steam is up, and valve connected to eccentric, turn the engine round, watching the exhaust and the ends of the two ports in the cylinder; thus you can hardly fail to discover where the mischief is, and at what point the leak takes place; leave the valve so, turn off steam, open the valve box, and see where valve is.—F. A. M.

Photographs on Tin.—R. P. (*Walkden*).—The plates used are termed "ferrotype plates," being very thin sheet iron covered with a dark coloured lacquer. The process is the ordinary wet collodion positive process same as on glass. The plates are not sold ready coated, but have to be prepared, just before use, by being coated with iodised collodion, then sensitised in a bath of silver nitrate, and developed with an iron developer as follows: Protosulphate of iron, 1½ ounce; nitrate of baryta, 1 ounce; alcohol, 1 ounce; nitric acid, 40 drops; water, 1 pint.—D.

Governor for Engine.—F. H. C. (*South Woodford*).—To the best of my belief, the form of compensating governor you describe has already been patented, or, if not so protected, is at any rate used in very similar form by one or two engine builders. I saw an engine six years ago which had a governor on precisely the same principle, which has also been applied to one form of marine engine governor. While regretting that your idea is not new, I must compliment you upon the very clear manner in which your sketches and explanations have been made. It would save much time and give far more satisfaction on both sides if all querists would imitate your example.—OLLA PODRIDA.

Boiler for Engine.—BOILER.—Double-block tin is not good enough for the purpose you require. Your boiler should be about 20 in. high by 10 in. in diameter, with a fire-box about 12 in. high by 8 in. diameter, and an internal flue or uptake about 1¾ in. or 2 in. diameter (a piece of pipe will do for this part). The gauge of sheet for shell should not be less than 14, and that for fire-box not less than 12 imperial wire gauge. You may use copper, but galvanised sheet steel will answer well. All the joints should be riveted close and well sweated with solder to ensure their being steam tight. You will want a safety valve test cock, steam gauge, and feed pump. The safety valve should not be loaded beyond 30 lbs. per square inch, and the boiler should not be used in the same room as the machine. The quantity of water it would take is of no moment, being small. I quote a *vertical* boiler as the most suitable, but in concluding must warn you that such work is very unsafe and dangerous unless done by a practical boiler maker.—OLLA PODRIDA.

Fire Screen.—SKIBOO.—Do you mean a four-fold screen, or the small cheval screen used to screen the fire, or a decorative ornament to hide the grate in summer? The three differ so entirely that I cannot help you without knowing which it may be. If the paper you mention is floral in design, the forms cut out and pasted on a black background, or on a dead gold paper, yield the best result; if, however, the designs are unsuitable for cutting out, treat the screen as a wall surface, with skirting, dado, chair band, filling, and frieze, and the effect will probably be satisfactory.—E. B. S.

Four-Folding Screen.—NOVICE.—Very soon a complete series of papers on folding screens will appear in our columns. Pending those, I may say, briefly, that the screen is usually made of light wooden framework, covered with canvas, such as paper-hangers use; the hinges are either of webbing, like those on a clothes-horse, or the metal double butts sold on purpose; if four-fold, a good size is 6 ft. high by 2 ft. for each fold, but it is entirely a matter of taste and convenience. The after-covering is so various that I cannot suggest it here. Gold Japanese leather paper is perhaps the best for an all-over surface.—E. B. S.

Medical Coil.—A. M. (*Edgware Road*).—From the fact of there being a box with tinfoil under your coil, I infer that yours is a spark coil, not a medical coil. There should be two wires coming out of the box: one at each end. Connect one of these to the pillar of the brake and the other to the spring. I cannot understand the rest of your letter, as you do not say what size of wire you are using, nor on what part you wound the six ounces. See my replies to J. M. (*Nottingham*), ELECTRIC LUBRICATOR (*Manchester*), W. B. C., and others in back numbers. A series of articles on coils will be forthcoming when room can be found for them.—G. E. B.

Sealing Battery Cells.—M. N. (*Plymouth*).—Melt two pounds of pitch in an iron ladle, and add to it 1 lb. of beeswax and 1 oz. of tallow. This mixture will serve the purpose; or you may use pitch alone, or sealing wax, or cobbler's wax if it suits your means. Anything of this kind will do. The zinc cells may be of any size or shape. The usual size have nearly a quart capacity. The zinc should be at least ⅛ in. in thickness.—G. E. B.

Manager of Electric Light Installation.—W. J. (*Swansea*).—To qualify for the post of manager of an electric light installation of any magnitude, you should enter a school of electrical engineering, or become the pupil of an electrical engineer. I suppose, at the outset, that you have had a fair elementary education, and have studied theoretical magnetism and electricity, for, without a thorough knowledge of these subjects, you would make but little progress. To theoretical knowledge must be added real practical knowledge, only obtainable in the work itself. It is quite possible there may be several men in charge of electric light installations who have learned to look after the lights and machines from seeing others do it, but these men cannot be said to be competent to manage any other, since they do not know anything of the principles of electric lighting.—G. E. B.

Electric Depilatory.—F. A. (*London, S.W.*).—As you wish to remove hairs, the apparatus you require is an electric depilatory; not a cauteriser. You will require a set of insulated needles, cost 6s. a pair, and some three or four cells of a chromic acid battery. The needles are inserted in the skin at the root of the offending hair, and then heated by the current to destroy the root. Apply to T. Gent & Co., Braunstone Gate, Leicester, for the necessary apparatus and instructions.—G. E. B.

Hot-Water Towel Airer.—ONE IN DOUBT.—I think with the aid of these sketches you will be able to fit up your towel airer successfully. No expansion pipe will be required, but an air cock (D in illustrations) should be fixed in the highest point of the coil to allow the air to escape while filling. Fig. 1 shows method of connecting where

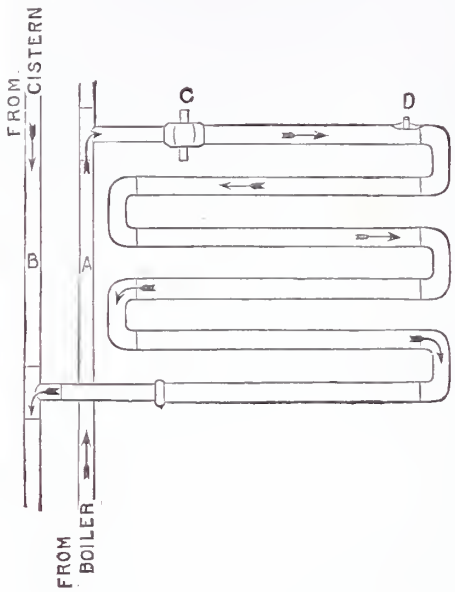


Fig. 1.—Hot-Water Vertical Connection.

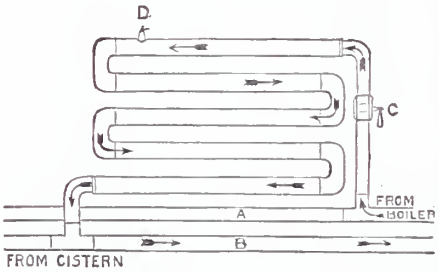


Fig. 2.—Hot-Water Horizontal Connection.

the supply pipes are vertical, and Fig. 2, when they are horizontal. A is the flow pipe, *i.e.*, the pipe from the top of boiler, and B the return pipe; C is a cock to stop the circulation when the coil is not required. Ordinary wrought iron hot-water pipe is shown in sketch, but cast iron coils would be fixed in the same manner.—T. W.

Alarm Bell.—BOMBARDIER.—If you will get for one penny No. 66 of WORK, and turn to p. 226, you will there see an illustration showing exactly how to connect up the wires to a continuous ringing bell. If used for a burglar alarm, a separate battery should be employed to foil Bill Sykes should he cut the main battery line wires. There will be waste in either case if the bell is not attended to in time.—G. E. B.

Smallest Incandescent Lamps.—W. W. (*Newcastle-on-Tyne*).—The smallest incandescent lamps are those of the "Fairy" or "Gem" pattern, as used for illuminated scarf pins. They are also called "Pea" lamps, because they are about the size of large peas. They cost from 5s. to 7s. 6d., and may be obtained from or through any dealer in electrical instruments.—G. E. B.

Galvanometer.—G. E. S. (*Berkeley*).—A description of this instrument, to be of any use, should be illustrated, and we have not room for this in "Shop." The subject will be dealt with in a short article at the earliest possible opportunity. The machine you mention will be described in the series of articles on "Coils," now in course of preparation. G. E. B.

Cabinet Sketches in Perspective.—PERSPECTIVE.—Most decidedly, miniature sketches of cabinet work should always be drawn according to the rules of perspective. You say, "or is it best to train the eye to the different perspective views, as I find the rules of it very confusing?" No doubt you do, but after a few years practice you will find they are not so complicated as they appear. It is very much a matter for regret when a person wants to learn any particular trade or art without first properly acquiring the rudiments of it, and I am sorry to learn from your letter that you must be included in this class. Begin at the beginning and you will "train the eye." I—as all others have to do—had to undergo a regular course of training by an experienced master (learning the rules first), and now I draw by "hand and eye." Get as many book catalogues as you can afford postage to send for, and you will find plenty among the contents suitable for you. Don't fail to get Messrs. Cassell & Co.'s and Messrs. Blackie & Son's (Old Bailey) catalogues. In the former you will find one named "Drawing for Cabinet Makers," 3s. Do not forget that if you intend to learn any branch of the art of drawing, and start on the "hand and eye" principle, when a few years have elapsed you will regret not having learnt the rules properly; one reason being the inferiority of your work, and another being ignorance of the rudiments whilst practising finished drawings.—J. S.

Engraving on Metal.—BRASS.—In answer to your letter I have to state that in nearly all engravers' shops work will be done in a different style. Your remarks I reply to *in seriatim*:—(1) Tools of whatever description may be purchased at all sorts of prices. (2) Chisels, if untradesman-like, are most useful tools in the hands of a skilful workman. (3) This paragraph is rather dense, but we always used the chisels wherever we could with advantage. (4) The drawing on of letters may certainly be done with pen and ink, but I am stupid enough to prefer my own way. (5) The artistic plate engraved in three different styles may not be appropriate for outside use, but it is there, and has been for the last fifteen years, and, although much worn, can still be discerned; and as I had nothing whatever to do with the design of the plate, the matter ends. (6) The thickness of the plate depends upon the quotation for the work; in my old shop the gauge of the plate was decided upon by the customer, who was informed of the cost, but nowadays I daresay that the plates are so thin that BRASS often cuts through them. (7) The cement does not find favour with our practical friend, and he has not met with its use in "all his travels." Perhaps he may find occasion to travel a little farther. (8) The "setting off" gravers and chisels is a matter of personal use; I could not work with another man's tools, and *vice-versâ*. (9) Undercutting was always insisted upon where I learnt my trade, and the tool is the same as for outlining used in a different way. (10) I need say nothing of this, the removal of the "burr" being quite a matter of shop practice. (11) The above remarks apply here. In conclusion, BRASS should be a little more courteous, as civility, even in letter writing, costs nothing.—N. M.

Subjects in WORK.—INQUIRER.—You and other correspondents who are anxious to know if particular articles have appeared in Vol. I. of WORK, cannot do better than buy an Index to that volume—which Index can be had of every bookseller for one penny. All information possible will then be before you.

Cheffonier.—INFLEXIBLE.—I regret to say that your cheffonier paper is not suitable for WORK. You give your name, but not your address. Kindly forward the latter to the Editor and your manuscript shall be returned to you.

Tempering Pivot Drills.—W. K. (*Bolton*).—Heat to cherry red and plunge into a tallow candle or into soap, hardening and tempering being thus done at one operation.—J.

Book on Metal Work.—SUCCESS.—"Metal Work and its Artistic Design," by M. Digby Wyatt, was published in 1852, by Day & Son, Lincoln's Inn Fields, at the price of six or seven guineas, I forget which. You may get a copy second-hand for about £2. Try Batsford, High Holborn, Sotheran in the Strand, or Bumpus or Quaritch in Piccadilly. The book is a splendid folio with fifty plates of old metal work in iron, bronze, and gold, with eighty-one pages of letterpress.—J.

Gesso Work.—A. B. C. (*Houndsditch*).—The composition for gesso work is sold by the Society of Artists, 53, New Bond Street, W. The price is 1s. 6d. for two tins; one containing the liquid and the other the powder. These are mixed when required for use; full directions are given on the tins.—E. C.

Cheap Cameras.—T. E. B. (*Landport*).—You must not trust too much to the promise of advertisements. It is true that a proper photograph can be taken without either camera or lens, a light tight box and a pin hole being sufficient, but the practical utility of it is quite another matter. Any apparatus to cost less shillings than an ordinary well-made set will cost pounds, is its own answer—a mere toy. Ten shillings would purchase the remaining necessaries for producing a photograph, or even half a crown, by going the cheapest way to work.—E. D.

Wire-wove Roofing.—PATIENCE.—I have seen wire-wove roofing used for many purposes, but could hardly say what effect it would have on plants if used for a greenhouse roof. Personally, I should not care to venture the experiment. The light transmitted is not so pure as that through glass, and might have the effect, as you fear, of making the plants sickly. I can see no advantage in using the wire-wove for such a purpose, except its non

ability to breakage, and if your greenhouse is ar enough away from the genus boy, who delights i throwing stones, I should advise you to stick to lass.—G. LE B.

Transfers for Slides.—A. E. B. (*Cromer*) asks: "Where can I obtain transfers to stick on glass, uitable for magic lantern slides?"—I should say in general way, these may be obtained at any place where they make the lanterns a speciality. A. E. B. ay, I know, obtain what he needs of Lancaster nd Sons, opticians, Colemore Row, Birmingham. have no personal interest in recommending fr. Lancaster, but I know A. E. B. can get what e requires of him—transfer varnish and full direcions. He would do well to write for his catagogue, price 6d., it contains much uscful information. n article on the subject of lantern slides will hortly be in the hands of the Editor.—O. B.

Barometer.—W. B. (*Leith*).—W. B. says:—"I ave a barometer, the tube of which has become ery dirty, kindly let me know how to clean it." V. B. does not say if it is the inside or the outside f the tube which needs cleaning; I presume it is he former. I also presume the dirt referred to is ome impurity in the mercury which has stuck to he tube. It would have been much easier to nswer the question if a little more information ad been given. If it is what I suppose, W. B. ust empty the tube and fill it with nitric acid, vhich will dissolve the impurities, after which it ust be well rinsed out with water to remove the cid, dried, and refilled with mercury, which for his purpose should always be distilled, as mere iltering does not render it free from all impurities. —O. B.

WORK Volumes.—W. E. R. (*Southgate*).—These re now sold bound in cloth, with index, price s. 6d.

Wringing Machine.—(*Ditton*).—If you take ny advice you will not attempt to make the above ourself, for even if you buy the rollers there are till a great many little things wanted; and by he time you bought all the things you could not nake, and the hard wood to make the frame, etc., ou would have spent as much money as you could et one for complete. If you write to Harper Twelvetrees, of 8, City Road, London, E.C., they vill send you an illustrated catalogue, and I think ou will find that they supply them complete for as ow as 20s. each.—E. D.

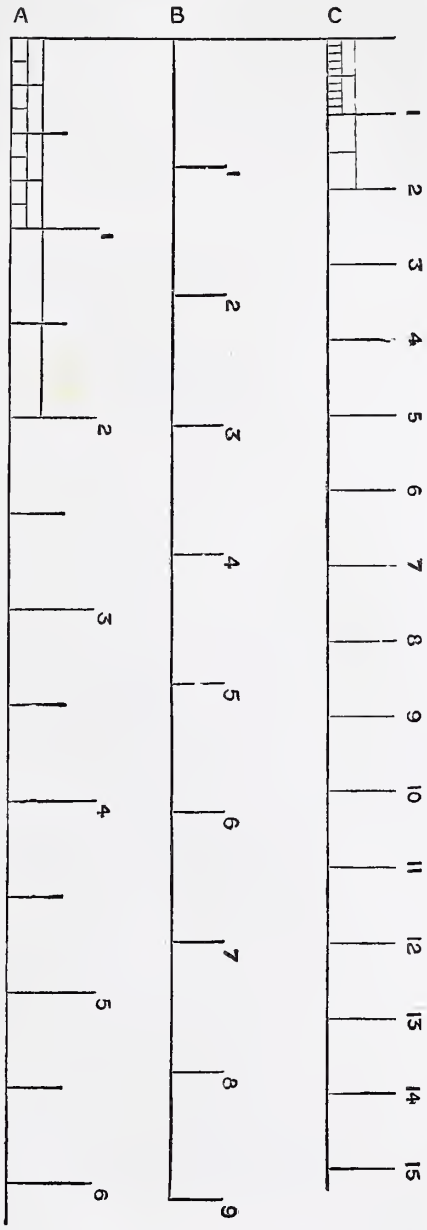
Wire for Coil.—PERPLEXED.—In the absence f a more definite statement respecting the contruction of your coil, I am at a loss how to dvise you. You omit to state whether or not you ave an iron core inside the paper cylinder. The oil will be useless without one. You do not say ow the magnet of your contact breaker is made. Have you coiled any of the primary wire on the legs f the magnet? If not, how can you expect the rake to move? The legs should be covered with ne layer of the primary wire. Again, you have ot stated the length of the core; but, although you ave omitted this, I am sure you have too much rimary wire. Two layers of No. 18 cotton-covered vire are quite enough for the primary; not 2 lbs., as ou have, according to your letter. I have given in ack numbers of WORK some hints to other correspondents on the construction of their coils. If you o not find what you want there, look out for my orthcoming articles on "Coils," and in them you vill find full instructions. You should write as ully as possible when you make your questions.—G. E. B.

Foot Warmer.—H. J. (*Southampton*).—The eason the foot warmer collapsed was because it was not filled properly; probably it was only half r three parts full. If it had been quite full when crewed down, it is very evident that the sides ould not have gone in, as they would have had owhere to have gone to, water being compressible nly to a very small extent, but if only partially illed there is a space left filled with air; this becomes rarefied with the heat of the water and o takes up less room, forming a partial vacuum. The pressure of the air on the outside then causes he sides to collapse. I have had lots of cases like yours, but the people have mostly owned that hey did not fill them, not knowing that it made any difference. Tell your customer to fill it right up to the screw, and there will be no further rouble.—R. A.

Soldering.—INQUIRER.—In reply to INQUIRER, I must say that it will hardly be fair to others, as there is such a pressure on "Shop," and so many awaiting replies, to take up space in describing articles and giving instructions that have appeared in the body of the journal; if INQUIRER will invest 3d. in the purchase of Nos. 17, 23, and 32, he will there find all the information he needs; generally speaking, if any advice is wanted on special points, I shall be very pleased to supply it. A piece of advice to new subscribers: make haste and get the back numbers, and resolve to keep on with it.—R. A.

Pie-Making Machine.—W. W. (*Sunderland*).—I am truly sorry that I do not know of any such machine. If I might suggest such a thing, I sbould think a good wife was about the best pie-making machine to be had; but speaking seriously, if there is anything like what you want, you would get it from W. Kent, manufacturer of domestic machinery, High Holborn, London.—R. A.

French and English Measures.—J. W. Y. (*Loughboro'*).—One French mètre is equal to 39·37079 English inches, or 3·280899 feet, or 1·0936331 yards. As the mètre is thus rather over a yard in length, I do not understand your enclosed scale, which you say is "in mètres." The mètre is divided into 10 equal parts, called décimètres, each of which is



French and English Measures.

divided into 10 equal parts, called centimètres, which are further divided into 10 equal parts called millimètres. In the following table, A is divided into inches, B is your own scale, and C is divided into centimètres; and you will see that 10 centimètres (or 1 décimètre) are nearly equal to 4 in., being exactly 3·9371 in.—F. B. C.

Washstand, etc.—FURNITURE.—You will doubtless have observed, before you see this reply, that I have given designs of wasbstand and dressing-table to a previous querist. From your letter I should say that the same would just suit you. If, however, you do not care for one, or both, write again, stating whether you want an ordinary or elaborate design.—J. S.

Model Turbine.—NO NAME.—Before one can give you instructions on how to build a turbine of half-man power suitable for driving a dynamo, it will be necessary for you to give the volume and pressure of water at your command, since the turbine will have to be built to utilise your available supply of water. I must, however, leave this in the hands of another contributor, as it is out of my line of business.—G. E. B.

Soldering with Paquelin Lamp.—NO NAME.—The Paquelin lamp does not smoke the work in the least if it is not applied to the work till the flame becomes blue, which is about a minute after being lighted. This lamp has had some severe tests lately in our workshops, and the opinion we have of it is that it fully bears out all that is claimed for it. I am aware that the ordinary benzoline blowpipes smoke to some extent, but you will not find this the case with the Paquelin. In answer to your second query, I know of no other spirits that are satisfactary to use with blow-lamps than methylated or benzoline, but there is no need to use the former.—R. A.

Crucibles for Melting Brass.—H. H. (*Southgate*).—The small crucibles you speak of are made of plumbago. They are made under Morgan's patent by the Patent Plumbago Crucible Co., at their works, Battersea, London, S.E. The melting point of brass varies considerably, according to its composition, ranging from between 750° to 900°.—R. A.

Telescopes.—A. G. W. (*Bournemouth*).—I can't refer you to any book until I know more precisely what you want. You should frame a question containing details of the information that you seek with regard to the "making of a telescope," "the adjustment of the lenses," etc. If you do this I shall be able to help you.—E. A. F.

Etchings, Drawings, Lithographs, etc.—READER.—It is almost impossible to explain satisfactorily to you the difference between the various processes as desired by you, for even if I could show you examples of each, you would require experience to identify some of them at sight; but broadly, etchings are of two distinct sorts: some resemble pen-and-ink sketches, others water-colour drawings in sepia; they are known respectively as "au burin" and "eau forte." Oleographs represent colour-printed copies of oil paintings; chromos the same of water-colour drawings. Lithos, or lithographs, are prints made from a drawing on porous stones specially prepared, and may be printed in many colours or only one, according to requirement of artist; but most litho prints or lithographs have a woolly appearance. Litho tint mounts are mounts tinted by litho process. India paper mounts are distinguishable by the engraving being surrounded by a margin (say of 2 in.) of toned paper, mostly primrose or buff colour. Flock mounts are used by photographers, and resemble velvet almost in effect.—F. W. B.

Cleaning Brown Leather Belts.—T. R. (*Belford*).—Various compositions for this purpose are sold by saddlers, shoemakers, etc. Some recommend vaseline, but perhaps none of these will be much better than soft soap, which keeps the leather beautifully pliant; it must, however, be well rubbed off, or it will cause dust to stick.—S. W.

China and Glass Drill.—J. H. S. (*Wigan*).—Steel drills are of very little use in drilling glass and china. You need a special drill, or bit, which is made of a splinter of rough diamond cemented in the end of a round piece of tin, and which fits on to the end of a holder made on purpose for china drilling. You can buy both drills and bits ready made, or, if you have a lathe, can easily make your own. If you wish for directions, kindly let me know. I suppose you are familiar with making the rivets, and that it is only the making of holes which presents any difficulty? If there is anything further you wish to know, write again.—W. E. D., Jr.

Carving in Stone.—PRO RE NATA.—When you have read, as you should have done, the introductory paper on the "Mechanical Processes of Sculpture," which appeared in No. 53—the first number of Vol. II. of WORK—you will find that modelling in clay is the first step to the sculptor's art. Mere carving in stone, such as is seen in public buildings, large houses, etc., is carried out by the workman from rough drawings only, and not from a model made for the purpose, first in clay and then in plaster.—M. M.

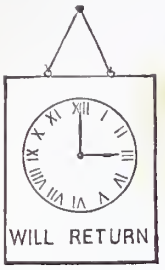
Moulding Machine.—A. S. (*London, W.*).—Instructions on working a moulding machine are scarcely needed by a man who can work a planing machine, because their methods of operation are the same. The only difficulty lies in the shaping and tempering of the cutters, which is a matter of practice. The cutters are either milled or filed to shape, and tempered at a light straw colour, and a few days' practice should put you in the way of this. You will not get much help from books. Those of Powis Bale, "Woodworking Machinery," 12s. (Lockwood), and Richards' "Woodworking Factories," 5s. (Spon), are the best, but of little value from your point of view. Except that they possess some historical value, books of this kind are out of date in a few years, in consequence of the constant alterations and improvements being made in this class of machinery.—J.

Springs.—MARKAM.—If you want a small quantity only go to one of the Birmingham gun makers; if a large quantity, go to Jessop, of Sheffield. To temper, heat the spring to a bright red, and plunge into water. Then hold the spring over the fire to dry the water off, and dip into the fat of a tallow candle. Hold the spring in a clear fire, turning it about to warm it evenly until the oil blazes up, and then remove from the fire, and allow it to cool. —J.

Slide Valve.—F. C. (*Cardiff*).—I shall give in "Shop," as promised, dimensions, etc., of wooden model mentioned on page 822, Vol. I., of WORK.—T. R. B.

Time Indication Patents.—M. S. R. (*Barrow-in-Furness*).—Appointment indicators are patented and in use in the United States. In many offices and business places of New York they may be seen, with an attachment which simply rings a few

minutes before the hands near their destination, so that this gentleman has had the *same idea* as the American inventor (if he has not seen it previously). Such things do occur, for I thought I had invented a plan useful in another trade, but found it actually in use at Newark, near New York. So people have ideas in common. A silent one is largely sold and used over here. It is a dial of small timepiece size, with the hour and minute hands; and the party going out to lunch or any business, he has it hanging inside his glass door, and turns the hands to the time he will return, thus, 3 o'clock—much neater than the Liverpool or London way of affixing a written paper, thus—



Will Return to Office
3 o'clock—
Gone to Lunch.

I often meet this, especially with regard to small lawyers.—J. S.

Papers on Dynamos. — INVICTA (*Birmingham*).—It is just possible that this reply and the first papers on dynamos will appear somewhere in Vol. II. of WORK. The drawings are not to scale, but measurements are given in a set of tables, and castings of the various parts can be bought at a cheap rate. Directions will be given on making coils.—G. E. B.

Leclanché Battery for Small Electric Lights.—D. O. W. (*Ipswich*) writes:—"I have had a 2½ c.p. lamp to enable me to see the time at night for the last two years. I use twenty-five No. 2 Leclanché cells arranged in series of fives, and I get a good strong light, sufficient to see to do anything in a large room 22 by 17 ft., for between five and ten minutes. It may be longer, for I have never let it go its longest. The advantage of the Leclanché cells is, they are no trouble, give no smell, require no lifting, and are always ready. They may require a little water, say once a year." Many thanks for your little bit of experience. If you had a fewer number of cells, the lamp would not be so bright. Its efficiency proves that you have just the right number of cells and that they are properly arranged.—G. E. B.

Door for Greenhouse.—PHI.—Thanks for your criticism of the sketch, on page 812, Vol. I., of the method of making the joint of the belt rail for glass door; but, in consequence of your being in ignorance of the exact terms of the query to which it was a reply, your letter has really no bearing at all on the subject. The sketch simply showed the querist the method of levelling the rail and stile, in contradistinction to a proposed method of mitreing, and has nothing whatever to do with either the rebating or moulding, as you seem to suppose, both of which matters and their details being perfectly well understood by the querist. Of course there are many different methods of obtaining the same end in door construction, as in everything else, and I have always found that each workman thinks his own individual style the best, and all others wrong, although, as a matter of fact, one way is as good as another. Personally, I am cosmopolitan enough to believe all methods good if the result is a workmanlike job without a heavy expenditure of time, and hope that our "Shop" replies may tend to widen the ideas and broaden the capacities of all thinking readers. Perhaps the fact that the "intelligent comp.," in making up the column on page 812, in which the sketch appeared, turned the cut upside down without referring to the reading matter, has fogged you a little, for, as it stands, it shows the narrow part of the door stile at the bottom instead of the top, its proper place; but I daresay if you tackled the "comp." with the mistake he would shove it on to the "reader." I am glad you are so satisfied with the replies in the "Shop" columns, and hope that, with the rest of us, you may derive much benefit from them.—G. LE B.

Heating Greenhouse.—NO NAME.—Your idea of erecting a box outside your small greenhouse, and putting your lamp therein, is fairly good, and, if carried out as described, should prove quite effective. Make your box large enough to contain your stove, with a tin box or boiler on top, capable of holding about three gallons; run a piece of 1½ in. zinc tubing from your boiler round the interior of the house and back to the boiler; let the outlet end leave the boiler near the top, and the return end enter it near the bottom—this will ensure a slight circulation of the hot water through the tubes. You should have no difficulty in regulating the heat to about 50° with an arrangement of this kind, but see that you keep the boiler always full, and have an escape hole for any steam pressure that may generate within it, or it may prove a source of danger. The 1½ in. zinc tubing you can purchase, and, if you are handy with a soldering bolt, fit it up yourself.—G. LE B.

Ventilating a Greenhouse. — H. J. T. S. (*Guernsey*).—Without knowing the construction of your greenhouse, and your mode of heating it, it is rather difficult to give a definite answer to your query, but the following hints may be of service. As the heated air will ascend to the apex of the roof, it is there that you must make your arrangements to draw it off, and as the ordinary ventilating boards, or louvres, readily admit cold down draughts on windy days, I would advise you to discard their use altogether, and fix a ventilating cowl made of zinc in their place. There are many of these devices to be had, and one of the best is "Boyle's Patent." It admits no down draught whatever, and has a continual outward suction. You can procure these ventilators in many sizes, and can select one to suit. As to the inlet of air, to supply the place of that drawn off, you must be very careful so as not to have a rush of cold from the outside. If you can manage to cause it to pass under or over your heating apparatus before entering the house, it would be a great advantage, as then the chill would be taken off, and the risk of damage to plants lessened. Failing to accomplish this, you might try covering the inlet openings with the finest wire gauze on both sides. I hope these hints may prove serviceable to you, but if not, write again, giving more details as to the construction of your greenhouse, and your mode of heating it.—G. LE B.

Water Motor.—E. G. (*Leyton*).—A small turbine would probably suit your purpose; one of the form known as "Jouval's" would be fitted to the head of water at your disposal.—F. C.

Gold Leaf.—AMBITIOUS.—As from your letter you are not, apparently, used to the gilders' tip and cushion, it would be much the best for you to buy "transfer gold," as it is termed, in which a piece of tissue paper is inserted between each leaf, and the book having then been subjected to mechanical pressure, each leaf of gold sticks to the tissue, and is drawn out of the book affixed to the same. You can easily perform the transfer process yourself, by getting some white tissue and rubbing over the face of it, regularly, a piece of white wax—that used by laundresses is the best. Then cut your paper up and, lifting a leaf of the book at a time, place the tissue upon each leaf of gold. When all are inserted, subject the book to a little even pressure and your end will be gained. To question No. 2, 6d. per pint is usually charged; chemists may ask 8d.; shellac is about 1s. per lb.—F. P.

Spiral Springs.—T. J. (*Sedgley*).—You must certainly anneal your springs to cut them and then re-harden and temper as you say, but the cost will be considerable. If you can do this you should be able to make the springs from the soft steel. You could make, or have made, a mandrel on which to coil them and cut them off hot; this would save the trouble of annealing. You might arrange with the spring makers to let you have the lengths of coiled spring unhardened, and cut them up and harden yourself.—F. C.

Bronzing Plaster of Paris. — RESTORER.—Figures cast in plaster must first be made non-absorbent before they can be satisfactorily bronzed. To effect this, if cheapness is a consideration, give the casting two or three good coats of warm patent size, and then try it with a coat of copal varnish. The latter will show by "bearing out" that the suction is stopped, or very nearly so, in which case the figure is given another bare coat of "hard drying" copal varnish upon which the dry bronze is rubbed with a little piece of wash leather. The size must dry hard between each coating, and the varnish for bronzing must be just sticky to the hand, but not at all wet. The best job is to use varnish diluted with a little turps instead of the size, as the former gives a harder surface. If the work is very delicate, mind in using size that you do not rub off the sharpness of the casting. For green, or copper, bronze effect, paint a suitable colour after sizing, then varnish and bronze prominent parts only.—F. P.

Ceiling Paint.—CONSTANT READER.—The difference in cost between painting an old wooden ceiling and whitening it only is very great. To properly paint it you would first have to wash off and scrape all the old whiting away from the wood, and then, when thoroughly dry, give it two coats of oily paint which need not be white. This would stop the suction of the wood, and you might then make a decent job of your ceiling with two more good coats of white lead paint. I am afraid painting four coats would be too expensive for you, but the following might suit your case. Thoroughly clean off the old accumulated whiting, and give two coats of white lead paint where the stains are, all over if necessary; this will kill the stain, and you will be able to make a nice white ceiling by distempering on the paint. The cheapest thing you might try, but which I cannot guarantee will be successful in your case, is to give the stained parts a thin coat of plaster of Paris and water, applied like distemper, with an ordinary brush. This will very often kill a stain in an old plaster ceiling; suppose you try it. Painting the stains is a certain remedy.—F. P.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. L. B. (*Oxford*); J. C. M. (*Bristol*); J. D. (*Belfast*); J. K. (*Manchester*); R. H. (*Sowerby Bridge*); NO NAME (*Sheffield*): P. F. (*Liverpool*); A. J. (*Faversham*); R. A. P. (*South Kensington*); T. K. M. (*Whitehaven*); R. J. A. (*Seacombe*); W. J. V. (*Penge*); G. B. (*Accrington*); JEWELLER; P. N. (*Halifax*); W. R. W. (*Poplar*); A. X. E.; D. F. (*Glasgow*); BETA; J. S. (*Heaton*); T. H. (*Walsall*); PERSEVERANCE; S. W. P. (*London, E.C.*); F. L. P. (*Whitworth*); G. W. (*Folkestone*); G. H. B. (*London, W.*); T. S. (*Spilsby*); T. H. B. (*Queen's Park*); CODGETO; W. J. W. (*Torquay*); W. P. (*Kingsland*); D. B. D. (*Glasgow*); E. H. B. (*Stoke Newington*); D. P. B. (*Truro*); ONE INTERESTED; R. B. B. (*Edinburgh*); J. P. (*Manchester*); W. H. S. (*Brockley*); W. E. (*Glasgow*); W. C. T. (*Birmingham*).

"WORK" EXHIBITION

(1890-91),

To be held at the Polytechnic Institute, Regent Street, London, W., from Dec. 29th, 1890, to Jan. 10th, 1891, inclusive.

Full particulars, including Classification of Exhibits, List of Prizes, Medals, and other Awards offered to competitors, are given in No. 70 of "WORK."

Forms of Application for Space are now ready, and will be sent post free on receipt of a communication addressed to The Secretary, "WORK" Exhibition, La Belle Sauvage, Ludgate Hill, London, E.C.

The following is a Summary of the Classification of Exhibits:—

Group I.—WORK in Wood.
Group II.—WORK in Metals.
Group III.—Tools for WORK.
Group IV.—WORK in Design only.
Group V.—WORK in Printing.
Group VI.—WORK in Domestic Appliances.
Group VII.—WORK in Wearing Apparel.
Group VIII.—WORK in Painting and Decorating.
Group IX.—WORK in Textile Fabrics and Leather.
Group X.—WORK in Musical Instruments and Music.
Group XI.—WORK in Watches, Clocks, Alarms, Bells, etc.
Group XII.—WORK in Building Appliances and Material for Building.
Group XIII.—WORK in Chemical Processes and Products.
Group XIV.—WORK in the Utilisation of Waste.

Trade Note.

THE following approximate estimates of the population of the largest American cities on June 1st have been made, based on the census returns which are almost complete:—New York, 1,627,227; Philadelphia, 1,040,449; Chicago, 1,000,000; Brooklyn, 930,671; Boston, 417,720. The population around New York Harbour, including New York, Brooklyn, Jersey City, Hoboken, and other towns, is estimated to reach 2,800,000. Chicago claims that her census return will exceed that of Philadelphia, giving her the second place among the American cities.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	..	..	..	1s. 8d.
6 months, "	..	..	..	3s. 3d.
12 months, "	..	..	..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [9 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [4 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

Machinery and Tools.—Largest Stock in London. BRITANNIA CO., 100, Houndsditch. Cash or Hire Purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks and Dies, Forges, etc. Catalogue of new, 6d.; second-hand, 2d.—BRITANNIA CO., Colchester.

Best Book on Lathe, Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [7 R

Designs.—100 Fretwork (speciality), 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. Note change of address. [1 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

THE WORLD'S WORKERS.

A Series of Original Volumes by Popular Authors. With Portraits, cloth, **1s.** *each, or post free,* **1s. 2d.** *each.*

Dr. Arnold of Rugby. By ROSE E. SELFE.
The Earl of Shaftesbury. By HENRY FRITH.
Sarah Robinson, Agnes Weston, and Mrs. Meredith. By E. M. TOMKINSON.
Thomas A. Edison and Samuel F. B. Morse. By Dr. DENSLOW and J. MARSH PARKER.
Mrs. Somerville and Mary Carpenter. By PHYLLIS BROWNE.
General Gordon. By the Rev. S. A. SWAINE.
Charles Dickens. By HIS ELDEST DAUGHTER.
Sir Titus Salt and George Moore. By J. BURNLEY.
Florence Nightingale, Catherine Marsh, Frances Ridley Havergal, Mrs. Ranyard ("L.N.R."). By LIZZIE ALLDRIDGE.
Dr. Guthrie, Father Mathew, Elihu Burritt, Joseph Livesey. By JOHN W. KIRTON, LL.D.
Sir Henry Havelock and Colin Campbell, Lord Clyde. By E. C. PHILLIPS.
Abraham Lincoln. By ERNEST FOSTER.
David Livingstone. By ROBERT SMILES.
George Müller and Andrew Reed. By E. R. PITMAN.
Richard Cobden. By R. GOWING.
Benjamin Franklin. By E. M. TOMKINSON.
Handel. By ELIZA CLARKE.
Turner the Artist. By the Rev. S. A. SWAINE.
George and Robert Stephenson. By C. L. MATÉAUX.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Dr Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

W. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

Pamphlet on the "Home Use of Pumiline" sent free on application.

WEAK & LANGUID

Feelings positively yield like magic to the invigorating properties of mild continuous Electric currents, generated imperceptibly by simply wearing one of

HARNESS'

ELECTROPATHIC BELTS.

They are guaranteed genuine, and sceptics may see them scientifically tested, and personally examine thousands of testimonials and press reports at the **Electropathic and Zander Institute,** of the **Medical Battery Co., Ltd.,**

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place.)

CONSULTATION FREE. All communications are regarded as strictly private and confidential, and should be addressed to the Company's **President, Mr. C. B. Harness.**

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

TOOLS TOOLS

MOSELEY & SON.
323, HIGH HOLBORN.
200 PAGE CATALOGUE BY POST 6D.
ORDERS OF 10/- CARRIAGE PAID

CASSELL'S CLASSIFIED CATALOGUE, containing particulars of upwards of ONE THOUSAND VOLUMES published by Messrs. CASSELL & COMPANY, ranging in price from

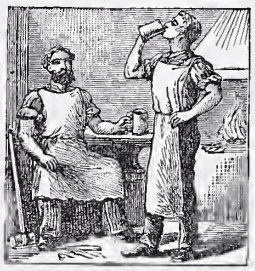
THREEPENCE TO FIFTY GUINEAS,

will be sent on request *post free to any address.*

CASSELL & COMPANY, Limited, *Ludgate Hill, London.*

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

24 Pages Illustrated, 1d.

CASSELL'S

Saturday Journal.

This Week's Number contains:—

DEATH OR DISHONOUR.
Complete Story.

How Gunpowder is Made.

Lady Merewether's Diamonds.
Complete Story.

Stopped on the Threshold.
Complete Story.

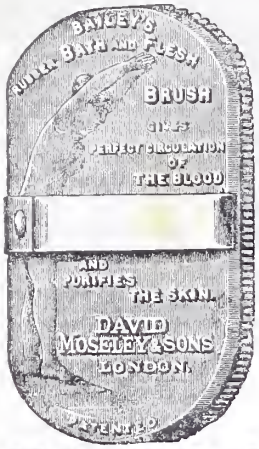
How Italian Images are Made.

ANNIHILATED BY AN EARTHQUAKE.

&c. &c. &c.

"The best and cheapest pennyworth of popular literature ever produced."—*The Times.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*



BAILEY'S
PATENT BRUSHES.

THE RUBBER BATH AND FLESH BRUSH

Is unequalled for Promoting CIRCULATION, Strengthening the NERVES, Purifying the SKIN, and Removing PIMPLES. Its effect is precisely similar to Massage Treatment.
Size, 5 inches by 3 inches.

CLEAN HANDS!

For everyone, no matter what their occupation.

REMOVES
INK, TAR, GREASE, PAINT, IRON STAINS, &c.,
with the use of soap and water.

PRESERVE YOUR TEETH!

CLEANSES THE TEETH PERFECTLY, without Scratching.
FOR CLEANING ARTIFICIAL TEETH it has no equal.

None of our Brushes become foul; and are the best ever produced, *vide* notices in *Queen*, *Field*, *Lady*, and other well-known papers.

PRICES:—Bath, 5s.; Complexion, 3s. 6d.; Toilet, small, 1s., large, 2s.; Tooth Brushes, 10d. and 1s.

Of all Chemists and Dealers in Toilet Goods, or from the Manufacturers, DAVID MOSELEY & SONS, 14, Aldermanbury Avenue, London; Ardwick, Manchester; 57, Miller Street, Glasgow; Brussels and Paris.

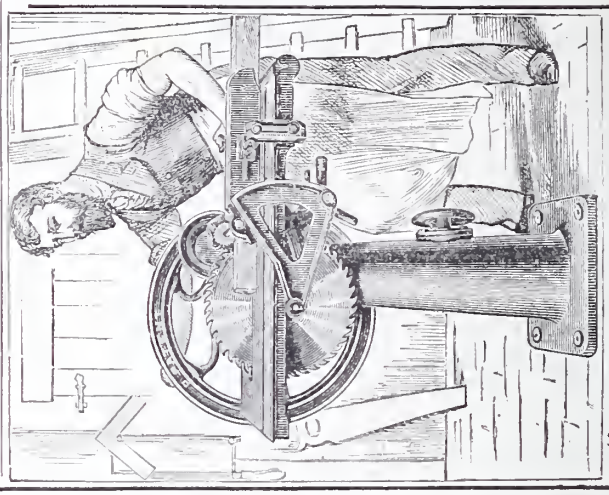
Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.



"THE LEYTON".
New Patent Circular Saw Bench for Hand Power.
Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.
LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

NEW SERIAL ISSUE. In Monthly Parts, price 7d.

British Battles on Land and Sea.

WITH ABOUT

800 ILLUSTRATIONS.

Part 1 ready August 25, 1890, including, as a PRESENTATION PLATE, *a large Tinted Engraving of*
"THE BATTLE OF TEL-EL-KEBIR."

"As good a boy's book as we could wish to give to the best boy we know is 'British Battles on Land and Sea.' We feel sorely tempted to lay down our pen and read the book through, from the very first page to the last. That the boy who once gets it into his hands will do so we feel very certain."—TIMES.

LORD WOLSELEY, in writing to Messrs. Cassell and Company with reference to the forthcoming serial issue of their "BRITISH BATTLES ON LAND AND SEA," says:—

"The fool hath said, 'Happy is the nation that has no history.' A nation in such a condition is like an individual or a community that has no standard of morality. The young people of a nation with a glorious past are brought up to admire, and in admiring to try and imitate the noble deeds of former generations. Such a nation has a recognised standard of honour, a high level of patriotism for its sons to imitate. The legends of old which described the achievements of national—often only mythical—heroes were but the endeavour of wise men to supply the want of a glorious history to the race or state that had the courage and the manliness to aspire to be great.

"Books like that you have sent me are, to my mind, calculated above all things to make the British subject, indeed I may say the Anglo Saxon throughout the world, proud of his country, and anxious to emulate the great and noble deeds of his forefathers.

"The want of to-day in England, is to foster intense nationality. The platitudes about cosmopolitanism are sickening to the man who wishes to see his country great. It is because I feel this so strongly that I hail with joy the work of which you have so kindly sent me a copy."

Prospectuses at all Booksellers', or post free from
CASSELL & COMPANY, LIMITED, LUDGATE HILL, LONDON.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

Vol. II.—No. 72.] SATURDAY, AUGUST 2, 1890. [Price One Penny.

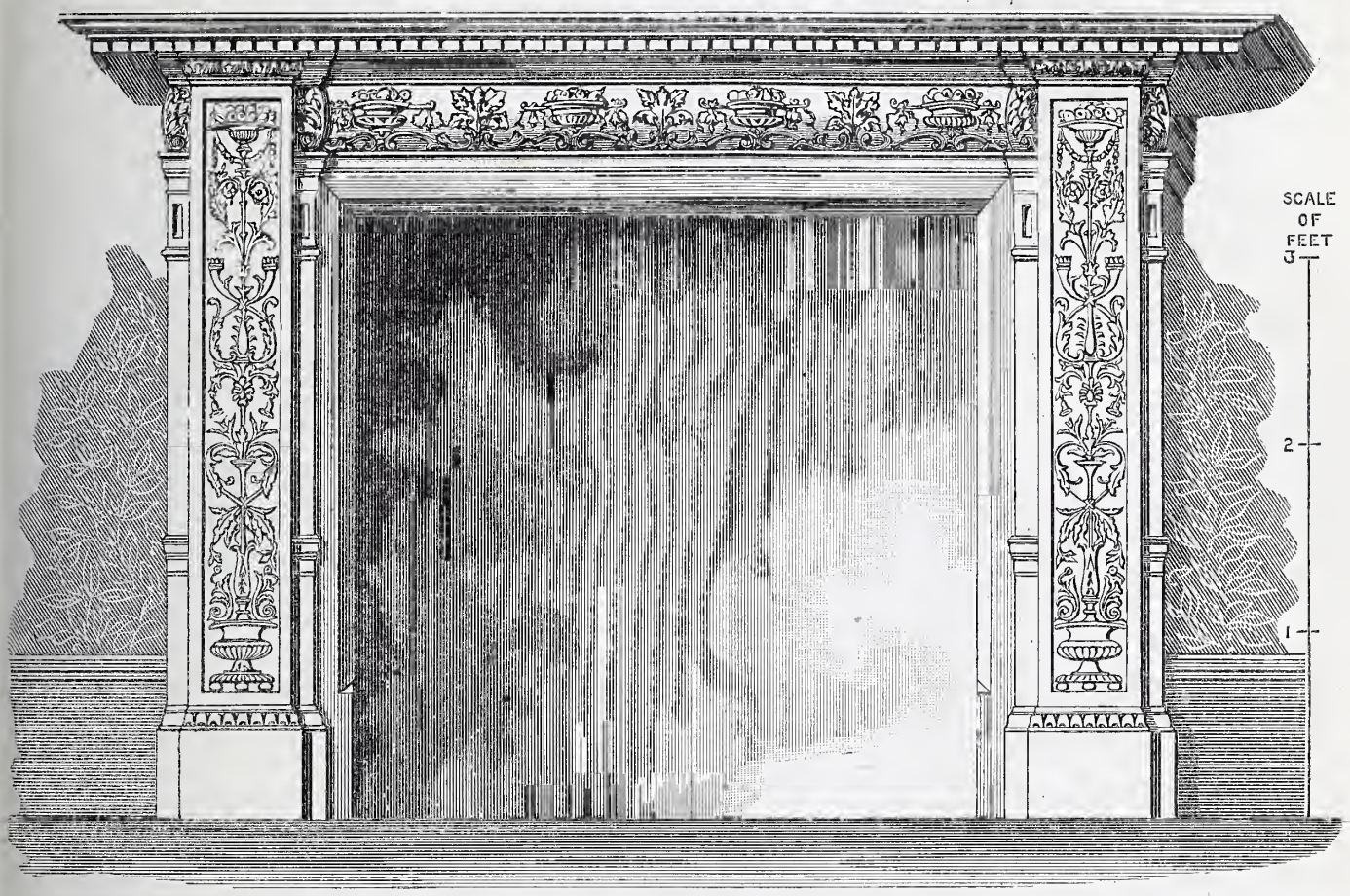


Fig. 1.—Design for Mantelpiece enriched with Carvings in Italian Renaissance. (Scale, $\frac{1}{12}$th full size.)

A MANTELPIECE WITH ITALIAN RENAISSANCE CARVINGS.

BY ALEXANDER MARTIN.

General Design—Carving on Pilaster.

The design illustrated in this article is principally intended for the display of some nice Italian Renaissance carvings; but, apart from the carvings shown, this same design would, with very slight alteration, form a chaste little mantelpiece. For the benefit of those who would prefer it in its plainer state, the slight alterations referred to shall be fully entered into further on. It is usual, also, to have an overmantel made along with a mantel of this sort, and, provided the Editor accords permission, I will give an Italian Renaissance design by-and-by that will be suitable for placing above this mantel, as well as being suitable by itself for any ordinary room. In the meantime there is sufficient work in what is here shown to keep most wood-carvers busy for some time.

Such a mantel as this would be best suited for execution in American walnut, or mahogany with very little figure in it. The plainer the figure of the wood for the carvings and mouldings, the better; although in the plain surfaces of the base, etc., some little figure would not come amiss. Another point in regard to the wood is, that it should be of a very close grain, in order that the delicate lines of the carvings may not be interfered with.

There is so much carving to be done in this job, that if the mantel were begun by a cabinet-maker in the usual way, after he had the different parts ready for carving, he would be unable to get on for want of these pieces. So it would be as well to get the pilasters carved before the making of the mantel be begun. Each pilaster measures 4 ft. 2 in. long by 6½ in. wide, and is 1 in. thick. At the top end there will be four inches covered with the bed moulding under the mantelshelf, and at the lower end seven inches will be covered with the base, so that the rest of the surface is what will be seen after the mantel is finished. The pilaster is not set in as a panel, observe, but is placed against the framing of the mantel-jamb. There is, therefore, 3 ft. 3 in. clear space left for carving; and in Figs. 2 and 3 is given the design for one pilaster, the other differing slightly in various points from this one. I may here say that in Renaissance work there is a greater amount of freedom to be had than in almost any other style of ornament. Simple floral lines; grotesque arabesques; conventional treatment or natural treatment; flowers, fruits, animals; the human figure itself—all seem to be pressed into its service indiscriminately. It fairly revels in all sorts of ornament; and, not content with even that amount of liberty, it also delights in having every panel, pilaster, frieze, bracket, or corbel, differing from its neighbour. This is, perhaps, its most agreeable feature—this balancing of pattern without necessarily having one feature a duplicate of its corresponding one. There is such an agreeable and interesting discovery in every fresh

panel when examining Renaissance work, that one is tempted to go on and on, ever delighted with fresh arrangements of the well-known forms, and novel introduction of more uncommon ones. Such a delightful change it is from the stiff, severe sameness of classic architecture, where the same details are repeated over and over again, without the slightest apparent effort to get out of the old well-worn rut.

Well, the design of pilasters in Figs. 2 and 3 is drawn half full size; and for the sake of clearness, as it was impossible to get it all in one length, the two diagrams overlap each other by about half an inch; this will readily be observed in the pattern. The cutting is, in this style, very flat, or in "low relief;" the ground will not be more than a quarter of an inch down from the face of the wood. As much modelling as possible may be put into the work, but it always is very flat, and the ground should not be pounced, but left quite smooth.

As a matter of convenience for readers, as well as for reasons of a purely technical nature which need not be entered on here, Figs. 2 and 3, which together fill an entire page, have been placed in page 317.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

Graining Oak in Spirit Colour and Water Colour.

The methods of imitating figured oak which I now purpose describing, although neither so durable nor popular as the oil-graining process, are well worth the attention of the practical grainer and the aspirants thereto amongst my readers. The nature of oil graining colour we know to be similar to ordinary oil paint—so far as the *drying* or oxidisation goes. In both mixtures the oil hardens into a film, or "skin," of a horny nature, and this action, however it may be properly accelerated by drying agents, should never be forced to completion in less a period than eight hours of fair weather. If oil colour is made to dry in much less than this time, the work must suffer in respect to durability; whilst in manipulating the colour the grainer is unduly handicapped. The interval of a proper period of time, for external work especially, between the various coatings of white-lead paint, the graining, overgraining, and final varnishing of oil grained oak, is a matter of much importance, and although the writer would scarcely advise fixed and arbitrary times between each coating or process—as advocated by some experienced grainers—it is very necessary that the worker should thoroughly realise the difference between paint which is only *surface* dry and that which is *hard "right through."* With these considerations in one's mind, it follows that painting and re-graining woodwork in oil should be a work extending over seven to fourteen days. This length of time for a single door would often make it a prohibitive work; and, as in some cases, if a master had to send his man a long journey, the time occupied by going and coming so many times would be greater than that required for the work. It is customary in most places for a plain painter to prepare and *ground* the door for graining; and if the usual two preceding coats are sufficient, then it is possible, by graining the door in one of the methods under notice, for the worker to both grain and varnish upon the same day, and that without any detriment to the job, or so much dependence upon the atmosphere.

The advantages of graining oak in spirit colour go further than this time-saving point of convenience, however, for another distinctive feature of such a quick drying imitation is the small risk of it getting "smudged" or rubbed off by the passer-by. In the densely-packed thoroughfares of Newgate Street, Cheapside, and similar central spots of London and the other large cities, the friendly warning of the white chalk markings would be very quickly obliterated from the pavement; whilst the "push and scramble" method of pedestrianism that the busy man must adopt makes it impossible to trouble about such minor affairs as rubbing the grainers' work.

The nature and preparation of spirit graining colour are best explained together. The chief feature of the mixture is the, necessarily, entire absence therefrom of linseed oil in its native condition, and, generally, in *any* form. The term "*spirit colour*"—a misnomer—is derived from the fact that the volatile *oil of turpentine* is the chief fluid, or solvent, used in the mixture. Turpentine alone, although containing a small proportion of resin, is not in itself a binding or fixing agent, so that this latter property must be added in the form of varnish. In mixing spirit graining colour, all ordinary conditions of manipulation are sacrified to the chief object of obtaining a very quick drying process. The best varnish to use is, therefore, a so-called *spirit varnish:* viz., one in which turpentine is the solvent. There are several kinds of varnishes made on this basis suitable for the purpose; the most reliable is that known as white hard *Bath varnish.* It is very necessary here to point out the entirely different natures of the above and the ordinary "white hard" spirit varnish; the latter, having methylated spirit as the solvent, is utterly unsuited for the purpose under notice. The proportion of spirit varnish to turpentine is more a matter of each circumstance than of rule; but a maximum of *one* of varnish to *three* of "turps" may be taken as a basis of computation. Although we must still, theoretically, look upon the graining colour as a *stain*—viz., a translucent fluid—it is necessary to add a little body to the liquid, as well as the pigments or "stainers." This is best obtained with the aid of a little whiting. "*Gilders'*" whiting implies the best and finest washed quality, and this should be used when possible. If free from moisture, it will be readily amenable to the palette-knife, and should be well rubbed up into a paste by the aid of turpentine. This whiting paste is now stained to the proper colour by the aid of such grainers' pigments as raw or burnt sienna, raw or burnt Turkey umber, and ivory black—the latter ground in "turps," and the others "in oil." Lest the proportion of whiting should trouble the worker, I may point out the similarity between the required quantity of this and the amount of patent paste driers that one would use—but for a different purpose—in compounding oil graining colour: a few ounces to the pound, or pint, in both cases. Whiting and pigment being mixed together, and the required colour obtained, the varnish should be then introduced, and well incorporated with the former in the pot, and the turps finally added and well stirred. Before starting the work, it is well to test the colour for *binding* qualities. Should the fluid, when dry, not bear *fair* rubbing, a little more varnish is required; whilst if it has any decided gloss when dry, it will stand diluting with more turps, and will also spread more satisfactorily therefrom. Experience and practice will, after one or two essays, give the grainer all confidence in his proportions and mixing, providing pure turpentine and a varnish of the same strength and nature are always used.

Although the above varnishes are the best and most reliable for durability and quickness of drying, copal oil varnish or Japan gold size may be substituted for the copal spirit varnish as the drying or binding factor. The ordinary "church oak" varnish would work up a mixture to dry in about four hours, and the gold size would be as quick as any varnish. The latter, however, would not be of so durable a nature, nor would the "church oak" be as quick as the Bath varnish; but if this cannot be conveniently obtained, equal quantities of "japanners'" and church oak will make a good substitute for spirit varnish. Having, in the preceding paper, exhaustively treated "grounds," graining colours, and pigments for oak, the student will readily apply its contents to this process of *spirit graining.* As a matter of very great convenience and economy, I would commend the use of the finest umbers, etc., which are put up in pound collapsible tubes by all the best colour manufacturers. Although about double the price of the ordinary "keg" pigments, which are sold at "per cwt." rates, they are cheaper to the grainer in the long run. For instance, if a grainer had a three-mile walk to reach his one or two doors which he wishes to grain and varnish "right off," his material need only be a little mixed turps and varnish in a can, a small knob of gilders' whiting, his door varnish, and a tube of burnt umber and raw sienna. With these he could grain either light or dark oak, would have good rich colours, and would not want to strain grit and "skins" away before using. Should the worker be compelled to use the common imperfectly washed whiting, it is best to dry it well, and the colour must be strained through fine muslin before being used.

To grain a door in spirit colour no special experience or knowledge is required other than the ability to grain oak in oil, and an intelligent application of the same *principles* to the different natures of the two mixtures. In practice we must treat spirit graining in the same manner as when overgraining in water colour, working it in separate portions. In graining a door, it is necessary to rub in one panel at a time, using a wide brush to quickly and evenly spread the colour, and then putting a slight grain in by drawing a dusting brush down it. A further grain is at once given by using fine and medium steel combs, and the panel is then allowed to set. When all are so treated the mouldings are worked. Although when "rubbing in" the panels the surrounding mouldings may have been brushed with the colour, it will be found that, under the influence of the turps solvent, the parts so touched will soon "rub up" again, and allow us to give an even coating to the whole of them. Whatever the nature of the mouldings, it is best to finish them with a dry brush, streaking or stippling them in a "woody" manner, and making them slightly darker and contrasting to the remainder of the door. In the same way as a door is painted we now proceed with the cross rails and then the stiles, and, as I have pointed out when overgraining the same portions, the joints between rail and stile must be worked sharp and clean. For the process now described, a piece of

g dipped into turps and a fine bevel edge th or a strip of zinc will enable us to wipe e intersections cleanly. Working and mbing each division at a time, we are thus ble to get almost as much variety and eanliness as in graining with oil colour.

By the time the framing of a door is rubbed and combed, the door itself will be dry and ady for veining. It is now that different ethods are necessary, for instead of wiping it the graining colour with rag and thumb ece, as in the oil process, we use a vein-g fitch (Fig. 12, page 40, Vol. II.), and put the "lights" with a solvent strong enough dissolve the spirit graining colour wher-er we paint it on. In using spirit colour ade from spirit varnish and turps, and pro-ding sufficient only of the former is used bind it, then a solution of common soda the best and cleanest solvent. This fluid ving been prepared the desired strength, a ttle water-pigment is added to stain it fficiently for the grainer to follow the ush markings as they are put in. Upon ferring to the illustration of veining fitch, will be seen that the hair is arranged in e tuft of long bristles, broad, but with a in edge. This is manipulated to get the me broad and narrow effects as are ob-ined with the "thumb piece" of similar ape. Practice with the veining fitch will, f course, be very necessary before the rainer can use it quickly and naturally. hese brushes, which are made in various zes, are held with the fingers and thumb—ke a stick of willow charcoal in sketching rge forms. Lightness and delicacy of action re very necessary to put sufficient only of e solvent for our purpose without any perfluity to run down and spoil the panel. Vhen the soda has done its work the door ust be well washed down with cold water nd dried with a wash-leather.

In using graining colour of a stronger ature, it may be found advisable to use rpentine as the solvent instead of soda ater. When this is the case the grainer ses a wide pad of soft flannel, and draws off e turps after making a few veins. The ffect of the wiping is somewhat softer than he soda process, and as it is also more con-enient, we find it used to a greater extent on he city warehouses than the soda. Turpen-ine when so used requires to be stained in he same way as the soda water; or the eining may be executed by diluting the pirit colour with more turpentine.

All such work of the average quality must ow be overgrained, and this process I have lready explained. Should there be any ifficulty—as is often the case when over-raining—in getting the water colour to pread properly on our grained work, the mplest way is to sponge it over with beer nd water in equal proportions, or to rub it ver with a little powdered whiting on a ag. The shading, dapple, etc., can then be ut in, and in a short time the grainer will ind his work ready for the finishing process f varnishing.

Graining oak in distemper, or water olour, is a process so little in demand now-adays that a brief outline only of the work ppears necessary. Since it is but a little, if t all, quicker than the spirit graining, and as t lacks other practical advantages common o the preceding process, there are but a few oints upon which to commend it. The aw and burnt umbers are the chief pigments sed, and these must be purchased of a uperior quality to the common umbers sold n powder form. The pigment being rubbed up in dilute beer, and the desired colour ob-tained, the mixture is then brushed over a panel. A small piece of damp sponge is now used to wipe off some portions of the colour and give variety of perpendicular shade. A dusting-brush or badger is next drawn down the panel, and a fine grain thus obtained; indiarubber combs may be used for the grain also. For veining, a damp wash-leather is placed over the "thumb piece," and the "lights" and half tones are quickly wiped out and softened slightly with the badger. If the graining colour is used very strong in beer, the work, when perfectly dry, will allow us to put an overgrain upon the first colour. When such is desired, a thin oak overgrainer can be dipped into a weaker solution of graining colour and drawn over the work, as in overgraining oak in oil. It must be borne in mind, however, that if the first colour is rubbed to any extent the grain and figures will be "smugged." Should it be desired to make a sure job of the over-graining, it is advisable to paint over the first water grain with a thin coat of Japan gold size and turps in equal proportions; this will dry within one hour, and the work can then be overgrained and shaded in water with safety. In using distemper graining on doors, etc., the same conditions of working in portions apply as to the spirit graining. For acquiring facility and confi-dence in wiping out the lights of oak, the distemper mixture is a most useful process to the student; the panel can be rubbed over and grained *ad lib.*, and the absence of smell and substitution of the damp wash-leather for linen rag are both appreciable conveniences to home practice.

Overgraining or "oak graining" metal rollers (see page 272, Vol. II.) are particularly valuable for finishing in good style the spirit-grained work; in such cases the roller grain is executed with water colour, and after the panels are shaded with the brush.

Distemper graining is also used very con-siderably in finishing cheap furniture. As this is somewhat a distinct line from house graining, and also a subject likely to prove usefully interesting to many readers, I hope, further on, to devote a short paper to this branch.

A LAMP BRACKET IN BENT IRON WORK.

BY OPIFEX.

Few forms of ornamental work are more useful, and none more effective, when legiti-mately applied, than artistically wrought iron. It possesses a peculiar charm for every one naturally endowed with that rather rare quality, good taste, and for those also who have been educated thereto; whilst with the great majority who are influenced by Fashion, and follow her whithersoever she leads, this kind of art work is, and doubt-less will continue to be, very popular.

The simple example which forms the sub-ject of this paper hardly deserves the name of wrought iron work—that is, if we use the term in its usual signification. Technically, wrought work means forged work, and this, again, implies the rather difficult process of welding (I speak as an amateur). I have, therefore, called this article a bracket in bent iron because not only have I eschewed welding, but even heating is only called into requisition for the forming of the hook. Nevertheless, the bracket may be strong and rigid, and capable of sustaining the weight of a heavy lamp or lantern, and if the directions given be faithfully followed, and the work fairly well done, the result will be very satisfactory.

The first—and, I may say, the most im-portant—step will be to make a full-size working drawing of the work. The whole success of our undertaking depends upon this, and the drawing should be made upon a board of sufficient size, or upon the work-shop floor.

The importance of this arises from the necessity of applying the work constantly to the drawing, for by this means only can accurate and satisfactory results be obtained.

With regard to the iron to be employed, I would strongly recommend the use of the best kind from the start, as although, when some experience is acquired, it is quite pos-sible to produce good work with common iron to be had at any ironmonger's, it is much more difficult to manage, and breaks easily, causing disappointment and dis-couragement to a beginner.

Charcoal iron, or improved iron as it is also called, costs more, and is more difficult to procure—at least, in the country; but the extra expense and trouble are more than compensated for by the quality of the metal, and the comparative ease with which it may be worked.

In the present example, the iron is bent and otherwise shaped while cold, with the exception already alluded to; therefore it is especially necessary to have good stuff, which will bear such treatment.

In case any of my readers should wish for a definite address where this description of iron can be obtained, I may mention that Messrs. Pfeil and Stedall, Broad Street, Bloomsbury, W.C., supply all sizes and scantlings, and in small quantities to suit any worker.

Fig. 1 is a side elevation of the bracket, from which it will be seen that it consists of a framework enclosing a simple scroll, the horizontal arm being provided with a hook, to which the chain which supports the lamp, etc., is attached.

The framework consists of three pieces, of which I give separate illustrations, and we shall commence operations by describing the back piece (Fig. 2). This is of $\frac{1}{2}$ in. by $\frac{3}{16}$ in. iron, the edges being slightly rounded, and, in order to simplify my directions, I give the measurements of a bracket which I have made from this design, and which is now before me. The back is 3 ft. 3 in. long, but, in order to allow for bending at each end, we require a piece about 4 ft. 3 in.

We now come to the most important part of the actual work, viz., the bending of the scrolls. I take for granted that the work-man has followed advice frequently given, and has prepared an accurate full-size draw-ing of the work in all its details, showing each portion clearly defined.

The back piece, then, consisting of a straight bar, 4 ft. 3 in. long, is now to be bent so that it shall correspond with the drawing. To do this, fix a piece of $\frac{3}{4}$ in. round iron firmly in the vice in a horizontal position, and holding the iron to be worked at right angles to the round piece, and close up to the jaws of the vice, hammer the extreme end of the work until the first and smallest turn is made. In the present in-stance, this should be a semicircle of about an inch diameter. This being accomplished, take an ordinary medium-sized screw-wrench, screw it up so as to fit the flat of the iron rather loosely, fix the iron to be bent in the vice in a horizontal position, and so that the jaws shall grasp it at the point at which the curve is to commence, and, using the screw-wrench as a lever, pro-ceed to bend the iron into the desired shape. This should be done gradually, moving the

wrench forward by equal distances—say, about ¼ in. at a time, and using a uniform amount of force to each bend, so as to ensure a true curve. I need hardly say that this operation requires some practice, and, therefore, I strongly advise the beginner to make many experiments upon odd pieces of iron before attempting the work proper, but of the effectiveness of the method there can be no doubt, and, with a little experience, any one possessed of average mechanical aptitude will find that he can turn a true scroll with comparative ease.

The direction already given with regard to the first, or inner, turn of the scroll is necessary, because it is not practicable to turn a very small curve with the wrench, but this being done in the way suggested, the vice and wrench alone are required.

The horizontal arm (Fig. 3) requires a piece of iron ½ in. by $\frac{3}{16}$ in. by, say, 2 ft. 2 in.—*i.e.*, 16 in. from the back to the shoulder and 12 in. for the hook. It is secured to the back piece by being mortised—if such a term is allowable in iron work—filing a round tenon and riveting at the back. The hook may be turned and shaped cold, as in Fig. 3; but it will be better to heat the iron and forge a hook something like the alternative design (Fig. 4).

Although I have pointed out that this arm is secured by riveting to the back piece, this should not be done in the first instance, the parts being merely fitted and made to correspond with the drawings, but not put together finally until all the parts of the bracket are complete.

The front stay (Fig. 5) is 26 in. from shoulder to shoulder; the straight portion, which is bolted to the back, is 6 in., and the scrolls take about 12 in., so that we shall require a piece of iron 3 ft. 8 in. by ⅜ in. by ⅛ in. for this item. The stay may, of course, be made of the same sized iron as the back and arm, but the scantling mentioned will be found quite strong enough, as it is bolted and riveted at so many points that perfect rigidity is secured, and the bracket will not be called upon to sustain any very great weight.

The scroll at each end of this front stay should be carefully bent in true spirals, and the lower one especially should flow gracefully, so as to foliate naturally with the reverse scroll of the back piece.

Having fitted these three parts, which compose the framework of the bracket, the next step will be to mark and bore (drill?) the holes for the bolts, or rivets, by which they are to be secured. Although I write bolts *or* rivets, I suggest that ball bolts be used in putting the bracket together, with the exceptions to be mentioned presently; but, in some cases, the bolts are to be used *as* rivets. For instance, in fixing the lower end of the stay to the back, two ⅜ in. ball bolts are cut about ½ in. from the heads and used as rivets, while the other end of the stay is secured to the arm of the bracket with a ¼ in. ball bolt, used as a bolt, the over length being cut off close to the nut and slightly riveted. In case any of my readers have not seen these bolts, I may mention that they are made in various sizes, and their peculiarity is that both head and nut are ball-shaped, and vary in diameter from ⅛ in. upwards.

The holes may be drilled in any way most convenient, a drilling machine or lathe entailing, of course, the least amount of labour; but they should not be made larger than necessary, lest the iron be unduly weakened.

Fig. 6 represents the main stem of the reversed scroll, which forms the "filling" of the bracket. This is of ⅜ in. by ⅛ in. iron, of which it will take 6 ft. 4 in., or thereabouts. The dotted line A B shows that

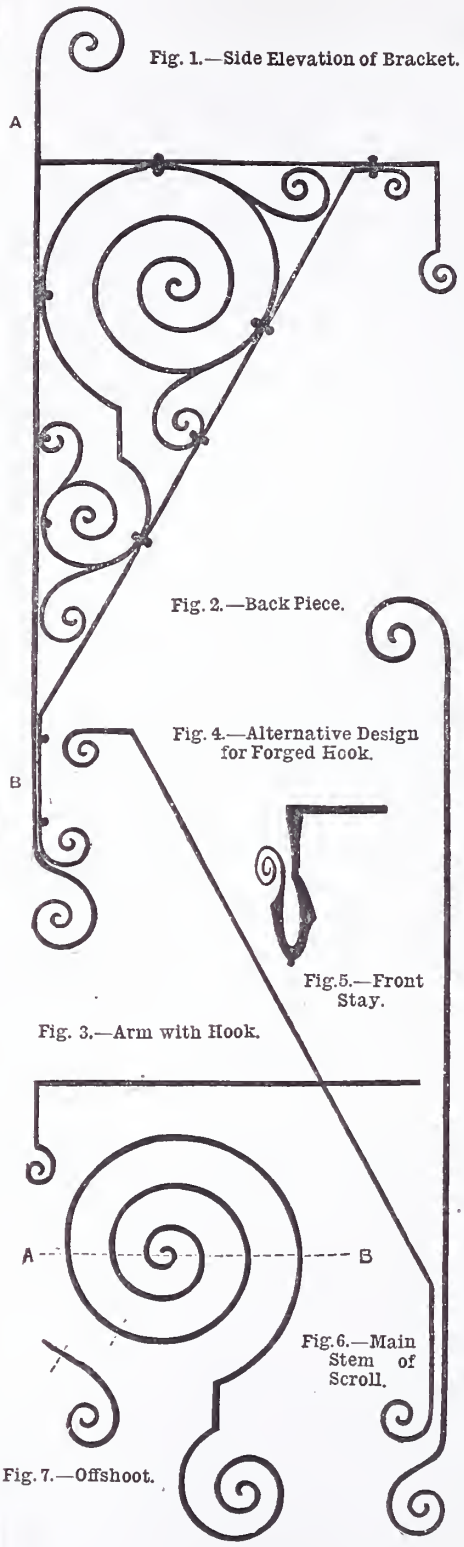


Fig. 1.—Side Elevation of Bracket.

Fig. 2.—Back Piece.

Fig. 4.—Alternative Design for Forged Hook.

Fig. 5.—Front Stay.

Fig. 3.—Arm with Hook.

Fig. 6.—Main Stem of Scroll.

Fig. 7.—Offshoot.

Lamp Bracket in Bent Iron. (Scale, 1½ in. to 1 ft.)

the upper and larger spiral consists of seven semicircles (at least, we may treat them as such), the inner and smallest being about an inch in diameter. This may be turned as before directed, and the rest of the spiral bent with the wrench, applying the work constantly to the drawing, and working round until the smaller reversed spiral is reached, when again the inner semicircle is turned, and then working backward until the whole scroll is completed, according to the design, when, if the work has been carefully done, it will be found to touch the framework of the bracket at five points.

The four offshoots should next be made as represented at Fig. 1, and one of which is shown in detail at Fig. 7. These offshoots being so much alike, varying only a little in size, and very slightly in shape, it will only be necessary to describe the method of attaching one of them to the main scroll and to the framework. We, therefore, take the offshoot which is largest, and is bolted to the centre of the front stay. This takes about 12 inches of iron, and is, of course, of the same scantling as the main stem.

When shaped accurately according to the drawing, the end which is to be attached to the stem is filed to a thin tapered edge and fitted to the stem so that it may appear to form part of it—or, rather, to grow from it and when properly fitted, and placed so that it shall also touch the front stay, a hole should be drilled about ⅜ in. from the end at which it is to be attached to the stem then another corresponding hole through the stem, and the two firmly riveted together with a small rivet made of ⅛ in copper wire. These holes should be slightly countersunk on opposite sides, and the rivet closely hammered, when the ends may be filed smooth.

Now make and attach the other offshoots in the same way, and having placed the completed scroll in position within the framework, mark all the points of contact clearly on both, using chalk or a coloured pencil. Emphasise these markings very decidedly with a centre punch, and proceed to drill all the required holes in whatever way is most convenient.

All the points of contact at the back of the bracket are fastened up by using ball bolts as rivets, as before described; while all other joinings are effected by ball bolts and nuts screwed up, the over lengths cut off, and the nuts secured by a slight riveting so that both heads and nuts shall be exactly the same.

In order to provide for fixing the bracket to any woodwork for which it is intended, two holes (countersunk for screws on the outside) should be drilled through the back piece and front stay at A and B, Fig. 1.

The bracket should be painted in flat colour, either black, blue, or chocolate, or a combination of these, or otherwise, according to the fancy of the maker.

BRICKLAYERS' WORK.

BY MUNIO.

UNDERPINNING.

THIS operation consists in excavating the earth from under the foundations of a wall already built, and carrying up a wall from the bottom of the excavation to the under side of the footings. It is generally resorted to when a cellar or basement is to be put in against a wall whose foundation has not been carried low enough. The excavation should be dug out within two feet of the face of the wall to be underpinned, shoring up the earth if it does not stand well, to prevent it falling away from the face of the wall. Then fix a stay against the quoin and two or three in the face of the wall keeping the top ends as low as possible, and letting them into notches cut in the wall

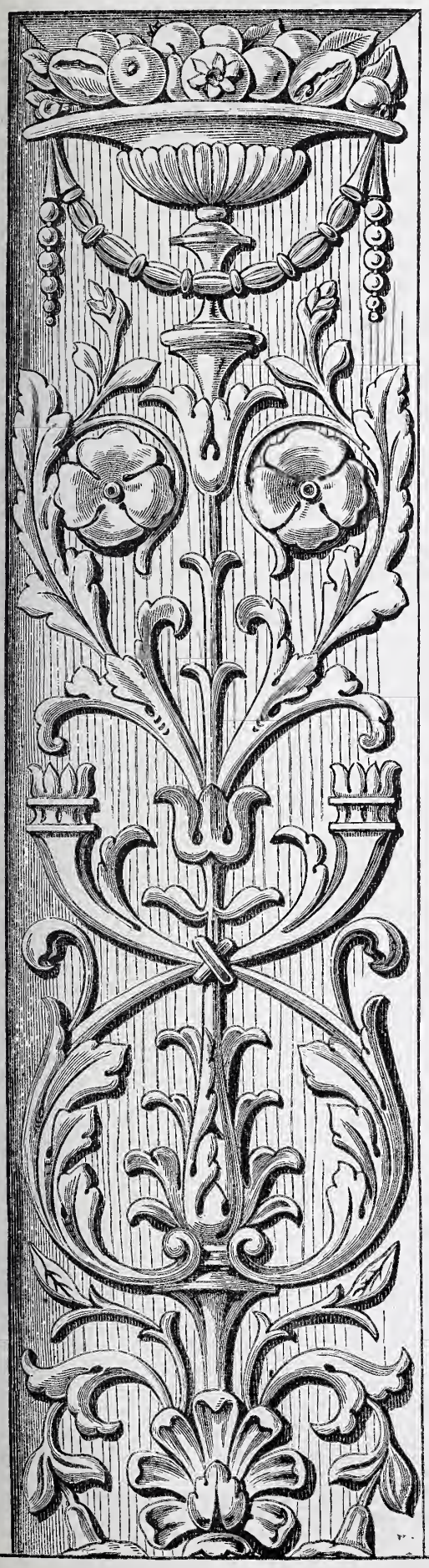


Fig. 2. — Design for Upper Part of Pilaster. (Scale, one half full size.)

PILASTER FOR MANTELPIECE ENRICHED WITH CARVINGS IN ITALIAN RENAISSANCE.

For Text, see pages 313, 314.

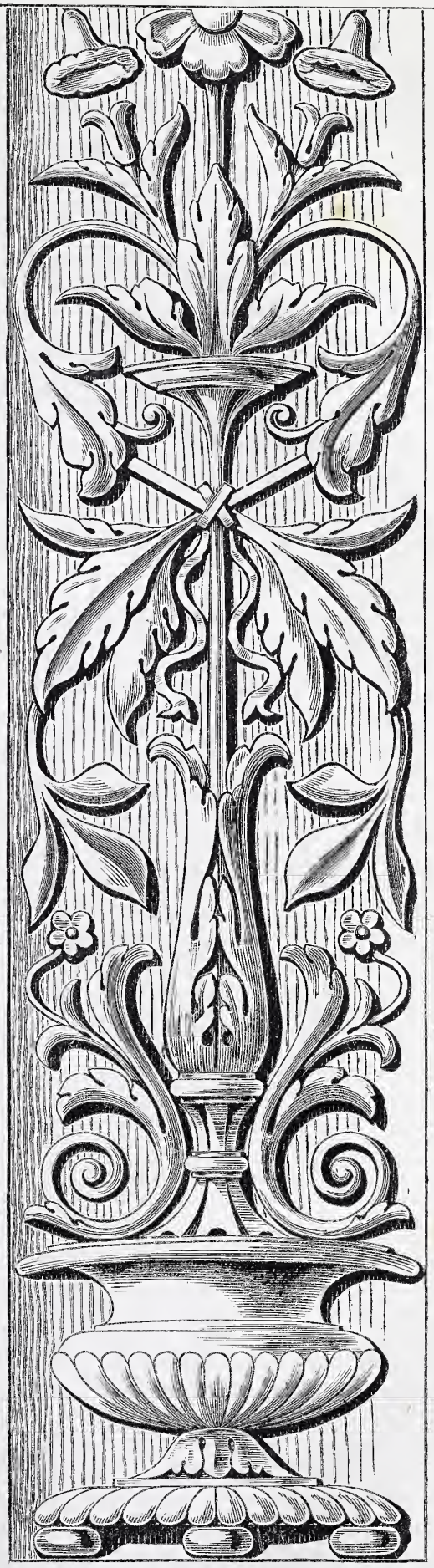


Fig. 3. — Design for Lower Part of Pilaster. (Scale, one half full size.)

The lower ends must be made good by driving strong posts into the ground.

Then dig out under the quoin for two feet in length and build up with brickwork set in Portland cement, and lay on the top a Yorkshire stone slab about 2 inches below the footings, and wedge up from this slab to the under side of the footings with oak wedges about one foot apart. The wedges should be put in double, the thick end of one upon the thin end of the other, and fill up between the wedges with thin stones or bricks bedded in Portland cement. Then dig out another length of 3 feet, and wall up and wedge as before, and so on the full length of the wall. A longer length than 3 feet should not be dug out at once, and the walling should be carried up as quickly as possible, and should not be left till wedged up. One or two boards should also be fixed under the footings while the walling is being done, to prevent any bricks falling on the workmen. Sometimes holes are cut as low as can be got in the wall, and putlogs put through and wedged up on strong posts to support the wall while being underpinned. Very great care and strong timber should always be used in this work.

Beamfilling.

This consists in walling up the triangular space between the top of a wall and the roof. It is generally done in buildings with open roofs, or such as are ceiled at the collar beam, but would be better if done in all roofs, as it prevents the wind from blowing in under the eaves. The top brick is generally set on edge, the upper edge being bevelled to fit against the roof.

Shoring Up.

When a shop front, or other large opening, is to be made in an existing building, the superincumbent wall has to be shored up till the beam or girder is fixed. Holes are cut in the wall above the level of the top of the beam at intervals of 3 or 4 feet. Through these are laid strong putlogs, under which are fixed strong posts or uprights, and the tops of the putlogs wedged tight in the holes; then cut down the wall at each end, and form the quoins, laying on the top a Yorkshire stone template for the ends of the beam to rest on; then cut out the remainder of the wall, and insert the beam, making good on the top with brickwork set in Portland cement, and wedge up tight with oak wedges. Then remove the putlogs and make good the holes. When the floor joists are not raised, but are level with or below the beam, they will require shoring up, and are hung from the beam in iron straps.

When the floor joists are to be raised, the top side of floor should be cleared, the skirting, fireplace, closets, or any plastering that is in contact with the boards should be removed, then cut the joist holes as far up as the floor is to be lifted, and, with a long lever, commence at one end and lift each joist 3 or 4 in., wedging them up till both sides are raised, and repeat this till the joists are at the required height, when they must be built up solid underneath and wedged level. Sometimes, when the front wall is in bad repair, the whole front is taken out and rebuilt. Each floor must then be shored up, and also the roof timbers. The props should always be set on a large stone or piece of timber bedded solid, so that there is no possibility of settling, and the timber should be sound and good and of ample strength.

Pointing.

The pointing executed by the bricklayer is of two kinds: flat pointing and tuck pointing. Flat pointing is generally done as the work is built, the joints are filled level, and the trowel is drawn along the under edge of the brick, making the joint project slightly outwards, when it is cut off to a rule by a knife turned up at the point $\frac{1}{8}$ in., called a "Frenchman." The joint should be about $\frac{1}{4}$ in. wide. Sometimes the trowel is drawn along the upper edge of the brick, and a jointer drawn along the centre of the joint by the rule. In some places a piece of soft black slate is used instead of the jointer. This is called black lining. Another method is to wall the face work with mortar made black by the admixture of foundry sand. The joints are filled up flush, and when stiff are rubbed with a soft piece of brick. A jointer with a hollow edge is then drawn along by the rule, and forms a bead. This makes very neat work when well done. After pointing, the face of the wall should be brushed over with a soft brush.

In pointing old work, the joints should be well raked out, and any damaged bricks replaced by new ones. Then wash the whole front, fill up the joints with fine mortar, and point as required. The mortar for pointing old work should be darkened by mixing it with sifted smiths' ashes, foundry sand, or lamp black.

Tuck pointing consists in laying a joint of white or black putty, by means of the rule and jointer. In walling a front which is to be tuck-pointed, the joints are raked out. If the work is ordinary red or machine-made bricks, it is generally washed over with a solution of green copperas and water to bring it to a uniform tint—about 3 oz. to a gallon is an average mixture, but it will vary on different kinds of bricks. A portion should be tried, and allowed to dry, before laying it on the front. The whole front should be coloured at once; sometimes a second coat may be required, but the first coat should be allowed to dry before the second is applied.

The stopping for the joints is made of fine mortar, tinted with Venetian red and Spanish brown till of the required colour, but this should also be tried and allowed to dry before being used. It will look best if made a little darker than the bricks; the joints are filled level with the stopping, and when sufficiently stiff are rubbed smooth with a piece of canvas, and the putty joints are laid on by means of the jointer and rule. The joints must be gauged to keep them parallel. The cross joints are laid on by the jointer, using a piece of board cut to the shape of a set square with a handle on the back. The square sides of the board should be about 9 in. long; one edge being laid on the joints already drawn, the jointer is run down the other edge, which keeps the joint square. The rule should have a rebate $\frac{1}{2}$ inch deep by $\frac{1}{4}$ inch on its upper edge, which allows the pieces of putty to fall from the side of joint in cutting. No more stopping should be laid on than can be jointed in a day, as, if left over night, it gets too dry, and the putty won't adhere. The copperas solution should not be allowed to come in contact with the stopping, or it will eat the colour out of it.

The putty is made from white lime which has been squeezed through a fine sieve, and well beaten to get the water out of it. It is mixed with silver sand and boiled linseed oil. A piece is laid on the rule, whence it is taken off by the jointer, and run along the joint; it is then cut off at each side by the "Frenchman." Black putty is made by mixing the white putty with lamp black.

In tuck pointing red pressed brickwork, the stopping is mixed as before and laid on after the brickwork has been coloured one coat; a second coat of colouring is then put on over the stopping, and the putty joints laid on. The colouring is made with Venetian red, with a little brown added if required; it is mixed in a solution of alum to prevent it being washed off, about 5 oz. of alum to a gallon of water.

White and yellow brickwork do not require colouring. The front is well washed and scrubbed to remove lime stains, the stopping mixed to the colour of the bricks, and the putty joint laid on as before. Tuck pointing is most expeditiously done by two men, one at each end of the rule, which should be 6 to 8 feet long. The joints should be perfectly level and parallel to each other, and the vertical joints exactly over each other. The putty joints should not be wider than $\frac{3}{16}$ in. When old work is to be repointed, the joints should be well raked out, the front washed down and scrubbed, the joints stopped, and the putty joint laid on as before directed; the stopping for old work will generally require lamp black mixed with it.

When lime stains cannot be got off by washing and scrubbing, a weak solution of hydrochloric acid and water will generally bring them off.

OIL POLISHING.

BY DAVID DENNING.

To the ambitious amateur, the heading of this article may not be so attractive as if it had been "French Polishing," but let me tell him that this will appear all in good time, and that till it does he will find almost each week something in "Shop" which will be of use to him. At present the simpler process of oil polishing must receive attention; and those who are not so dazzled by the oftentimes meretricious glare of a French polished surface that they can still see something to admire in a comparatively dull oiled surface, it is to be hoped will be able to learn something. There is, though, in treating of oil polishing, after all very little to be said. Patience and elbow grease are still more essential than with wax polishing, for any one who expects to get even the semblance of a polish or gloss within a week or two with the aid of oil will be most grievously disappointed. How long, then, it may be asked, does it take to finish a thing properly with oil? The answer may seem a paradoxical one, for to give it in plain English, it may be said the work is never finished. An oiled surface will always bear more rubbing than it has had, and, to say the least, will not be deteriorated by friction. At the same time a good amount of polish should be got in from one to two months, according to the amount of labour bestowed. This is more than can be devoted to the finishing touches of a piece of furniture generally nowadays, so that it may almost be considered that oil polishing is an obsolete process. Why, then, should the subject be treated on in WORK?

Well, it does not follow that because the process is too long to be remunerative in ordinary work it should not be worthy of attention, especially as it has merits which recommend it where speed is not a primary consideration. Its one great advantage is

that it is much more durable than either French or wax polishes; inasmuch as it does not blister by heat like the former, nor spoil with water to such an extent as the latter, to which in general appearance it may be compared. It is, however, because it does not blister by heat that it is specially useful. We have only to look at an ordinary French polished dining-table top to see the damage caused by hot dishes, plates, etc., laid on it, unless great care has been taken. On an oil polished dining-table top the same hot dishes, etc., might be placed with impunity almost; and bearing in mind what has been said, no one will have any difficulty in understanding that it is chiefly dining-table tops that have prevented oil polishing having become quite extinct. Of course, those who want to polish the whole of a table, or anything else, with oil may do so if they like, but it is usual, even when the top is oiled, to polish the legs and frame otherwise. Now, after all this preliminary talk, the reader, if not discouraged to pursue the subject, may want to know how to oil polish and what materials are used. Linseed oil is the material, the only one in pure oil polishing beyond the rubbers. Occasionally other ingredients besides oil have been recommended, and are used, till it is difficult almost to recognise wherein the distinction between oil polishing and French polishing consists. The two processes may, so to say, be mixed up to an almost indefinite extent. With these, which may be called the advanced forms of oil polishing, we have nothing to do, at present at any rate, as no good purpose could be gained by discussing them, and to do so might only tend to the confusion of the novice. Authorities are found to differ on the quality of oil to be used: some recommending boiled, others raw linseed oil, with various proportions of the two according to fancy. I am, for ordinary work, disposed to favour boiled linseed oil, but in saying this, I do not at all wish to imply that others who differ from me are wrong, so that if any would-be oil polisher has a penchant for something else, or some fancy mixture of boiled and raw oils, by all means let him use it. The procedure is very much the same. It consists in rubbing the oil well into the wood, not saturating or flooding this, but scrubbing it, and then rubbing long and hard. The process may be repeated almost indefinitely daily or at intervals till a polish which is deemed sufficient appears. To give an example, take a table top: rub some oil well into it, and then polish with a rubber formed by wrapping some baize, felt, or similar material round a brick or other suitable block, the object of which is, by its weight, to some extent to relieve the polisher. The rubbing should be continued till the surface of the wood is dry. The only perceptible difference in the top will be the darkened appearance caused by the oil, as little or no gloss will appear at first. By repeating the operation, however, the polish will come up gradually, and a surface which in the opinion of many is superior to that of French polish will be the result.

From what has been said, it will be seen that oil polishing is hardly suitable for anything but plain work, on account of the labour required. It must not, however, be forgotten that any piece of work can be polished so, if only the necessary time and labour be given to it. Even when it is not deemed practicable to bring up a polish with oil, a very pleasing finish may be given to a piece of work by merely rubbing it with oil. The colour is enriched to an extent which would perhaps hardly be credited by those who have not had frequent opportunities of seeing wood in the white and oiled. In choice mahogany especially the improvement is very marked. Light oak is also greatly improved in tone, so much so that it may be questioned whether young fretworkers who are not proficient in French polishing would not be more satisfied with the appearance of anything they have made if they were simply to oil it, instead of what to an experienced eye seems too often very like spoiling it by giving it a coating of shellac, alias French polish.

A WALL BRACKET WITH CARVED SQUARE PILLARS.

BY J. H. MOODY.

A frequent contributor to Work, whose writings I always read with interest and benefit, once aptly compared the weekly programme of our magazine to a *menu*, and referred severally to the papers therein as "joints" and "sweets," accordingly as they treated of plain joinery or of work of an ornamental character. Pursuing the same simile, I now compare the columns of "Shop" to the salad which usually completes the list of good things; hence, to my mind, it follows that our Editor is the authority whose hand administers oil or vinegar to the ingredients of the salad in proportion as they need qualification. Now, judging from the selfish tenour of some of the communications published in "Shop" from time to time, one would imagine that those critics who display so much sourness need a particularly lavish administration of oil to mollify them, but happily their mollification is not necessary, for approving testimony predominates.

Perhaps disapproval will greet this article, and the dissatisfied ones may find fault because these pages are occupied by such a trifle as the appended illustrations represent, but I will not fear the rancour of adverse opinion if the disciples of the art wherein enamel paint plays a conspicuous part approve of my contribution, and welcome it to the catalogue of handsome things destined to become more handsome beneath their deft fingers; for notwithstanding that the pretty fancies put forward as suitable to be treated with enamel paint are already numerous, yet I think my bracket will be found to possess good points, worthy of imitation.

I notice that some establishments offer for sale articles of various kinds and designs made in white wood, especially for the benefit of those who delight in enamel decoration; but I notice also that these articles are put together in the simplest methods of joinery, and are made of material selected regardless of unsightly knots and other blemishes; it may be that price is a consideration in the production of them, but I fail to see how they assist the operator or can give good result, and I doubt whether the medium which is said to beautify everything can redeem the crudeness of that which is cheap and nasty.

I am free to confess that I began this bracket, Figs. 1 and 2, with rather indefinite ideas. At first, I had in view the utilisation of some odd bits of turnery that my store contained—preserved, as is my custom, against their ultimate appropriation—but as the design developed, my ideas were resolved into a style wherein turning would have no place, so I put the pieces into store again, and resigned myself to the style into which I had drifted; this was without any feeling of regret on my part, as I achieved a result eminently satisfactory to myself. I realised that bold scrolls and flowing curves associated with carved square pillars made a very harmonious whole, and the preliminary sketch gave me every hope that the finished bracket would be a charming object if properly constructed.

The adoption of square work in the pillars will be especially agreeable to those who for certain reasons, unnecessary to mention, wish to be independent of turning, and the carving of such pillars is not a difficult matter, while they are exceedingly effective in appearance.

The chief points to observe in devising such a piece of ornamental furniture as this bracket are, without doubt, symmetrical arrangement of outline and selection of harmonious detail—all, of course, in keeping with the style chosen, and if in either particular the design be deficient, the one offence condemns the entire work; my care, therefore, was to avoid incongruities and aim at perfection of design. To this end I made the different parts of my bracket to agree with each other; as regards proportion, for instance, I was careful that the projection of the shelf on either side beyond the centre compartment should not be too great, likewise that the commencement of the cornice should not be placed too far above the shelf, as the addition of a pediment on such terms would make the whole thing top-heavy; I determined also the depth of the work beneath the shelf to accord with the proportions of the parts above it.

It may seem superfluous to mention these matters, but I can vouch that due observance of them is of no small importance, and saves considerable trouble and probable disappointment.

In commencing this job, if you intend to leave the wood in its natural colour and eventually polish it, choose your material from walnut or Honduras mahogany as straight grained as possible, and without a particular amount of figure. For the requirements of enamel painting, pine will do, avoiding, of course, all pieces containing knots or shakes.

Cut from $\frac{3}{4}$ in. stuff a piece $1\frac{1}{2}$ in. wide, and long enough to give, when equally divided, the two styles of the back framing. Next, from the same $\frac{3}{4}$ in. stuff cut another piece 2 in. wide, and long enough to cut the top bar and the lower bar of the framing. All these pieces must be dressed up smooth and square; they can then undergo another stage of preparation, and be got ready for joining together severally as bars and styles, which means that tenons must be cut upon the short bar to fit in mortises cut upon the styles, and the long bar be cut with laps to fit corresponding laps cut also in the styles. The styles and long bar are halved together by means of these laps.

Before gluing up this back framing, the styles and bars must be scratched with a couple of reeds near to the edge of the square opening, which will appear when the four pieces are placed together. Reference to the sketches will enable the workman to determine the position of the joints that I have here described. The rectangular space between the four pieces of the frame requires now to be fitted with a panel. This panel is cut from thin wood, and pierced with a circular opening just large enough to contain the diameter of the circular mirror. Provision must be now made to secure the mirror at front, for which purpose another

piece of thin wood must be cut to the shape as shown in the drawing, and pierced also with a circular aperture, the diameter of which must be rather less than that of the mirror. This second thin piece of wood is bevelled upon its edges, and when glued upon the first piece in proper position, provides a rebate for the mirror's reception.

A mitred moulding (Fig. 3) fitted exactly between the four pieces of the back framework makes the rebate for the panel. To fasten this moulding in place, I used needle points, as they can be driven in far enough to hold the parts, and they conveniently break off rather under the surface of the work after being struck two or three times by the hammer; their place of entry then becomes nearly hidden by the closing up of the fibres of the wood.

The scrolls and bracket pieces which create the outline and fill up the corners in the back frame above and beneath the long bar are made from the same thickness of wood as was used for the back itself; they do not call for any especial mention, saving that they are cut out with the proper saw, and are dowelled on to the styles. The scroll-work curtain filling up the space under the long bar and between the styles may be of much thinner wood than the parts just mentioned, and it were best cut with the grain running downwards. It must be tightly wedged between the two styles, and should have a piece of the same thin wood glued upon its back across the grain, and also three-cornered pieces glued into the angle at each side to give it strength.

This completes the construction of the back of the bracket, and after the shelf (Fig. 4) is cut to shape and reeded, it can be fastened in position by screws driven through the long bar from the back. The top piece can also be cut to proper size and fastened in its proper place by screws driven through it into the top bar.

The pillars (Fig. 5) being next taken in hand, I will mention that the carving upon them can be accomplished with a dovetail saw, and with one or two chisels and files of various shapes; a very valuable auxiliary will also be found in a templet cut from cardboard, showing the outline of one side of a pillar. This templet can be applied at different stages of the carving, to show the workman when and where his work requires correction.

The drop terminals beneath the shelf are fashioned by the same methods as the pillars, and pillars and terminals are connected by dowel screws passed through the shelf. The pillars are held at top by ordinary screws driven through the roof-piece.

Mention must also be made of the curtain pieces of the canopy, which are fixed between the square part of the pillars in front and between the pillar and the style at either side; they are of the same

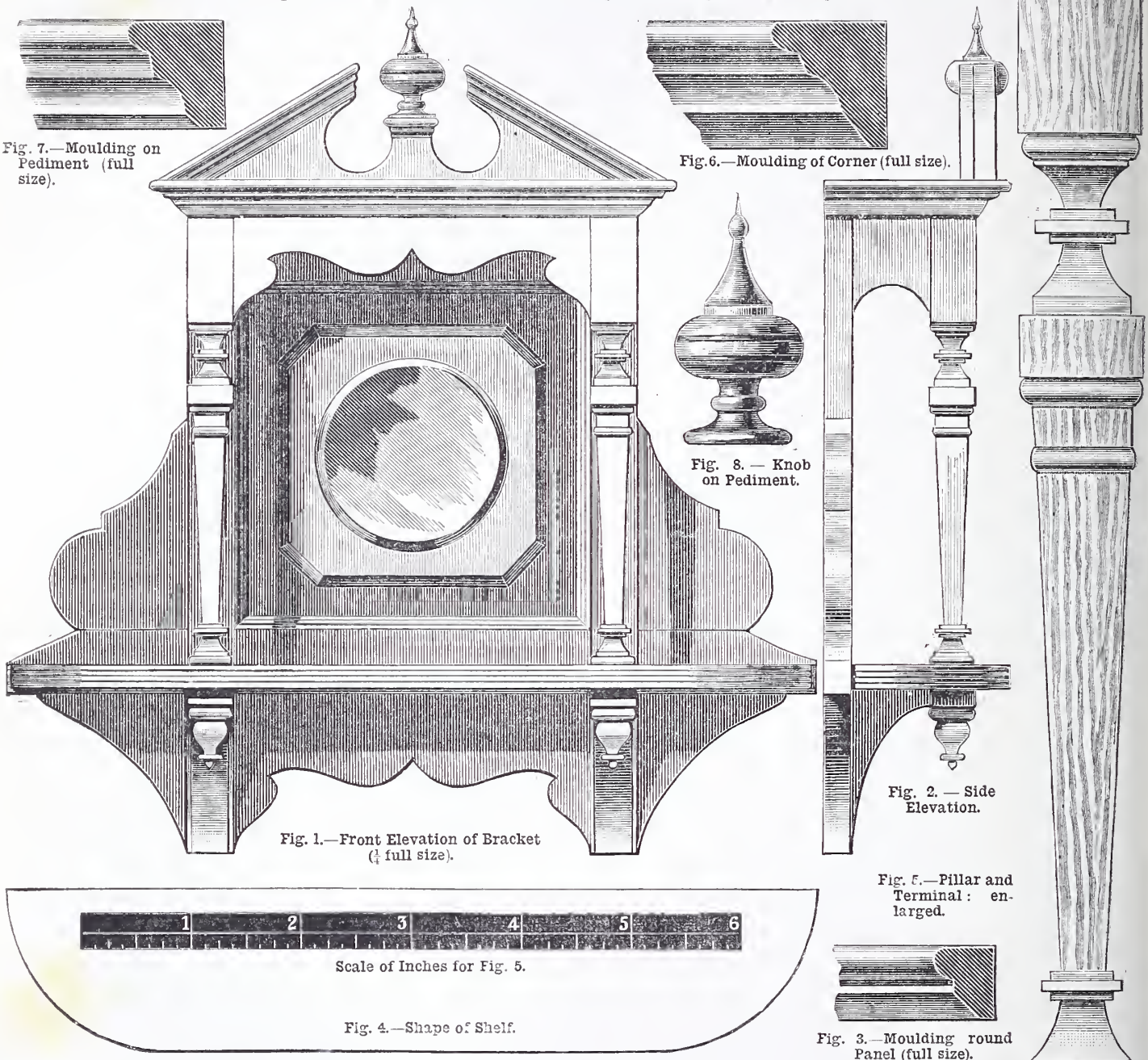


Fig. 7.—Moulding on Pediment (full size).

Fig. 6.—Moulding of Corner (full size).

Fig. 8. — Knob on Pediment.

Fig. 2. — Side Elevation.

Fig. 1.—Front Elevation of Bracket ($\frac{1}{4}$ full size).

Fig. 5.—Pillar and Terminal: enlarged.

Scale of Inches for Fig. 5.

Fig. 4.—Shape of Shelf.

Fig. 3.—Moulding round Panel (full size).

hin wood as the curtain piece below the helf, and they are strengthened in the same way by pieces glued across the grain at the back.

The brackets below the shelf at front are imple in form, and are screwed from the back on to the styles; in size they should each be large enough to fit exactly between the style and the drop terminal, and if this is carefully done, the terminal, which appears to be a continuation of the pillar through the shelf, will also look as though it were part and parcel of the bracket piece behind it.

Now comes the cornice (Fig. 6) for consideration, and I have no doubt that he who constructs the bracket satisfactorily up to this point will also be perfectly qualified to make the moulding of which it is comprised; the fixing of it upon the top piece is but simple mitreing.

Above the cornice is the pediment: this is to be made of ½ in. stuff, and fastened to the top flush with the front edge and behind the moulding. Note particularly the shape of this pediment, and take care that the portion which divides it is drawn correctly in the centre. The moulding (Fig. 7) upon it will be seen to be not so wide as that of the cornice, and the completed pediment will be fixed above all by means of three-cornered blocks glued into the angles at the back. The knob, or finial (Fig. 8), must be obtained accordingly as there are facilities at hand. In order to buy such an one as represented, it will not be necessary to search very far into the region of the Bethnal Green Road; there are many turners in that neighbourhood who keep a stock of them.

The bevelled mirror I was lucky enough to be able to purchase cheaply from a dealer in odds and ends, but I imagine that circular silvered plates are kept pretty constantly in stock. However, the constructor need not be disheartened if he fail to obtain a mirror suitable; the alternative of painting a group of flowers in monochrome upon the panel will be quite admissible, and will have a pleasing effect; in fact, had I not been fortunate enough to obtain the glass, I intended to adopt that plan myself.

PRACTICAL DETAILS OF BOOKBINDING.

BY GILBERT CLARKSON.

Rounding and Jointing—Turning-up, or Cutting with Plough—Pressing.

The rounding of a book is an operation which cannot be well described, it has to be seen to be understood. It is true the back is beaten with a flat hammer held in the right hand, but at the same time the fingers of the left are not idle, they have as much to do as the hammer, and the rounding is only successfully accomplished when both hands perform their part.

Having rounded the book, it will be necessary to joint it (according to trade parlance). This operation is performed by placing the backing boards on each side of the book at equal distances from the back. The whole is carefully put into the laying press, the lower edge of the boards being even with the cheeks of the press, which must be screwed up as tight as possible. With the hammer the back is beaten firm and round, which causes the boards to make a groove by the projecting over of the part left above. This is a long, tedious operation in a big job, and many a blister has been raised on the binder's hand, and many a time in the course of a day he (like the girl in the song) will have to wipe his hot brow. But, thanks to the engineer, this need not be, for there are now backing machines, which not only lessen the labour for the workman, but also lessen the expense for the employer. Messrs. Furnival and Co., and Messrs. John Greig & Sons, manufacture these machines (Fig. 19). They are very compact, taking up but little floor space. They can be easily adjusted from one size to another. A steel roller does the work of the hammer, and it has only to be brought once over the back of the book from one side to the other. It makes a much better joint than is possible with the hammering process.

When books are bound in cloth and other cheap styles, the edges are generally cut with the guillotine. Indeed, almost all cutting is now done with the machine. We cannot afford to cut books with the plough, the prices are *cut* so low. Hence the plough is very seldom used, and there are actually binders who, although good tradesmen, cannot *turn up* a book (this is the trade term for cutting a book with the plough).

Books that are intended to be turned up are treated a little differently from those that are cut round with the machine. While they are drying, after having been glued up, it is usual to look out and prepare the boards for them. The boards are first cut roughly to the size wanted, with the lever millboard cutting machine (Fig. 19 A), and lined with paper on one side; this has a tendency to draw the board and make it lie to the book. After the boards are lined, the books are rounded and jointed, and the boards when properly dry are squared and cut to the exact size for the books. They are then laced in, *i.e.*, the bands on which the book has been sewn are laced through. Two holes are made in the board opposite each band. The slip is first passed through to the inside, then brought out through the other hole. The slip will have to be well scraped and pasted before lacing. The proper time for scraping the slips is immediately before waste-papering the books. After this operation is complete, the slips are cut off close to the board and beaten well into it by placing the inside on an iron (called the knocking-down iron) fixed in the laying press, and beating on the outside with the hammer. This must not be done slovenly, as much of the beauty of the binding depends upon it.

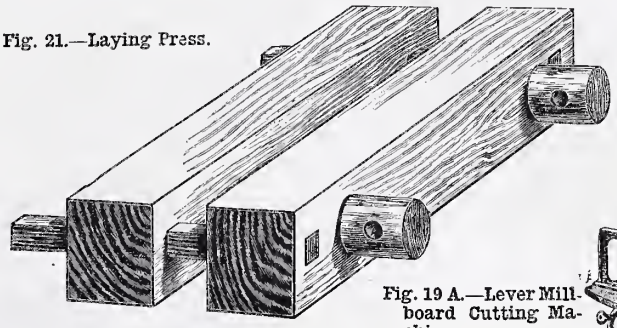


Fig. 21.—Laying Press.

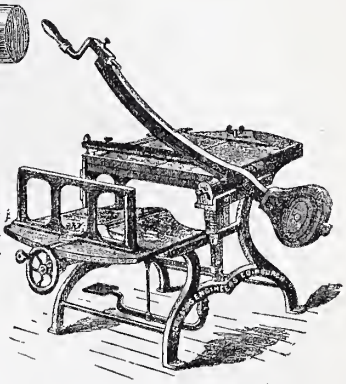


Fig. 19 A.—Lever Millboard Cutting Machine.

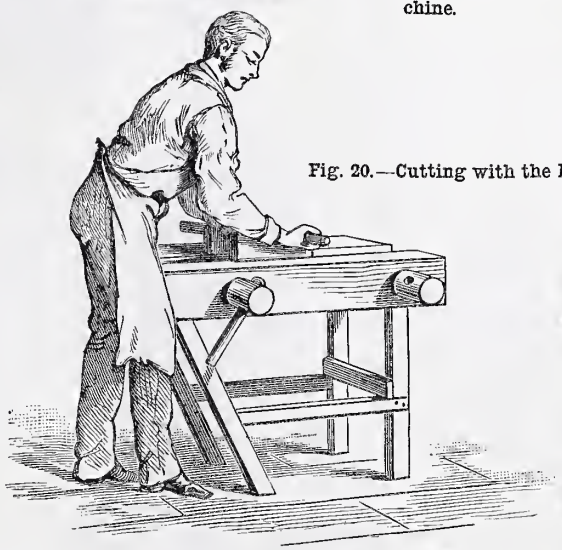


Fig. 20.—Cutting with the Plough.

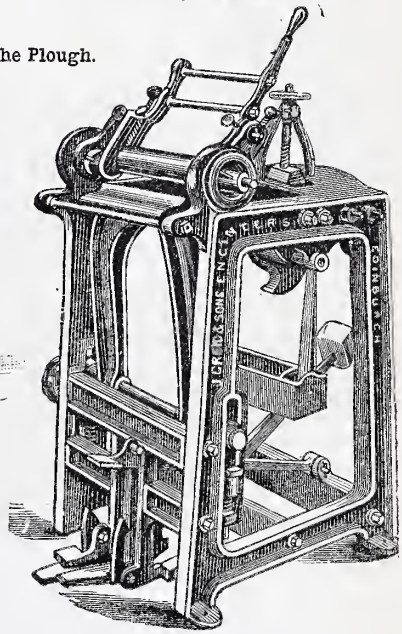


Fig. 19.—Improved Book-Backing Machine.

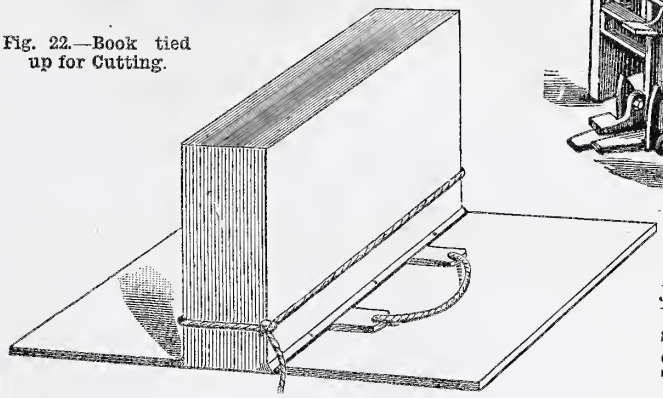


Fig. 22.—Book tied up for Cutting.

It does not add to the appearance of the binding to see great lumps along the joint underneath the leather.

The binder who knows his business will now put his books "in the press." And if he is a careful workman he will press them with tins—he will put a sheet of tin or zinc between the board and the book, and on the outside of the board if he can get a sufficient number of tins for his "parcel;" he will at least put a smooth pressing-board between every book, and build them carefully in the press. He must needs build them carefully, for if his parcel is a big one and the books of different sizes (as they are sure to be), when he is applying the pressure the books may bulge at the centre and fly out of the press altogether. I have seen this happen more than once, and on one occasion I had a very narrow escape from a flying board. When the books are in the press, and the pressure applied, the backs are "washed off." This is the boy's job, and he is sure to be called to it when the bell is ringing for stopping time, and the poor wee fellow growls out—"Why can't you have yer books in sooner?" However, he has got to do it, and he proceeds thus—he pastes the backs well over with rather thin paste and allows them to steep a few minutes, then scrapes them with a blunt stick, then lifts a handful of shavings, dips them in water, and washes all clean and smooth. The books are left in the press to dry.

In cutting books with the plough (Fig. 20) it is very important to have them square. If they are the least bit out at the head, the tail will present the same defect as it is compassed from the head.

The head of the book is always cut first, taking off as little as possible—the right-hand board is drawn down and the volume placed in the press with the back towards the workman. Some binders dispense with cutting boards, and leave the left-hand board to cut against, but the safest plan will be to use the cutting board. The book must be screwed up tight in the laying press, (Fig. 21), the plough taken with the head of the screw in the right hand, and the other end in the left, and worked backwards and forwards in the groove, the knife gradually advanced through the book by turning the screw gently, which should be all one way, as the workman's arms are advanced from his body (Fig. 20).

When the head has been cut, the book is taken out of the press and looked over for the shortest leaf, so that the proper quantity may be taken off the tail. It is again put in the press and the cutting proceeded with as for the head. In cutting the fore-edge, open the boards and tie the leaves with a piece of cord round the head and tail to prevent them returning after the back has been made flat. This done, knock the back flat on the press. Two strips of steel, called "trindles," are generally kept for this purpose; they are passed between the back of the books and the boards (*see* Fig. 22). They are taken out as the book is placed in the press. After the fore-edge has been cut the string is taken off, and the back resumes its rounded form; the fore-edge in consequence has a grooved appearance.

All this may appear simple enough, but when the reader comes to put it into practice he will not find it, as I have said, quite as easy as it may appear from the description. It will be better for an amateur even to pay a small sum to a friendly and sympathetic bookbinder that he may see the operation performed.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

46.—Bell Centering Punches.

To avoid loss of space by repetition and prevent loss of time to my readers and myself by unnecessary correspondence, let me say that all the tools and appliances mentioned in this page are submitted for notice by Messrs. Moseley & Son, 323, High Holborn, London, W.C. The Bell Centering Punch shown in Fig. 1, a full-size illustration of the appliance, is a handy and useful tool that is indispensable to every engineer, machinist, and turner. It enables any one to instantaneously centre any geometrically shaped article for the purpose of drilling or turning. In use the punch is held up right over the article to be centred, and the punch centre slightly tapped with the hammer, when the true centre is instantly marked, and may be deepened by an ordinary centre punch. The price of the larger punch in Fig. 1 is 3s. 6d. These punches are very accurate, and are made of the best material and well finished. Their capacity, outside measurement, is $1\frac{11}{16}$ in., and weight 5 oz. They are made by the Cushman Manufacturing Company, Hartford, Connecticut, U.S.A. The smaller punch, of which the lower part only is represented, has a capacity of $\frac{7}{16}$ in. outside measurement, and is intended for jewellers, clock makers, etc. Its price is 2s. It consists of a steel punch working in a guide of the same material, with a bell-shaped mouth. The punch is held up by a steel spring. It is surmounted by a neat ebony handle, which brings up the entire length of the appliance to $4\frac{1}{2}$ in.

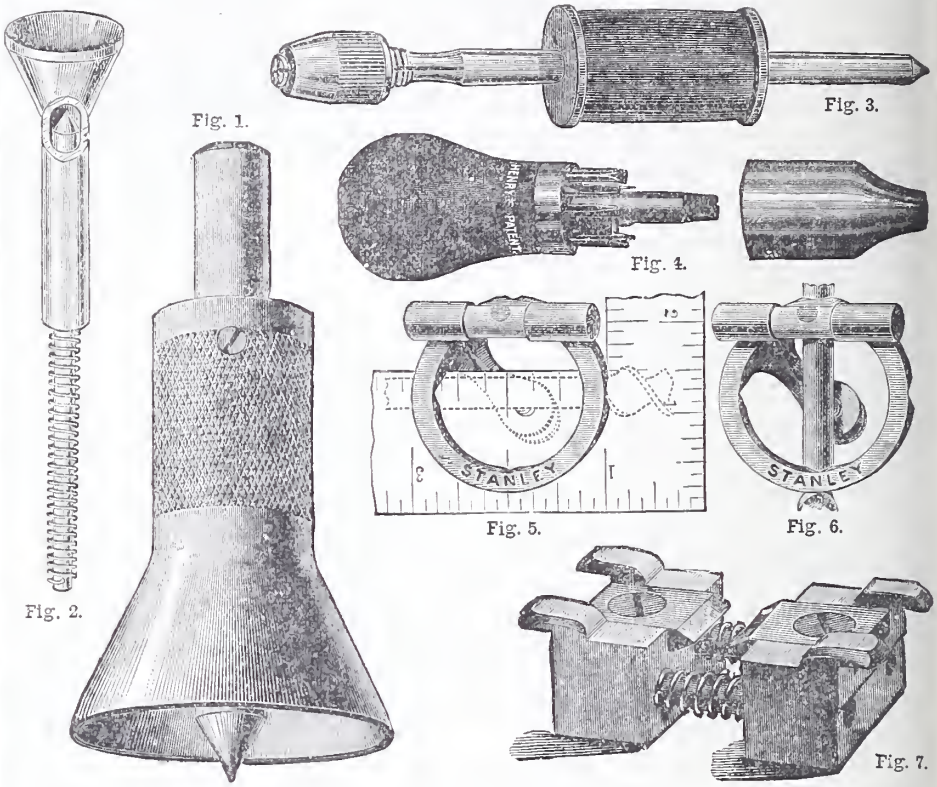


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

Figs. 1, 2.—Bell Centering Punches. Fig. 3.—Clock Drill Stock. Fig. 4.—Henry's Patent Combination Haft. Figs. 5, 6.—Stanley's Bit and Square Level. Fig. 7.—King Vice Cutting Tool.

47.—Screw-Cutting Stock and Dies—Bauer's Patent.

This is a new and powerful stock with six dies for cutting screws of $\frac{1}{4}$ in., $\frac{5}{16}$ in., $\frac{3}{8}$ in., $\frac{7}{16}$ in., $\frac{1}{2}$ in., and $\frac{5}{8}$ in. in diameter. The stock is made in the usual way as far as the handles go on either side, and its length from end to end is very nearly 18 in. The centre, which is $4\frac{1}{2}$ in. long by $2\frac{1}{8}$ in. wide, presents on one side a central circular hole $\frac{7}{8}$ in. in diameter, flanked by two hexagonal-headed screws $\frac{3}{8}$ in. in diameter, which enter the stock through holes pierced for their reception. These screws enter the centres of two discs of steel, $1\frac{3}{4}$ in. in diameter and nearly $\frac{1}{2}$ in. thick, which are cut or tapped on the circumference in six places to the depth necessary to cut screws of the diameters named above, and revolve in circular recesses sunk in the under side of the stock for their reception. When a screw is to be cut, the corresponding cutting parts in each disc are brought opposite to each other in the centre of the stock, and are fixed in position by tightening the screws with a wrench. The operation of screw cutting is then proceeded with in the usual way. The price of this screw-cutting tackle, made as described on Bauer's Patent, is 16s. A set of twelve best taper and plug taps to be used with the stock is supplied for 14s.

48.—Clock Drill Stock.

This handy drill stock for jewellers, watch and clock makers, etc., has its form so clearly shown and its purpose so plainly illustrated in Fig. 3, that it needs but little description. It is $4\frac{3}{4}$ in. in length, and is fitted with a reel-shaped ebony pulley for actuating the drill by a bow and cord. There is a split chuck at the bottom for the reception of small drills, which is tightened or relaxed by the milled screw, which works by means of an internal thread up and down the threaded surface of the chuck. Its price is 2s. 6d.

49.—Henry's Patent Combination Haft.

This well-made pad and set of twelve tools, manufactured on Henry's Patent by Messrs. J. Britton & Son, Stoughton, Massachusetts, U.S.A., will be best described by stating the advantages that are claimed forth over others by the makers. It is the only tool holder that carries the tools in the same end of the holder in which they are used. There is no shifting the holder end for end in changing the tool, nor shaking the tools out into the hand to get the one wanted.

The same motion that unscrews the instrument in use removes the cap covering the tools that are not in use. No wrench is required, and the rosewood handle is solid, and may be struck, if necessary, with a mallet. The tools are held in a split chuck, as may be seen in Fig. 4, and the cap, which is shown removed in the illustration in order to exhibit the tools and chuck, is of brass, nickel-plated. Its price is 3s. 6d.; its length 4¼ in.

50.—Stanley's Bit and Square Level.

It is difficult to name a more useful pocket appliance for the sum charged for it, namely, 1s. 6d., than Stanley's Bit and Square Level. It is, as may be seen from Figs. 5 and 6, a circle of brass 1⅝ in. in diameter, 5/16 in. wide, and ¼ in. deep, carrying a small level carried in tubular projections springing from the upper part of the casting. Behind is a projecting arm, with a screw with a milled head passing through its outer end, which serves to fasten it to any tool to which it is desired to attach it. The frame or ring has three pairs of v slots or notches on the back by which boring can be done with perfect accuracy as to vertical or horizontal borings or borings at an angle of 45° by observing the air bubble in the level when turning the bit. The frame can also be attached to a carpenter's square, as shown in Fig. 5, by letting two shoulders which project from the back rest on the top of the horizontal square, thus rendering it an accurate spirit level, and the upright leg of the square will then indicate an exact plumb line. Its application to a boring bit in a horizontal direction is indicated by dotted lines in Fig. 5, and to a bit in a vertical position in Fig. 6. Its price, enclosed in a small box, is 1s. 6d.

51.—Combination Shears for Cutting Metal and Wire.

I find in this lot of tools and appliances a pair of excellent shears for cutting sheet metal, which will be found useful and serviceable by all who are engaged in sheet metal working on a small scale. The shears are 8 in. long, with blades 2⅜ in. long, and the loops at the ends of the respective handles are large enough, the one to take the thumb up to the second joint, and the other the tops of three fingers. Projections on the top of each blade, just above the screw on which the parts work, form powerful nippers for cutting wire. The price of the shears is 3s.

52.—King Vice Cutting Tool.

Every one who is possessed of a vice should provide himself with one of these useful adjuncts to that appliance, as it will be found to be the best cutting tool yet produced for cutting bolts, wire, keys, rivets, etc., as it will operate effectively on rods ¼ in. in diameter. There are, as may be seen from the illustration of the tool in Fig. 7, two cutter blocks, with shoulders projecting from the upper and outer corners by which the tool rests on the jaws of the vice when dropped in between them. One of these blocks is free, and slides on guide rods fixed in the other, the two blocks being kept apart when not in use by spiral springs coiled round the guide rods. In the top of each block is fixed a powerful cutter, with a wedge-shaped edge. The cutting edges cannot be forced against each other, this feature being provided for in the determined length of the steel guide rods projecting through the free block and coming in contact with the opposite jaw of the vice, which thus provides a positive stop. The length of the tool is 3⅛ in., the width 1⅝ in., and the depth, not including the lugs, ⅞ in.; the width of the cutting blades being ¾ in. The cut is made simultaneously from both sides, and is clean and without burr or ragged edge. The jaws of the vice employed should open to the extent of 2½ in. to enable the tool to be dropped in between them and used with effect. The parts are interchangeable, and new cutters can be fitted when necessary. The price is 3s. 6d.

53.—Hibernia Drill Chuck.

This is a strong and powerful drill chuck made for the lathe by Messrs. Marples & Sons, Sheffield. It is 5⅜ in. long and ⅝ in. in diameter at the mandrel end, and ⅞ in. at the opposite end, in which the expanding jaws of the chuck, furnished with v grooves on the inner side, are inserted. This end is deeply screw-cut for 1¾ in. to take the massive cap, 1¼ in. wide at the widest part, by which the jaws are gripped on the drill or tool that has been placed between them. The price of the chuck, which is well-made and nicely finished, is 3s.

54.—New Combined Blowpipe and Fire Chamber.

This is a new kind of blowpipe, differing from any yet brought into the market, because every ordinary blowpipe acts on a flame altogether independent of it, while in this the fire is contained in a chamber formed by a cap placed on the end of the pipe. The pipe itself is of brass, fitted with a white metal mouthpiece. It is about 8½ in. long, including mouthpiece, and is bent at the other extremity, so as to present a short arm about 2½ in. long at right angles to the longer arm, the bent part, of course, taking the form of a quarter of a circle. At the end of the short arm is a cup-shaped chamber, through which the extremity passes, terminating in an end having a pin-hole aperture. Round this end is placed some wire gauze, which forms the bottom of a circular box 7/16 in. deep and ⅝ in. in diameter. In this is placed a piece of sponge saturated with spirits of wine, which is kept in place by a thimble-shaped covering, with an opening at the top ½ in. in diameter, that fits tightly over the box. The spirit is ignited, and the blowpipe is then used in the ordinary way. The price is 2s. 6d., or 2s. 9d. post free. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Simple Spirit Lamps for Soldering, etc.—E. H. (*Brighton*) writes;—"I use an empty water-tight brass cartridge case (as thrown away by the rifle volunteers). Twist a piece of copper wire tightly round it and form a handle like a candlestick, stuff the empty case lightly with cotton wadding, then fill with as much methylated spirit as the wadding will take up; fit a cap to prevent the spirit evaporating when not in use. For a copper bit, I get a piece of clean copper wire, dip an inch in killed spirit, then hold it in the flame of the lamp with a bit of blowpipe solder. With these and a small blowpipe I can solder everything that is too small for a tinman's bit, and a good deal more too."

Fairy Bells.—A. G. (*Cardiff*) writes:—"I notice in page 95, Vol. II., that J. H. S. (*Walthamstow*) states he has a fairy bell with twenty-six strings, and as he has kindly offered to give any further information required, I wish to ask if he will oblige me with the number of strings he has, of each size of wire."

Cutting Mitres.—Post Office Box (*Richmond, Va., U.S.A.*) writes:—"Before leaving England in April, I was inquiring for a handy machine for cutting mitres on picture framing. A friend, an excellent amateur carpenter, advised me to have nothing to say to the ordinary mitre-cutting machine, but to trust to the 'shooting board,' page 188, Spon's 'Mechanics' Own Book,' and the plane, for mitreing moulding. He explained that the great difficulty in keeping the knife true in a mitre-cutting machine renders it unfit for use by any one but a skilled mechanic. So far I have been unsuccessful with the shooting board and plane; the mitres turn out fairly true with the saw, but the plane, however keen and fine set, chips the gilt off the edges of the moulding at the joint. Am I badly advised as to the shooting board? Will someone kindly let me know their experience in picture framing."

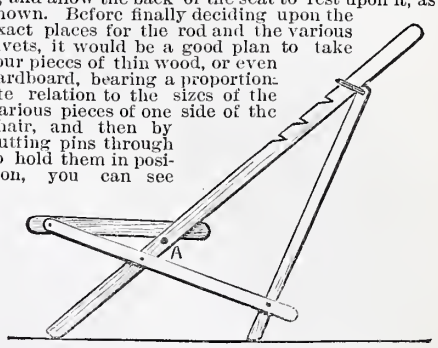
China and Glass Drilling and Riveting Tools.—F. T. (*London, N.*) writes:—"It might be helpful to your readers to know about the price to pay for a thoroughly good outfit of drilling and riveting tools for China:

	s.	d.
Drill	5	0
Two diamond bits	5	0
Side cutting pliers	1	9
Half-round wire, two sizes ...	1	0
Small hammer	1	0
	13	9

II.—Questions Answered by Editor and Staff.

Insulated Wire.—Magnet.—Your query is wanting considerably in detail, and shows a want of knowledge in the subject at issue. However, I fully understand what you want to get at. Wind your coil exactly in the direction given in your sketch taken from "Science for All," and couple up your battery according to the directions given in Work for February 15th, and you will have the North Pole at your right hand.—W. D.

Garden Chair.—Chair.—I think the accompanying sketch will make the thing clearer to you, and perhaps help you out of your difficulty. Instead of riveting the back ends of the seat rails to the back legs, put a ¼ in. iron rod right through both legs at A, and allow the back of the seat to rest upon it, as shown. Before finally deciding upon the exact places for the rod and the various rivets, it would be a good plan to take four pieces of thin wood, or even cardboard, bearing a proportionate relation to the sizes of the various pieces of one side of the chair, and then by putting pins through to hold them in position, you can see better how your chair will work when finished, and so decide upon the exact spot to insert your rivets. Perhaps this is not very clear to you; if not, look at the sketch and try to imagine that you are looking at four slips of thin wood, instead of finished chair legs, and that the rivets shown are your pins, and I think you will catch on to the idea. A model of this sort often serves to bring one out of a difficulty, and I would recommend you to adopt it whenever you can find it practicable, as it saves a lot of thinking.—G. le B.

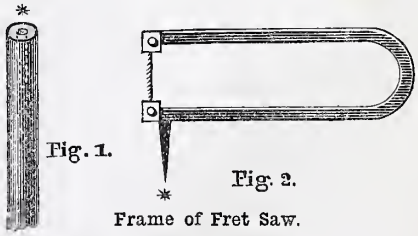


Garden Chair: position of Iron Rod.

Polishing Silver-plated Articles.—J. T. (*Carlisle*).—If there are scratches in the deposits of silver after it has been scratch-brushed, it shows either that the wires of the brush are too coarse and hard, or that the articles were not polished before they were placed in the plating vat. If the articles were smoothly polished before being plated, the fault must be in the brush, and you must use one having finer wires. All scratches in the surface before plating are reproduced in the silver coat. A note on burnishing is already in the Editor's hands.—G. E. B.

Gramme Dynamo.—G. E. S. (*Berkeley*).—I should advise you to get a set of castings with the F.M. cores, 2 in. by 1½ in., and wind these with 6 lbs. of No. 22 double cotton covered copper wire. Do not get laminated punchings for such a small machine, as you will find these troublesome to fix and wind. Get a solid Pacinotti cogged armature (3½ in. × 2 in.) with your castings, as part of the set, and wind this with 1½ lbs. of No. 22 double cotton covered copper wire. Connect the armature coil in shunt with the F.M. coils. If you run the armature at a speed of 2,500 revolutions per minute, you should be able to light up from three to five incandescent lamps of 10 c.p. each lamp. You will find more details in my forthcoming articles on "Model Electric Lights."—G. E. B.

An Easily-made Fret Machine.—E. F. (*Battersea*).—You ask me how to fix the frame of saw on gaspipe. I do not think that I can make it much plainer than what I said in page 332, Vol. I. Drive a piece of beech, or any similar hard wood,



Frame of Fret Saw.

in the top of the gaspipe, and in the wood bore a small hole, as Fig. 1. In this hole knock in the point of the frame, Fig. 2, and see that you get the under side of the frame square with the pipe, or else it will always have a slanting stroke.—W. R. S.

Spokes.—J. W. B. (*Oldham*).—Spokes are not, and cannot be, turned in the ordinary lathe. A wheeler will sometimes place a spoke in a lathe whilst he is dressing one side, then give it a turn round with the other hand, and finish dressing the other side off. Most of the spokes you see in wheels on light carts are either hand or machine-dressed ones. Spokes in heavy carts and larries are always dressed by hand labour, and made of English oak. The machine-dressed spokes, which come in large quantities from America, are invariably of hickory. In large coach-builders' shops a spoke-dressing machine is kept, but would take up too much space in "Shop" for me to describe it; but ready dressed spokes can be bought so cheap that a wheeler is not necessitated to buy a machine. These, however, can be procured from Messrs. Whittingham and Wilkins, Long Acre, London. Instructions how to make and dress spokes will be given in the papers on wheel-making.—W. P.

Patent.—W. L. N. (*Birmingham*) should examine the specifications of the patent which he fears may interfere with his trade, and ascertain how much ground it actually covers. As he does not want to make watches, it may be that his alarm is needless. The specification may be bought from the Patent Office, or he can see it for nothing at a Patent Library. As he is a Birmingham man, he had better go to the Patent Library, Corporation Buildings, Birmingham.—C. C. C.

Sheet-Iron Tanks.—CONSTANT READER.—If your tanks are not thick enough to caulk light, you can proceed somewhat as you say. Prepare a very thick paint of red lead, white lead, boiled oil, and terebine; make it as thick as treacle; coat the laps well with this mixture and also a strip of canvas and place it between the two; you will not be able to draw the rivets through two thicknesses of stout sheet iron; you ought to punch all holes by a gauge before attempting to put together. Your holes should be fairly close together—about 1¼ in. from centre to centre.—R. A.

Brass Polishing.—ARGUMENT.—The following description will give you an idea how brass work is polished. The machine shown in Fig. 1 is for use where steam or other power is employed, and is speeded up to 2,000 or 3,000 revolutions per minute (the greater the speed the better the polish obtained). The screws C on the ends of the spindle are cut the reverse of each other, so that when the spindle is running (they always run towards the operator) the resistance caused by the work which is being polished tends to screw the bob on the spindle. It is fitted with fast and loose pulleys. The spindle should be made of steel, and bearings should not be less than 4 in. wide, because the high speed and sand working in wear them away quickly.

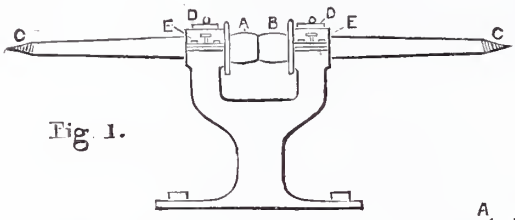


Fig. 1.

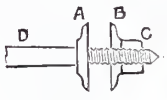


Fig. 2.

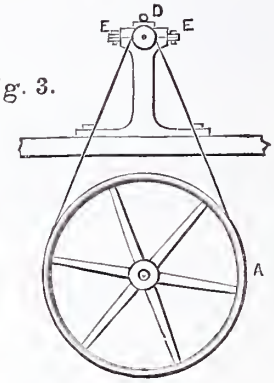


Fig. 3.

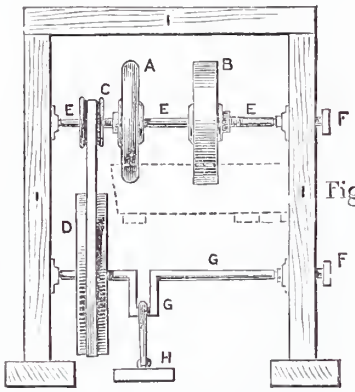


Fig. 4.

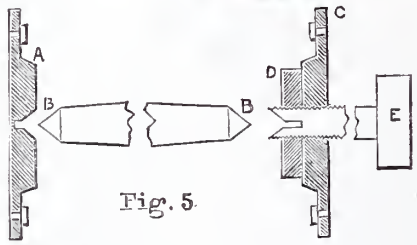


Fig. 5.

Polishing Machines. Fig. 1.—A, Loose Pulley; B, Fast Pulley; C C, Tapering Ends of Spindle cut with a Rough Thread; D D, Oil Boxes; E E, Adjusting Screws for Bearings. Fig. 2.—Alternative End of Spindle—A, Fast Collar; B, Loose Collar; C, Lock Nut; D, Spindle. Fig. 3.—Method of Driving Spindle—A, Driving Wheel; D, Oil Boxes; E E, Adjusting Screws. Fig. 4.—Another form of Machine—A, Round Face Bob; B, Flat Face Bob; C, Pulley; D, Driving Wheel; E E E, Spindle; F F, Adjusting Screws for Spindles; G G, Crank and Driving Spindle; H, Treadle; I I I, Framework. Fig. 5.—Enlarged Section of Spindle Ends and Bearings in Fig. 4—A, Plate with Taper Hole; B B, Ends of Spindles tapered to fit Plate, etc.; C, Plate for other End, screwed; D, Lock Nut; E, Adjusting Screw fitting in Plate C.

Fig. 2 is another arrangement for fixing bobs to spindles, and is used with wooden wheel bobs, which are described further on. The mode of driving these spindles is shown in Fig. 3. A is the driving wheel fitted to a shaft, which runs under the bench on which the spindle is mounted, the top of the bench being used to hold the polishing sand. Fig. 4 is a good substitute where steam power is not used, and from which fairly good results can be obtained. The sketch shows the general construction of it. Approximate dimensions are—height from bottom to top, 4 ft. 6 in.; outside width, 3 ft. The framing is made from 6 in. or 8 in. by 3 in. wood; the bobs are fixed on spindle in similar manner to that shown in Fig. 2, and can be made of various shapes on the face, according to work. Fig. 5 is an enlarged section of bearings of spindles in Fig. 4. Plates A B should be about 2½ in. by 1½ in. by ¾ in., made of iron, with a steel face, and hardened. Plate A should always be made with a drill hole at the bottom of countersink; also the end of adjusting screw E must be made in the same manner; the object of it is that the points of spindle B B shall not be worn down, also spindle will run easier. Points of spindle and adjusting screw must be steeled and hardened; the harder the better. The materials used for polishing are bobs, mops, sand, crocus, Sheffield lime, and rottenstone. The bobs used on Fig. 1 are made from walrus and seahorse hides, bull's neck, and from felt. The leather bobs are best, and vary in size from 1 or 1½ in. by ½ in., to 6 or 8 in. by 1½ in. The wooden wheel bobs previously mentioned are discs of wood turned true and the face covered with leather; either of the above three kinds are suitable. The leather is fixed to the wood with glue and wooden sprigs, such as used by shoemakers, the leather being first soaked in water to make it pliable. When the leather is dry, the bob is again turned true. The bobs are of the kind used in Figs. 2 and 4, and are made of various sizes, 8 in. to 12 in. being the most usual; the large size would be used in Fig. 4. Mops are made by a large number of pieces of calico being fastened together, and are of various diameters and thicknesses. They are used in Fig. 1 for colouring up the work. The sand used is called Trent sand; it can be procured in the rough or prepared. To prepare it, it is first pounded in a mortar, then run through a fine sieve; the finer the sand is made the better will be the work. The sand is then mixed with oil, just sufficient to keep it together, so that it cannot be blown away in dust. Sheffield lime, crocus, and rottenstone, are used for colouring purposes. Sheffield lime is, I think, the best, it keeps the mop cleaner and cleans the work better than the other two. When polishing, the work is applied to the bob at an angle, so that the sand held in the hand may trickle down between it and the bob. After being done with the sand it has a dull, greasy appearance, but this is removed in being coloured on the mop. The crocus, Sheffield lime, or rottenstone, is applied to the mop as occasion requires (experience shows when), and adds lustre to the work. Work done on a machine as shown in Fig. 1 has not so good a finish as that done on a power spindle, but a good polish can be obtained with care. When the article has been done with the sand, a piece of brass or steel should be held against the bob to scrape off the sand; then apply rottenstone or one of the other compositions to the bob and colour off. The dotted line in Fig. 4 is a box about 6 in. deep, in which the sand is kept. The sand can be cleaned from embossed or figured work by being soaked in petroleum and then brushed with a soft brush; the articles should then be dried out in warm sawdust, rubbed over with some clean old rag, and lacquered if required. There are many firms in your city who supply polishing requisites: Messrs J. E. Hartley & Co., St. Paul's Square, and Mr. W. A. Carlyle, 48 and 50, Constitution Hill, are two of them; I have also seen spindles in Messrs. R. Lloyd & Co.'s, 135 and 136, Steelhouse Lane, and in the second-hand shops in the same street, but second-hand articles are not always the cheapest. Leather and felt bobs are sold in a shop in Steelhouse Lane, but I forget the name of the firm.—BRASS.

Sweaty Hands.—S. W. (*Camberwell, S.E.*).—I am sorry that I do not know of any remedy for this. It is constitutional, and you ought to consult a medical man; it is dangerous to apply anything that will stop perspiration; the cause of it must be removed. You might try drying your hands after washing in oatmeal or bran, and rub occasionally in either whilst at work; this may rectify it a little.—R. A.

Bronzing.—C. H. G., C. B. G., NEMO, and others.—The following recipes and instructions collected from various sources will give these querists the information they require. Browns of various shades may be produced on brass articles by immersing them in a solution of nitrate and iron. Violet, by a solution of chloride of antimony. Chocolate, by burning on the surface of the brass moist red oxide of iron, and polishing with black lead. A good green can be produced by treating on brass as follows: make a solution of 1 oz. bichloride of mercury in 1 pint of vinegar; brush the articles well with this, and whilst wet dust on black lead thickly and polish; lacquer with green lacquer composed of one part lac varnish or shellac, four of turmeric, and one of gamboge dissolved in methylated spirit. Steel grey may be produced by a diluted boiling solution of muriate of arsenic. Blue can be produced with hyposulphite of soda. Antique green bronzes may be obtained by alternately washing with diluted acetic acid and exposing to the fumes of ammonia, or by boiling in a strong solution of nitrate of copper. Another method is by washing the metals in a liquid made of 10 grains sea salt, 10 grains cream of tartar, 10 grains acetate of copper, and 30 grains carbonate of soda dissolved in 4 fluid drams of vinegar. G. B. G., who inquired particularly about steel bronze, might try some of the metallic enamels; steel ardenbute, made by T. Pavitt & Co., is very good; it is sold at most ironmongers' and colourmen's at 6d. per bottle, and, I believe, Aspinall makes a similar thing. For steel for concertina reeds I should try some of the steel pen manufacturers at Birmingham and elsewhere.—R. A.

Silvering Bicycle Parts.—W. E. B. (*Hull*).—(1) Your correspondent means, I think, how to silver plate or nickel plate. It is needless for him to attempt this without a somewhat expensive plating plant, and considerable experience in using it. If he means only to plate parts of his own tricycle the idea is absurd, he would get them done for a few shillings. If he means to try it himself he will spend five or six times more for the necessary plant and will not be able to do it then. (2) "How to Nickel Plate, E. and F. Spons' Recipes." London.—A. S. P.

Wheel Gearing.—G. R. (*Durham*).—Taking your wheels Nos. 1 and 3 at 4 ft. diameter, and wheels Nos. 2 and 4 as 6 ft. diameter, then axle No. 4 will make sixty-four revolutions to one of wheel No. 1, so if the latter makes four revolutions per minute, a 6 ft. wheel on axle No. 4 will be travelling at a speed of 54½ miles per hour. I do not think you can get enough power in a "hand crank" to do this work. On an ordinary road you would require about half a horse power to keep the speed up.—F. C.

Hand Power Hoist.—NEMO (*Bradford*).—For your hoist, you should put the hauling rope pulley direct on the axis of the worm, and the worm wheel upon the barrel shaft; the multiplication of power will be 22 to 1 to raise 6 cwt. and overcome friction. The hauling rope pulley may be 20 in. diameter, and its groove may have radial notches in its sides to prevent the rope from slipping. The worm should then be 1½ in. pitch, and the wheel it gears will have twenty teeth, which will bring its diameter to 9½ in. nearly; the winding barrel (or pulley if that is used) should then be 18 in. in diameter. The screw is to be 4 in. in diameter, then it will be self-sustaining in any position, the angle of thread to axis being obtuse enough to prevent the worm from being driven by the worm wheel. These dimensions will give velocities as 22 to 1 between the hauling and lifting ropes. The worm shaft should nowhere have a less diameter than 1 in., and the barrel shaft, on which the worm wheel is keyed, must not be less than 1¼ in. in diameter. No cog wheels are necessary in this construction. I should advise you to inquire the price of such gear before making it; you may find it cheaper to buy it.—F. C.

Gravity Daniell Battery.—C. F. T.—The directions for charging this battery were quite correct, and you have followed them faithfully. I think you must have omitted to amalgamate the zinc, hence you got a film of zinc oxide and finely divided copper on the zinc element (this was the powder sent me for analysis), and this resisted all further action. The solution must not be disturbed at all after the battery has been set up.—G. E. B.

Slot Guard.—J. C. (*Penge*).—The invention is ingenious, but I am afraid too complex to become a commercial success. The battery is rather an

objectionable feature as being liable to fail, and for any portable apparatus it would be very inconvenient.—F. C.

Staining Furniture.—J. H.—The wood may be stained yellow—a most unusual colour for furniture—by using a solution of picric acid. If this is not sufficient, write again.—D. D.

Tool Contrivance. — J. D. — No special contrivance is required to turn washing machine rollers. Your lathe is, of course, provided with a T rest, and it may be presumed you have the ordinary tools for doing plain work. Beyond these nothing is absolutely necessary but skill, which can only be acquired with practice.—D. D.

Oak Varnishing, etc.—H. A. (*Hackney*).—If you find that the varnish has sunk into the wood, give another coat. You will, however, save varnish by first sizing the wood. Apply the size with a brush and do not varnish till dry. The best varnish to use depends on circumstances, for you would naturally not use the same on a piece of carving as on work out of doors. As you do not say anything about this, all I can do is to advise you to ask at the oilshop where you deal which is the best for your purpose, whatever it may be. You cannot do better than read WORK, including the "Shop" columns, for information about polishing. Individual inquiries are answered and difficulties met there, and no book on the subject can do more than deal with generalities.—D. D.

Musical Glasses. — MUSICAL. — A full set of musical glasses should consist of twenty-five, that is, two octaves, but any number may be used, either more or less, the difficulty increasing the larger the number, and growing smaller the fewer, used. The glasses should be as nearly as possible of the same height. Champagne, port, or claret, if of good flint glass, and cut, not cast, give excellent results. It requires some amount of time and patience, not to mention expense, to get a complete set and well in tune, although the latter may be adjusted by partly filling the glasses with water. No rule can be given for selection, glasses of apparently the same size, thickness, and height varying in pitch to the extent of several notes; this must depend, therefore, upon the ear; generally, however, it will be found that thin glasses give a deep, and stout ones a shrill, tone. Having selected the requisite number, place them upside down on a board, leaving a space of ¼ in. clear between the edges. They should be in two rows, the "natural" notes in the front row, and the "sharps and flats" in the second row, thus:

C♯ D♯ F♯ G♯ A♯ C♯ D♯ F♯ G♯ A♯
C D E F G A B C D E F G A B C

Measure 1½ in. from the outside of these, and from this measurement out your baseboard, which should be of ¾ in. pine. On this board fasten each glass by three wooden clips, or buttons. It will not be necessary to make three for each glass, as some will fasten down two each. They should be of ⅜ in. stuff, and be lined on the under side with soft leather to make them grip firmly on to the stands of the glasses, and also minimise the risk of breakage. Some prefer to sink each glass into the baseboard the thickness of its own foot, and then screw the buttons on level; but having tried both methods I have come to the conclusion that the former is the best, as by it you can more easily replace a glass, and there is no risk of the foot being too large, as the buttons can easily be adjusted to any difference of size. Sides and ends should be now fitted to the baseboard and hinged so that they will all fall outwards when the glasses are required for use; and in addition a lid should be hinged to the back, in the centre of which a falling handle should be placed. The whole should be raised on four feet about an inch high.—R. F.

Noisy Tremulant in Organ.—J. W. H. (*Holmwood, Co. Down*). — Probably your tremulant requires the pallet recovering with leather, so as to deaden the sound when in action. If you have room, it can be enclosed inside a box lined with felt, which will still further deaden the sound. Another alternative is to remove it entirely from the organ and place it in a cupboard at some distance from the instrument, or in the next room, conveying the wind to it by a 1½ in. tube. It will answer just as well as when fixed on the instrument itself, and can be fixed where it can be easily got at when required. As it acts on both "choir" and "great organ," probably there is only a single soundboard for both manuals.—M. W.

House Agency.—HOUSE AGENT.—Appraiser's and House Agent's licence is set down at £2. It, and all information with regard to it, may be obtained at the nearest Money Order Post Office. We are given to understand that a person may simply let houses without a licence, but he must not let furnished houses of more than the annual value of £25 per annum, or make any valuation between outgoing and incoming tenant. In short, without a licence he can never extend his business far. In the writer's district, the usual commission on collecting rents is 5 per cent.—S. W.

Lantern Slides. — H. C. T. (*Holloway*) asks, "Is it the negative that forms the slide, or is the picture printed? Do the plates have to be exposed any longer than for an ordinary photograph?" In answer to H. C. T., I would refer him to WORK for the 6th of March, where I described the method of printing lantern slides. I would here briefly say the negative is not used, but a plate printed from it. The exact time taken for printing will have to be determined by experiment, as the plates of different makers vary in sensitiveness. I think H. C. T. will find the information he needs in the answer I have referred to. If not, write again and state difficulties more fully, and I will endeavour to answer.—O. B.

Dressing Table, etc. — ANXIOUS TO KNOW. — There is not sufficient space at my disposal to treat of these articles so fully as I should like; therefore, should there be one or two points rather blunt, you will know the reason. As, however, you only ask for designs, perhaps you do not need the little I do say. You do not ask for anything elaborate, so I have given you ordinary

Dressing Table.

patterns. Refer for drawer making and joinery to "Some Lessons from an old Bureau" (page 113, Vol. I.); and for table top to "Lining up" (pages 210, 234, Vol. I.). These are meant to be 3 ft. 6 in. long each. The drawers will run on mortised and tenoned frames, either left clear or filled in by a board of thin stuff, in the same manner that a slate is encased within its frame. For making the plinth refer to "Combination Bedroom Suite," "Coal Box," or some other of the numerous articles in WORK. You will also find some serviceable

Washstand.

hints in "A Small Sideboard." In corners of plinth, glue and screw small blocks underneath for further strength, to which to attach castors. Width of pedestals, inside plinth, 13 in.; width of opening, 15 in. The heights range from 28 in. to as much as 31 in. You will find 29 in. the most convenient. Sides of table (measuring on plinth) about 18 in. Each drawer under table top will be a trifle larger than the one above it; you can easily calculate the sizes, allowing 4½ in. for plinth and ⅜ in. for each division. The same thickness will suit for sides. Jewel boxes will be about 11 in. wide, and 10 in. or 11 in. high, and 8½ in. or 9 in. from back to front. Divisions and sides for them will do of ½ in. stuff. The glass frame will be about 17 in. by 24 in., exclusive of mouldings and pediment. I have purposely placed brackets, in preference to turned columns (the latter will not be so firm), for the support of the glass frame, which will swing by means of a movement to be obtained at any cabinet brass founder's. Washstand will be the same height. Get the marble from any mason's, and let him bore a few holes through it, by means of which the tile-back, etc., can be screwed on. Six tiles, let into a rabbet and secured by a thin board nailed behind, will be required. Legs to be turned from 2½ in. stuff. I would say more, but space will not permit. Buy an Index of WORK, Vol. I.—J. S.

Horse-Power of Pumping Engine.—E. H. M. (*Thackley*).—The friction of a fairly good pumping engine and pumps should not exceed twenty per cent., and upon this basis your questions are solved as under:—

To raise 60 cubic feet of water 30 fathoms (=180 ft.) per minute:—

```
                60  cubic feet.
                62·3 lbs. per cubic foot.
               ----
               180
              120
             360
             ------
             3738  lbs. weight.
              180  feet lift.
             ------
             299040
             3738
             ------
             672840  foot lbs. net work.
20 per cent. 134568
             ------
             807408  foot lbs. gross work per
                     minute.
```

$$\frac{807408}{33000} = 24\tfrac{1}{2} \text{ horse-power (nearly).}$$

The other questions are solved in the same way, and, as our space is limited, I merely give the results, noting that 33,000 foot lbs. per minute is one horse-power. To raise 50 cubic feet 20 fathoms, 13½ horse-power; to raise 20 cubic feet 10 fathoms, 2⅔ horse-power; the total power required is 40⅔ horse-power.—F. C.

Application of Electricity to the Cure of Disease.—W. W. (*Patterdale*).—I write as experience dictates. Although I have suffered very much from neuralgic pains and nervous weakness consequent upon indigestion, and have tried magnetic belts and electrical appliances, I have not experienced any benefit therefrom. In my circle of friends there are others who have had similar experiences, and I do not know of one *cure* effected by galvanic or magnetic belts. I have seen electricity applied in our hospitals for the relief of pain, and as an aid in the cure of certain diseases. Morbid growths may be removed by the electric cauteriser; superfluous hair by an electric depilatory; the action of nerves and muscles may be stimulated by the proper application of a high-tension current, as from a medical coil, and thus proper circulation restored in paralysed limbs; poisons may be eliminated from the human body by electrolysis; but belts are useless for such a purpose. If you will write to me, enclosing stamped directed envelope for reply, telling me all particulars about your complaint (cause, age, habits, work, and any other matters relating to your sufferings), I will advise you how to obtain relief. I shall have something to say about medical coils in my forthcoming articles on "Coils."—G. E. B.

Zither Wire.—W. J. (*Belfast*).—The strings used for the zither consist of steel, brass, gut, and steel or silk covered with copper or silver wire. The first and second melody strings are of No. 8 steel, the third of No. 9 brass wire, the fourth and fifth of steel covered, while of the accompaniment strings, Nos. 1, 3, 6, 8, and 11 are of gut, the remainder being of silk covered. Tutors for the zither, containing a complete scale with method for tuning, can be obtained from Messrs. Chilvers and Co., St. Stephen's, Norwich, who also supply strings, etc.—R. F.

Engine Castings.—A. E. quite depends on type, quality, and number of parts, some being so much simpler than others. From £2 to £3 would be charged for 3½ in. or 4 in. cylinder engine set. The following supply sets: Mills, Sunderland; Lee, High Holborn; Dorrington, West Gorton, Manchester.—J.

Pinholes in Soldering.—E. W. (*Soldering*).—I should say that the cause of the pinholes that you complain of was either withdrawing the heat before the solder had sufficiently flowed on the articles, or some defect in the spelter. What is its composition, and do you buy it or make it yourself? You can do nothing to avoid the pitting caused by throwing the borax on the work; but why throw it on if you are particular about the work? Take up a little on the spatula and apply to the parts requiring it. With regard to the pinholes previously mentioned, if the articles are to be plated there would be no objection to filling them with soft metal.—R. A.

Bookbinding; Monogram in Gold.—A. G. C. (*Tottenham*).—If, as you say, you are a constant reader of WORK, I am afraid that you do not profit much by your reading; for the information which you desire has been given not less than three times. In Nos. 14, 24, and 27, on pp. 221, 381, and 429, you will find detailed instructions for lettering book backs in gold. The same thing applies to stamping monograms or any other device upon book covers. Kindly turn up these pages, and when you have found them, please make a note of it.—G. C.

Worn Bearings.—A. L. B. (*Preston*).—I do not know of any way of lining worn bearings with white metal. The way I adopt with the class of bearings that I have most to do with—viz., lawn mowers, knife machines, etc.—is to bush them by sweating a thin piece of brass in each of the halves of the bearing, or by filing the bearings down till the sides do not quite touch when placed on the spindle, and then hollowing them down a little with a round file. If the bearings are in one piece, as sometimes is the case, I turn a thin tube of brass, and let in to them. I have generally found these plans to answer very well. Instruction on soldering appeared in Nos. 17, 23, and 32.—R. A.

Magnetising Telephone Bars.—J. T. (*Liverpool*).—I was very much pleased to have your letter in reference to the above, although I cannot understand why you should take exception to the method of magnetising steel bars described by me. By the way, it was T. A. L. who *asked* for the information; he was not describing the method. The description is given over the initials W. D., and, to use a vulgarism, "that was me." I know it is a little difficult to understand the winding of right- and left-hand spirals, and the way to get a desired polarity, but the method given by yourself is exactly what I have sketched. If you look at the diagram again you will doubtless find that this is the case. I am always pleased to receive a letter from any one who shows an interest in what he is writing about.—W. D.

Elephants' Teeth, Working.—J. S. S. B. (*Dublin*).—In "Holtzapffel's," Vol. I., page 139, I find the answer to your question. "The grinders of the elephant are occasionally worked; but their triple structure of plates of the hard enamel, of softer ivory, and of still softer cement, which do not unite in a perfect manner, renders them uneven in texture. Owing to the hardness of the plates of the enamel, the grinders are generally worked by the tools of the lapidary; they are but little used, and when divided into thin plates are disposed to separate, from change of atmosphere, the union of their respective parts being somewhat imperfect. They are made into small ornaments, knife handles, and boxes, which are occasionally imported."—F. A. M.

Rushes for Caulking.—B. S. B. (*Warwick*).—H. Bullard, High Street, Royston, Herts, will supply you with enough rushes to caulk a dozen barrels for 6d., and postage 3d., per parcels post, as they are very light. I cannot give you any information on coopering, except in the use of the rushes, which are generally split and greased before being placed in the joints.—C. H. B.

Camera.—If CAMERA will refer back to No. 13 of this publication, he will see a detailed illustrated article on the subject of camera making. The diagrams given are for a whole plate square camera. For a half plate a little lighter wood may be used, the dark slides being made 6½ in. by 4¾ in., instead of 8½ in. by 6½ in., and the back of the instrument to contain a focussing screen of 6½ in. square, and the rest reduced in proportion. Yes; any size smaller plate may be used than that for which the camera is constructed; the only provision is to have carriers to hold the size of plate required fitting into the dark slide. Undoubtedly the best lens for all-round work is the rapid rectilinear; the portable symmetrical is also an excellent lens.—D.

Painting and Papering.—T. G.—The length of time it is advisable to leave "plaster work," before painting or papering thereon, will vary under different circumstances. Walls finished in "Keen's" or Parian (white, hard-faced cements) can be painted upon in a day or so. Walls finished with a large proportion of plaster in the "skimming" (finishing) coat, may be painted upon as soon as thoroughly dry, but it might not be advisable to fix thereon papers containing pigments, the colour of which is easily affected by lime, for some months. The ordinary "skimming" of small houses consists principally of lime putty, and I expect in your instance this is so. New walls, as soon as dry, are often temporarily coated with distemper, which is tinted with pigments not easily affected by lime, of which lime-blue, ochre, umber, and Venetian red are the most common and useful. Although these colours will stand the lime, I may state that the latter will perish the size contained in the distemper in less than six months. A whole year is the least time that can be safely advised for ordinary plaster walls before being permanently papered or painted. As to "which is best," paint or paper, this, of course, depends on circumstances also. The cheapest paper, worth twice sizing and varnishing, would cost a shilling per piece. The trade charge for supplying, hanging, and varnishing such would be about 3s. per piece, complete. Papering a staircase for varnishing is not a noviee's job. You might manage to paint it satisfactorily. The most pleasing colour and treatment for painting the walls would be a light green-grey "filling" (upper portion), and a terra-cotta or Indian red dado colour. This will harmonise admirably with light oak woodwork. "Cream" for the filling would not wear so well, showing discoloration sooner than the above. "Light salmon" would be better, but not so cheerful and harmonious in effect. The cost of painting the walls would be about the same as papering and varnishing same. To make a good job, you must give the upper part four coats (see "Painting a Billiard Room," Vol. I.). The dado should be marked out after the walls have had two coats all over; then, when the filling has had the other two of "green-grey," one coat of dado colour will cover it, as is advisable, you varnish the dado afterwards. As you have succeeded with your kitchen, you may make an attractive job of the staircase. You should paint the cornice with the walls, and finish it by "flatting" same in a few tints of filling and dado colours. A simple dado border and frieze will prove very effective if carefully stencilled with the dado colour (dark terra-cotta) upon the filling, then run a black line between border and dado.—LONDON DECORATOR.

Medical Coil.—J. G. (*Birmingham*).—Look out for a description of a medical coil in the series of articles on "Coils" about to appear in WORK.—G. E. B.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Pocket Lamp.—E. H. (*Brighton*) writes in reply to W. G. H. (*St. Germans*) (see page 191, Vol. II.):—"I had one of the lamps he mentions some twenty years ago (when a bachelor and in lodgings), and I write to warn him that they are practically useless and dangerous. I gave 1s. for it at a tobacconist's; it is filled with sponge and charged with benzoline, and lighted by a little square percussion cap being struck with a spring; it will burn for about fifteen minutes, but is blown out with the slightest puff of wind. It is a delicate thing to trim and set the cap, and if the cap should miss fire, as is often the case, the operation of taking another cap out of the little box and fixing it in the dark is about as agreeable as groping for the B flat that has disturbed you out of a sound sleep. If you carry the thing in your waistcoat pocket for a few hours the heat of the body causes the spirit to expand and evaporate, and fill the inside of the lid, so that when the cap is struck all the spirit takes fire and makes the metal hot. This in turn drives the spirit out of the lamp at a furious rate, and in the course of a few moments you will, in all probability, be left in darkness with your fingers well burned. If you require a light the vesta is far better, and if a spirit lamp for other purposes, refer to my 'simple spirit lamp.'"

Brazing Band Saws, Wood Mitre Cramp, etc.—A. X. E. (*Nottingham*) writes:—"In page 262, Vol. II., *re* 'Brazing Band Saws,' S. B. (*Nottingham*) writes asking if some reader of WORK would give him instructions how to use Duncan & Mills' brazing machine. In reply I beg to state if you will kindly furnish me with S. B.'s address, or else furnish S. B. with mine, in order that I may communicate with him or *vice versâ*, I shall be very pleased to give him the instructions how to use his machine, personally, if possible, as he evidently lives in or near Nottingham somewhere. Also kindly allow me to point out one or two little errors (as I think) in WORK, No. 51, pages 811 and 812; first, *re* 'Wood Mitre Cramp,' J. S. A. (*Edinburgh*), in describing sketch of above, line 15, says: 'Fig. 3, I think, will explain itself. A is a piece of ⅜ in. birch, 2 in. by 1⅛ in. In the centre there is a hole half way through, into which the point of a screw (a wooden screw before described) fits, and on either side there is a hole for the cord to pass through. B is a piece of the same size which forms the nut of the screw,' etc., etc., etc. What I wish to point out is, that if ⅜ in. birch is intended for the thickness of the wood nut, etc., described, I think it is quite inadequate; a piece 2 in. by 1½ in. by ⅞ in. thick of good sound birch would be of some use, but wood ⅜ in. thick would not hold more than one ring of thread, pitch eight to an inch, which would be very fine for wood."

Mandrel for Lathes.—D. F. (*Glasgow*) writes: "In reply to J. T. (*Walworth*) (see page 159, Vol. II.) I would like to say that I make a speciality of light engineering, and such work as he describes for amateurs, inventors, and others." [D. F., and all other such workers, should in future advertise their addresses in the cheap "Sale and Exchange Column" of WORK.]

Acid Guard.—G. M. (*Cheadle, Staffordshire*) writes in reply to ACID (see page 262, Vol. II.):—"I may state that if no heat is near, gutta-percha tissue over planed boards would render them acid proof; it could be joined by pasting the edge with chloroform, and immediately lapping the other edge over, about 6 in. at a time could be done. If heat would be present, say as high as boiling point, vulcanised sheet indiarubber, about ⅛ in. thick, could be used and joined with rubber solution, the same solution being used to cover tacks employed to fasten it in place; good rubber tube would answer as waste pipe, but should not be too highly vulcanised, and as free from other substances as possible. Arthur Cort, of 27, Lilford Road, Camberwell, London, could supply you with samples of rubber, etc., and methods of using."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—E. H. G. (*London, S.E.*); CONSTANT SUBSCRIBER; J. P. (*Blackburn*); MATCHWOOD; W. H. R. (*Birmingham*); G. M. (*Clapham*); J. L. & Co. (*Birmingham*); A. M. (*Cromarty*); ALKAME; F. A. C. (*Appledon*); E. A. P. (*Doncaster*); G. B. (*Accrington*); RETAW; H. S. (*Stoke Newington*); W. J. J. (*Belfast*); NOVICE (*Manchester*); PHONOGRAPH; TICH; H. J. M. (*Pembroke Dock*); W. J. P. (*Gospel Oak*); R. R. W. (*Manchester*); W. W. (*London, S.W.*); W. A. A. (*London, E.*); F. C. H. (*London, S.E.*); A. W. (*Edinburgh*); F. S. (*Kidderminster*); W. E. W. (*London, W.C.*); H. L. (*Torquay*); M. P. B. (*London, E.C.*); E. E. (*Chelsea*); R. G. (*Leamside*); J. R. M. (*Walton*); J. M. (*Middlesborough*); A. B. (*Northampton*); J. W. B. (*Hunslet*); G. M. (*Port Ellen*); F. B. C. (*Liverpool*); E. J. C. (*King's Cross*); C. J. W. (*Bury St. Edmonds*); W. C. (*Brockmondwike*); W. J. P. (*Gospel Oak, N.W.*); W. H. (*Plymouth*); K. AND D. (*London, E.C.*); J. M. P. (*Nottingham*); W. C. (*Birmingham*); ROLLO.

"WORK" EXHIBITION

(1890-91).

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in page 290 (No. 70) of this Magazine:—

For Design for Medal.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE . . .	Half-a-Guinea.

For Design for Certificate.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE . . .	Half-a-Guinea.

If any Competitors wish to submit a Model in Clay, Plaster, Wax, etc., as a Design for Medal instead of a Drawing, they are at liberty to do so.

Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

Prize Competition.
Medal (or Certificate, as the case may be.)

A Motto must be affixed to each Drawing, and the name and address of the sender enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted to three competent judges, who will select those that are considered most worthy of prizes.

The Prize Drawings will become the property of Messrs. CASSELL & COMPANY, Limited, who will return all Designs made by unsuccessful competitors to their respective owners carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced in WORK in due course.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [9 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [11 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

Machinery and Tools.—Largest Stock in London. BRITANNIA CO., 100, Houndsditch. Cash or Hire Purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks and Dies, Forges, etc. Catalogue of new, 6d.; second-hand, 2d.—BRITANNIA CO., Colchester.

Best Book on Lathe, Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA, Colchester. [7 R

Designs.—100 Fretwork (speciality), 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. Note change of address. [1 S

Tiles, for Furniture, Window Boxes, Hearths, etc. Great variety in patterns. Low prices.—JOHNSON, 45, Great Ancoats Street, Manchester. [10 R

Model Ships' Fittings, engines, castings, etc. Illustrated Catalogue, 4d.—STIFFIN & CO., 324, ESSEX Road, London, N. [2 S

The Polytechnic Series.

Consisting of Practical Illustrated Manuals specially prepared for Students of the Polytechnic Institute, Regent Street, London, and suitable for the Use of all Students.

FIRST LIST OF VOLUMES.

Elementary Chemistry for Science Schools and Classes. By ROBERT AVEY WARD. 128 pp., crown 8vo, cloth, **1s. 6d.**

Forty Lessons in Carpentry Workshop Practice. By CHARLES F. MITCHELL. Revised by GEORGE CAMPION POPE. **1s.**

Practical Plane and Solid Geometry, including Graphic Arithmetic. Vol. I.: ELEMENTARY STAGE. By Prof. HENRY J. SPOONER, C.E., F.G.S. **3s.**

Forty Lessons in Engineering Workshop Practice. By C. F. MITCHELL and E. G. DAVEY. Revised by J. ROGERS, M.A.S.E. Price **1s. 6d.**

The Polytechnic Technical Scales. Ten Scales printed on Card, in Case. **1s.**

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

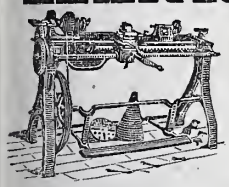
Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets, containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

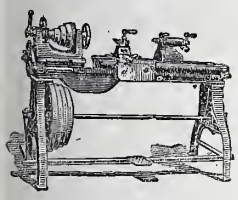
Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

JOHN AARON,

Engineers' Tool Merchant,

GAOL LANE, HALIFAX, YORKS.



Lathes, Pillar and Bench Drills.

SAWBENCHES.

SHAPING AND PLANING MACHINES.

All kinds of Tools, Chucks, &c.

SPECIALITIES IN AMATEURS' LATHES.

Catalogues free on application.

All inquiries have prompt attention.

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Sent post free,

Cassell's Classified Catalogue.

Cassell & Company's Magazines for August.

THE QUIVER. For SUNDAY and GENERAL READING. *New and Enlarged Series. Monthly,* **6d.**

"THE QUIVER is best of all the magazines devoted to Sunday reading."—*Saturday Review.*

CASSELL'S FAMILY MAGAZINE. *Monthly,* **7d.**

"The Stories in CASSELL'S FAMILY MAGAZINE are good, the pictures are clever, the selection of subjects is strikingly varied."—*The Times.*

"LITTLE FOLKS" MAGAZINE. *Monthly,* **6d.**

*** *New Volume just commenced.*

"Everyone ought to know by this time that LITTLE FOLKS is the best magazine for children."—*Graphic.*

CASSELL'S SATURDAY JOURNAL. *Weekly,* **1d.**; *Monthly,* **6d.**

"The best and cheapest pennyworth of popular literature ever produced."—*The Times.*

THE MAGAZINE OF ART. *Monthly,* **1s.**

"The best written and best illustrated of the Art periodicals—a wonderful shilling's-worth."—*Graphic.*

THE WOMAN'S WORLD. *Enlarged Series.* Illustrated. *Monthly,* **1s.**

"It is the best Magazine for women."—*The Queen.*

*** ***Prospectuses of the above Magazines will be sent post free on application.***

CASSELL & COMPANY, LIMITED, LUDGATE HILL, LONDON; AND ALL BOOKSELLERS.

Bovril.

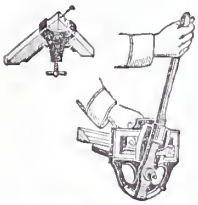
Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.



PROFITABLE HOME WORK.

With Booth Brothers' **Registered Mitre-Cutting Machine**, any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,

TOOL MAKERS, DUBLIN.

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6D OR FOR 7 STAMPS BIRMINGHAM. [33

London Warehouse: 124, NEWGATE STREET.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic **WEAKNESS** speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place),

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 73.] SATURDAY, AUGUST 9, 1890. [PRICE ONE PENNY.

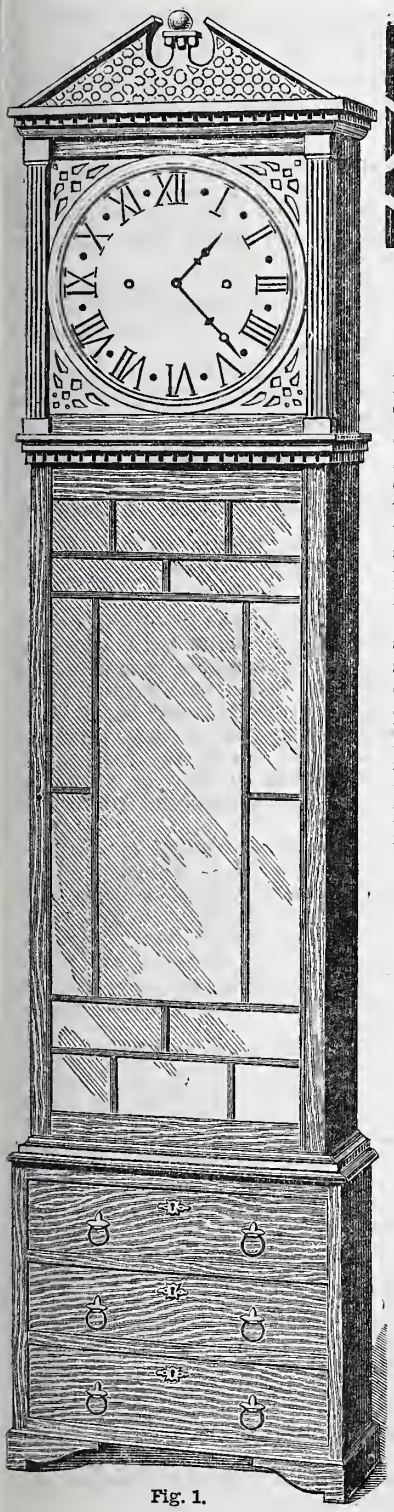


Fig. 1.

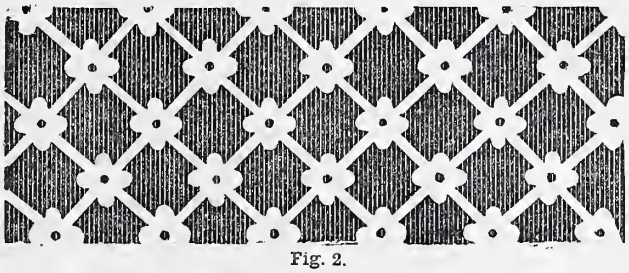


Fig. 2.

CLOCKS AND CLOCK-CASES.

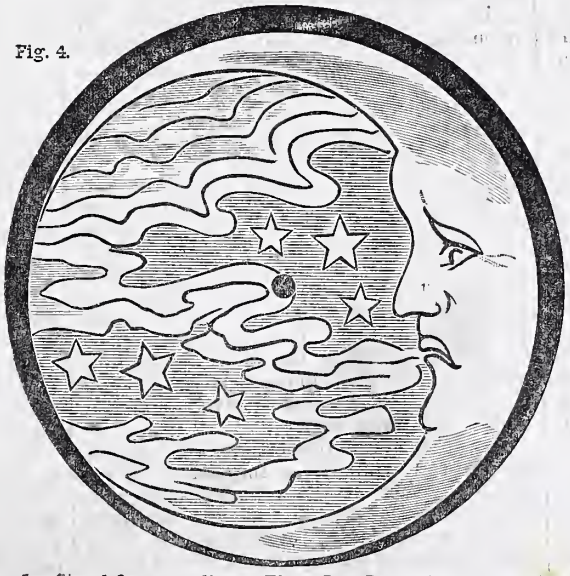
BY E. BONNEY STEYNE.

I.—CABINET IN THE SHAPE OF A GRANDFATHER'S CLOCK.

THERE are a great many people who admire "grandfather clocks," and are yet without them. In this world the above statement with its substantive varied could be adapted to every conceivable object. But while many of the things we are without are beyond our means, or above our powers to acquire, if a substitute will do, there is no reason why any skilled craftsman should not "simulate" (to use a dressmaker's verb) the real thing—with an imitation that is at least tolerably honest.

For the idea of mounting the ordinary drum clock in a case modelled upon the old eight-day time-piece is preserved from dishonest pretence by its lower portion being obviously a cabinet and chest of drawers. To mount a cheap clock so as to suggest a costly one would be a blunder, because shams in that direction are indefensible. But while the taste of the design may be questioned, it hardly involves the sin of hypocrisy, since no clock with suspended weights and long pendulum could exist in company with a glass case for bric-à-brac, and a base filled with drawers.

Fig. 4.



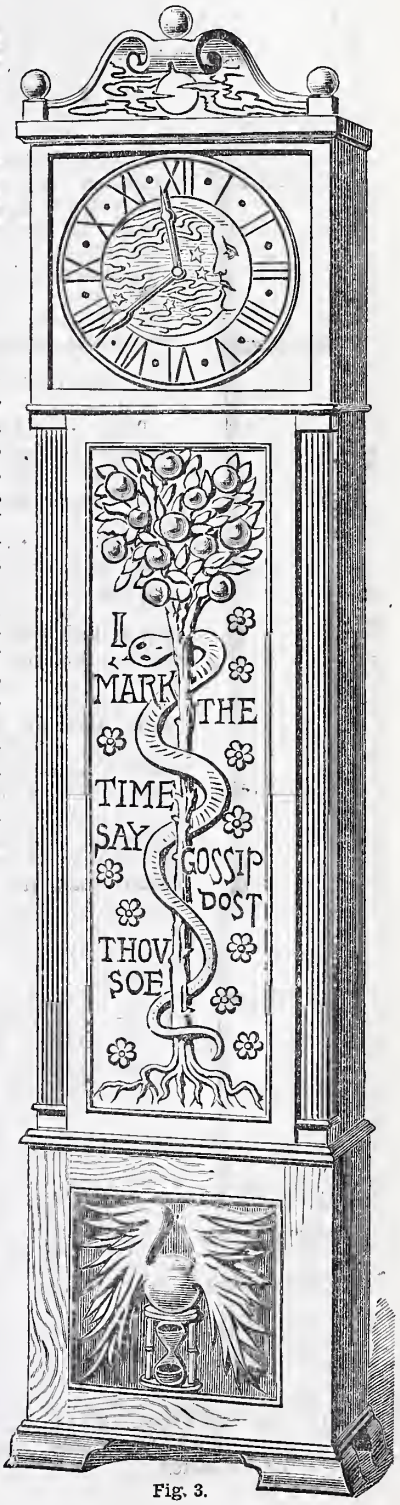


Fig. 3.

Fig. 1.—Stand for an Ordinary Eight-Day Drum Clock with Glazed Cupboard and Drawers. Fig. 2.—Detail of Ornament at Top of Fig. 1. Fig. 3.—Grandfather's Clock decorated in Gesso Work. Fig. 4.—Detail of Clock Face in Fig. 3

The decoration has been kept throughout of a quasi-Chippendale character. The front of the clock story does not open, as the face of the dial itself would of course be hinged. (I should explain that it is the ordinary clock, set in a mahogany turned frame one sees in shops, that I have in mind.) The upper portion, with its two fluted pilasters, its simple fretwork, and its turned finial, is clearly of the most commonplace order; yet I think not unpleasant, and effective in dark polished wood.

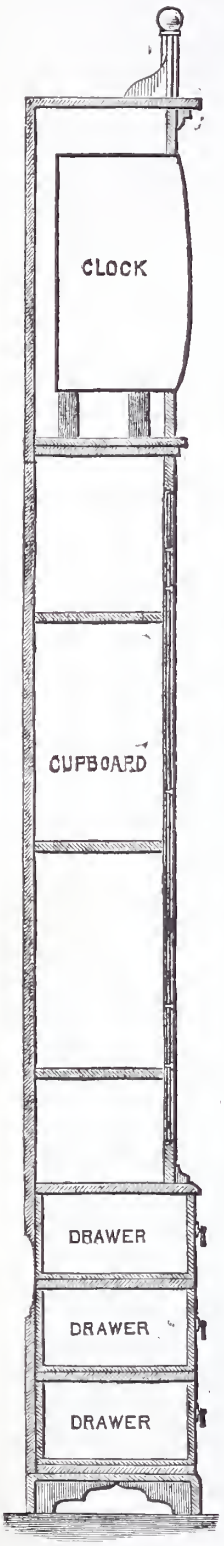


Fig. 5.—Section of Fig. 1.

For the next story a door with simple framework for the glass is not absolutely out of harmony. Diamond-shaped framework, or tracery modelled on Gothic lines, such as Chippendale often used, would no doubt be preferable, but involve far greater skill in its construction.

The base—a chest of three drawers—is also commonplace, but useful, and helps to give the needful solidity to the structure.

The mouldings throughout are entirely of simple machine-made pattern, or else of the square fillets common to work of the period it follows.

Designed to be within the reach of any skilled workman, all the details have been kept as simple as possible. And while allowing more elaboration, it should, I think, be devoted to the enrichment of the drawer handles, escutcheons, and superior quality of wood, rather than in any mere ornaments. Inlay could be employed consistently, if not overdone.

The size is not given, because the diameter of the clock face governs the width of the design, and its height must be a matter of taste. The drawing shows an unusually high one, but the glazed story is so easily modified that any who desire to make it will find little difficulty in the adaptation.

As a clock of the sort it suggests projects farther than a hanging time-piece, in the section I have shown how the clock may be arranged without damage to its stability; but as it will be a little top-heavy, the lower part should be made rather weighty to avoid disaster.

II.—A Grandfather's Clock Decorated with Gesso Work.

Once upon a time every household that could afford to possess the stately old time-piece prized "the old clock on the stairs" as one of its most cherished heirlooms. Poets have sung of it, preachers have taken it as a text for the eternally true homily of the flight of time; and yet, despite singers and divines, it faded out of fashion, and was relegated to the kitchen or the lumber-room, or vanished no one knew or cared whither. The tendency to hark back to the days of Queen Anne set artistic folks rummaging. Once more the nobles who had sunk to the scullery or been kicked upstairs to the lumber-room were bidden to take their old posts of honour in the hall or in the drawing-room. The blue willow-pattern plates were rescued from the rack above the sink, and hung up in the drawing-room as deities to admonish their owners to shape their lives according to the precious sweetness of old blue and white. The brass candlesticks were robbed from the cook, and the kitchen fireplace mourned their loss, as they rose to the dignity of wax-candles, with elaborate arrangements in bougies and shades lavishly bestowed to heighten their splendour. The clocks, whether because of a fatally reiterated ditty, "Grandfather's Clock," supplying a new nickname, or because the new-old fashion in furnishing bade it, again reared their heads, and ticked as solemnly as ever. That the blue china improved the morals of the æsthetes, or that the old clocks made them more sensible of the importance of swift-flying time, is not yet known. Possibly historians of the eighteen-hundreds will trace subtle influence on its people from these and kindred sources; for history writers are people of fine invention and a class of "fictionists" not fully appreciated.

Of late the art of gesso has been revived; these columns have set forth its practice, and if the readers of Work are not experts in the art, it is possibly their own fault. But without knowledge of the actual work in its best examples, it is easy to under-rate this very beautiful recruit to the army of home-arts. Although but a late comer, the show of examples in the last exhibition of the Arts and Crafts Society, at the New Gallery, was second in interest to nothing in the show. The low relief-work, combined with rich lacquers in many-coloured metals, and vivid novel hues, revealed possibilities of splendour from comparatively inexpensive materials, that set all longing to commence experiments in gesso at once.

It has been urged against our unfortunate to-day that it has no style of its own, no school of decoration distinctly Victorian and English. In face of the work of Mr. William Morris and Mr. Walter Crane, the de Morgan tiles, the Whitefriars glass, the revived brass repoussé work, and dozens of other people and productions, it is hard to say that the style has not arrived. The people as a body are not educated enough to forswear base art, it is true; but to like better work, if only for trivial reasons of novelty and fashion, may—it is hardly safe to be too sanguine—lead the average person to dislike inferior work.

Among the gesso decorations were several clocks, and while it is impossible to reproduce either of the actual examples in this article, and the design given has little reason to be named in competition with their glories, an attempt is made in it to set clever brains to work for themselves and distance the example, set not so much for imitation as for suggestion. Next to a thoroughly worked-out plan, faultless and perfect, that can be followed exactly, a good bone of contention is most likely to lead to the required end. For if any one wishes to decorate a clock in gesso, he has probably thought out a scheme for its adornment, and will fail to be satisfied with this. But in spite of its time-honoured allegory, it may suggest an idea for suitable embellishment.

The motto from Mr. Austin Dobson's poem, "The Sundial," is apt enough for the purpose. The tree of Igdrasil, with the serpent, the tree of knowledge, with its twelve golden fruits, to typify the year, and the winged sun, the hour glass, the moon, and the winds, are all in keeping with the theme.

The gesso is intended to be coloured with various lacquers and shades. For instance, the fruit of the tree would be in orange-gold shaded to red, the leaves in many greens, the serpent in blue and green metallic lustre, the motto in plain gold letters.

The clock face would have a silver moon roughly suggesting a face, with drifting clouds of silver on a blue ground, the stars and some of the clouds being gilded in various shades of pale gold.

The ordinary form of clock is suggested in the drawing, as it is hardly likely any one would construct a case for the mere purpose of after decoration.

If in progress any hints are required, through the columns of "Shop" I shall be pleased to supply them.

A NEW SYSTEM OF MARINE SIGNALLING.

BY J. C. KING.

The flag-signal system in use in the British Navy, with many merits has conspicuous defects, chiefly due to atmospheric influences upon flags; one being the difficulty to read the signals when the flags are blown edgeways, causing mistakes or delay; another the time taken to run up the flags, and it needing an expert to send or receive a message; another, interruption by fogs or darkness.

The system now brought under notice is the invention of Mr. R. J. Crowley, a capable officer of the United States Army, who was for nine years with the signalling staff.

The sketches and code now illustrated will easily explain the simplicity and effectiveness of the system, not only for the naval service, but for stations where signalling is available.

Fig. 1 is the apparatus ready for use; it consists of a metallic tube to be fixed to a maintop or station. This tube has eight arms standing horizontally from the tube, four on each side, in the same plane. On each of these arms is a shutter swinging on loops to the arms, operated by chains which reach to a stand in the maintop, or to the deck, or cabin. The motor of communication are four handles for manual operation. The signaller has a small board of the complete code in front of him to work from.

The code is alphabetical and numeral, and may be made a cipher-code if wanted.

For the alphabet, or numerals, any one who can spell English words, or add figures together, can work the code; send off and read off messages and signals, and, with practice, do it almost as quickly as by telegraph; so that messages are received or delivered at the same distances as the flag-signals now

used, with unerring certainty. The operator or signaller has thirty signals, twenty-six for the alphabet to spell words, and four spare signals to tell if letters or numerals are to follow, "to wait," or to mark "an error."

Fig. 2 shows two of the signals in view, the staff holding them being turned to face the point signalled, to or from.

The eight shutters are painted with red and white vertical bands on one side, and a white star on a dark ground on the other side; these act so that the two shutters shown coming together form a large and distinctly marked signal.

The code, not given here, shows how thirty signals are made out of the fronts of eight shutters to form four reading fronts—either one, two, three, or four at once.

This arrangement makes the signals very conspicuous; and by a simple arrangement of single combinations, double combinations, cross-double combinations, and triple combinations, one of the easiest worked and simplest to be learned codes of signals

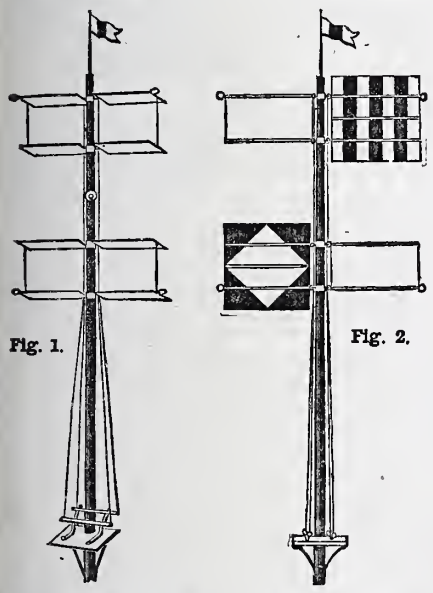


Fig. 1.—Apparatus ready for Work: "At Attention." Fig. 2.—Apparatus at Work.

that has ever been invented is now in use in the United States, and will be on trial by the British Government, as it has agreed to give the signals and code a trial at once.

The illustrations of the code of thirty distinct signals will enable any one to judge of its merits.

For night or fog-signalling, electric lights at the ends of the yards that carry the shutters have coloured glasses worked before them by the same four operating handles as for the shutters, the signals being number and interval flashes.

A large working model, with electric lights, in action, may be seen and tried any day at Messrs. Salter, Hunt & Co.'s, 62, King William Street, London, E.C.

CROSS-STAFF FOR DRAWING ELLIPSES.

BY JOHN WHITFIELD HARLAND.

THE illustrations (Fig. 1, plan; and Fig. 2, section) show a very useful cross-staff for drawing absolutely true ellipses of every size conceivable, and of every possible proportion that can occur. Whilst this means of describing ellipses is very old indeed, dating probably from the fifteenth or sixteenth century, several original improvements are now introduced for the first time, so far as I know, more particularly in the dividing of scales into English duodecimal parts at *a a*, and French decimals (centimètres and millimètres to "dixièmes"—that is, down to the thousandth part of a mètre or yard, which is supposed to be the ten-millionth part of the distance from the pole to the equator on the meridian of Greenwich) at *c c*, so that any decimal fraction that can be expressed in the proportion can be practically obtained with this little instrument, if accurately made. Construction:—Get some thin sheet brass about $\frac{1}{32}$ of an inch thick, and cut it to the size shown in the plan G G G G—*viz.*, $4\frac{3}{4}$ in. by $4\frac{3}{4}$ in. square, but with three corners rounded to a circular form with a radius of $2\frac{3}{8}$ in., the remaining corner being perfectly square at D, so that it may be placed square on the paper or board against a T or set square when required; or it may also be rounded off. Through the centre C draw two diameters E E, F F at right angles, one of which F F will be parallel to E D; and the other, E E, parallel to D F. The most exact accuracy is required in this. At E, F, E, F, cut with a graver a notch in the edge of the plate G G G G to enable you to place it exactly upon any given lines representing the major and minor diameters or axes of the required ellipse. Now plane up perfectly true and parallel a piece of dry mahogany or boxwood, $\frac{3}{8}$ in. wide, and $\frac{1}{4}$ in. thick, and about 23 in. or 25 in. long, to make the mitred pieces H, H (see section, Fig. 2), and set them exactly $\frac{3}{8}$ in. apart—*i.e.*, $\frac{3}{16}$ of an inch each side of your centre lines E E, F F, and having previously drilled holes *i, i, i, i* through the plate G G G G about the centres of where these pieces come and also countersunk them for the heads of $\frac{3}{8}$ in. wood screws, proceed to fix them to the plate from the back, one by one, with, say, three screws to each piece H, H (Fig. 2). Now take the piece of boxwood or mahogany, which will remain after sawing off your pieces H, H, and from it cut off two pieces S, S for slides—1 in. long. Into each, exactly at half the length—that is, $\frac{1}{2}$ in. from each end, and $\frac{3}{16}$ from each side—fix a steel pin going nearly through and standing up about $\frac{1}{4}$ in. These two pins may be made of No. 0 wood screws $\frac{3}{8}$ in. long, filed taper to a point after they are driven by cutting off their heads with a file and rounding them accurately; but if you have a lathe, by all means turn them out of a steel knitting needle softened in a candle or a gas jet, and cut on them a wood-screw thread. To insure great accuracy, I suggest as shown in the drawings the lines *a a, b b, c c, d d*. You should obtain a piece of printer's brass rule, 8 *to pica* (*i.e.*, the 48th of an inch) in thickness, and mitred so as to overlay, or overlap, the slides S, S a 32nd of an inch, filed down to $\frac{9}{16}$ wide, screwed down to the pieces H, H from the face with $\frac{3}{8}$ in. screws, countersunk for screw heads in three places in each at *j, j, j, j*, care being taken not to come opposite the screws *i, i, i, i* from the back (see dotted circles) and C, and fix the pieces H, H to the plate G G G G. Before fixing the four pieces A, A, B, B, or after fixing them, which is preferable, dismount them again in order to engrave or etch the two scales—*viz.*, the duodecimal and decimal scales.

Now, for the purpose of the utmost accuracy, as any error is magnified and multiplied, use the method of dividing shown in Fig. 4, the divisions of the line X Z being diagonally carried to the line X Y by parallel lines proportionately smaller on the principle of the diagonal scale which reduces the chances of error. A dividing machine would, of course, do this better still. To facilitate the measurement of the distances between the points *k, k*, construct on each side of the groove at *c c* and *a a* (as shown in plan, Fig. 1) scales, one of inches, eighths, and sixteenths; the other of centimètres and dixièmes—*i.e.*, one duodecimal; the other decimal. In order to do this with the least error, draw a line X Z at an angle to your scale line X Y, and divide it into equal spaces, as shown; then take an exact inch on the scale line X Y and join the 1 in. point with the eighth point on X Z, and with lines parallel to the line thus obtained at the 1 in. point in X Y you will get the $\frac{1}{8}$ in. scale very accurately along the space from X to 1 in.—*i.e.*, your inch will be divided with accuracy into eighths; proceed again with the eighths of inches for 2nd and 3rd inches. If you wish sixteenths to appear, subdivide each space on line X Z (Fig. 4) into two equal parts and proceed as before; you will have sixteenths on X Y, and the decimals in like manner. The drawing of these scales would be most readily done with the point of a strong needle, or "etching needle," upon the brass itself. If you cannot engrave, cover your brass with a ground of melted wax, which you can smoke till black in a candle flame, and scrape the lines through it to the surface of the brass as fine as you can; then etch it—that is, bite in the lines with one part nitric acid to three parts water; wash in clear water, dry thoroughly, and melt off all wax by heating. You may then rub the black wax into the etched lines and polish the surface with charcoal and oil first, and rottenstone afterwards.

Printer's rule is planed true and straight at one edge, and is bevelled at the other; it is $\frac{15}{16}$ in. deep or wide (*i.e.*, exactly the diameter of a shilling). As the thick edge is true, utilise it, filing the outer edges away, or cut it lengthwise to $\frac{5}{16}$ in. full, and then finish square with a file to the exact width of $\frac{5}{16}$ of an inch. Likewise fit two other pieces 1 in. long by $\frac{5}{16}$ in. wide on the upper face of the slides S, S. Screw them in place, and let the pins previously mentioned project through them; or another plan is to drill holes for these pins and rivet them at back, afterwards screwing the plates to the wooden slides S, S (see perspective view, Fig. 3) with $\frac{3}{8}$ in. screws, as shown, countersunk, as before. A line square across the brass plates should be engraved or etched, passing exactly through the centre of pins marked *k, k* (in Figs. 1, 2) in order that these points may be brought opposite to any of the divisions of the two scales previously etched or engraved on the pieces A, A, B, B. On the rod, which may be called a "trammel," you may have a pencil holder (as shown, Figs. 6 and 7), with thumbscrew T, and the rod may be divided into scales of inches and centimètres also to save measurement. Note, however, that the scales *a a, c c* commence at *nought* from the line E E, and the trammel commences from C (see Fig. 6). Under the trammel you may fix a slide for the first hole representing the point K, and have a movable slide with a thumbscrew to fix at any point on the scales having a hole drilled for the other point K to enter, to save boring holes that in time would wear away (see Figs. 6 and 7), and by having trammel rods of varying lengths, upon which both the slides *r, r* and the pencil holder *p* would fit, any size of ellipse could be described. Instead of a pencil, the blade of a cutting gauge could be used, which would cut

cardboard mounts or thin wood mats at once, instead of merely drawing them. This will complete the construction; now for the directions for use. Place one of the slides, that which is in line with the major axis or diameter, with its point *k* exactly covering the point C; now determine the size and proportion. Suppose you wish to describe an ellipse of 10 in. long by 8 in. wide—*i.e.*, major axis, 10 in. : minor axis, 8 in., for instance, or 15 in. by $11\frac{1}{2}$ in., or any other size and proportion.

Rule I.—*Deduct half the minor from half the major, and the result gives the distance the points k, k should be apart.* Example:—Half 10 is 5; half 8 is 4; deduct 4 from 5—difference 1; set the point on the major 1 in. from the point *k* at C. Then take a piece of wood, say $\frac{1}{4}$ in. square (or stronger according to the nature of the wood), and make two holes 1 in. apart at one end, and set off 5 in. from the hole nearest the end in which the holes are made, and at this point make a notch. Placing a pencil point at this notch, twist, with your fingers half-way between the points *k*, *k* with one hand, and holding a pencil flattened with a penknife at one side against the notch at 5 in.—the rod round as if you were describing a circle—you will find that, instead of a circle, you are describing an ellipse 10 in. by 8 in. Now, instead of this example, take half 15=$7\frac{1}{2}$, half $11\frac{1}{2}$=$5\frac{3}{4}$—deduct $5\frac{3}{4}$ from $7\frac{1}{2}$, result $1\frac{3}{4}$. Set one point, as before, exactly over C, and on the major set the other point *k*, $1\frac{3}{4}$ in. from C; then with your rod in the holes $1\frac{3}{4}$ in. apart, mark off $7\frac{1}{2}$ in. for the position of the pencil and describe the curve—result, an ellipse 15 in. by $11\frac{1}{2}$ in. Curiously enough, if you add to both the same number of inches, etc., with the same distance between the points *k*, *k*—say 2 in. or 3 in. or 5 in., etc.—and add 2 in. or 3 in. or 5 in. to the length marked off on the rod, the ellipse becomes 17 in. by $13\frac{1}{2}$ in., and 18 in. $14\frac{1}{2}$ in., or 20 in. by $16\frac{1}{2}$ in., etc., as the case may be—*i.e.*, the orbits are parallel throughout. If you add 20 ft. or 30 yards, the orbits are still parallel; only add it to both major and minor and to the rod measurement, leaving the distance between the points *k*, *k* the same. Hence

Rule II.—*All ellipses drawn from the points, k, k at any given distance apart are equidistant from one another at every point of their orbits*—i.e., *parallel to one another.*

On some future, and I hope not far distant, occasion, I hope in "Shop" to give a scale of co-ordinates in relation to the points *k*, *k*, which by a new rule will give the exact area of any given ellipse. The holes marked on plan at *g*, *g*, *g* are to fix the plate G G G G down to the board or paper with drawing pins, as shown at *g*, *g* in section in Fig. 2, to prevent shifting. To cut veneers, or grooves in them for inlaying for table tops, etc., use the cutting-gauge blade instead of the pencil, altering the length of rod or trammel only, but keeping the distance from the points *k*, *k* the same to insure parallelism of elliptical orbits.

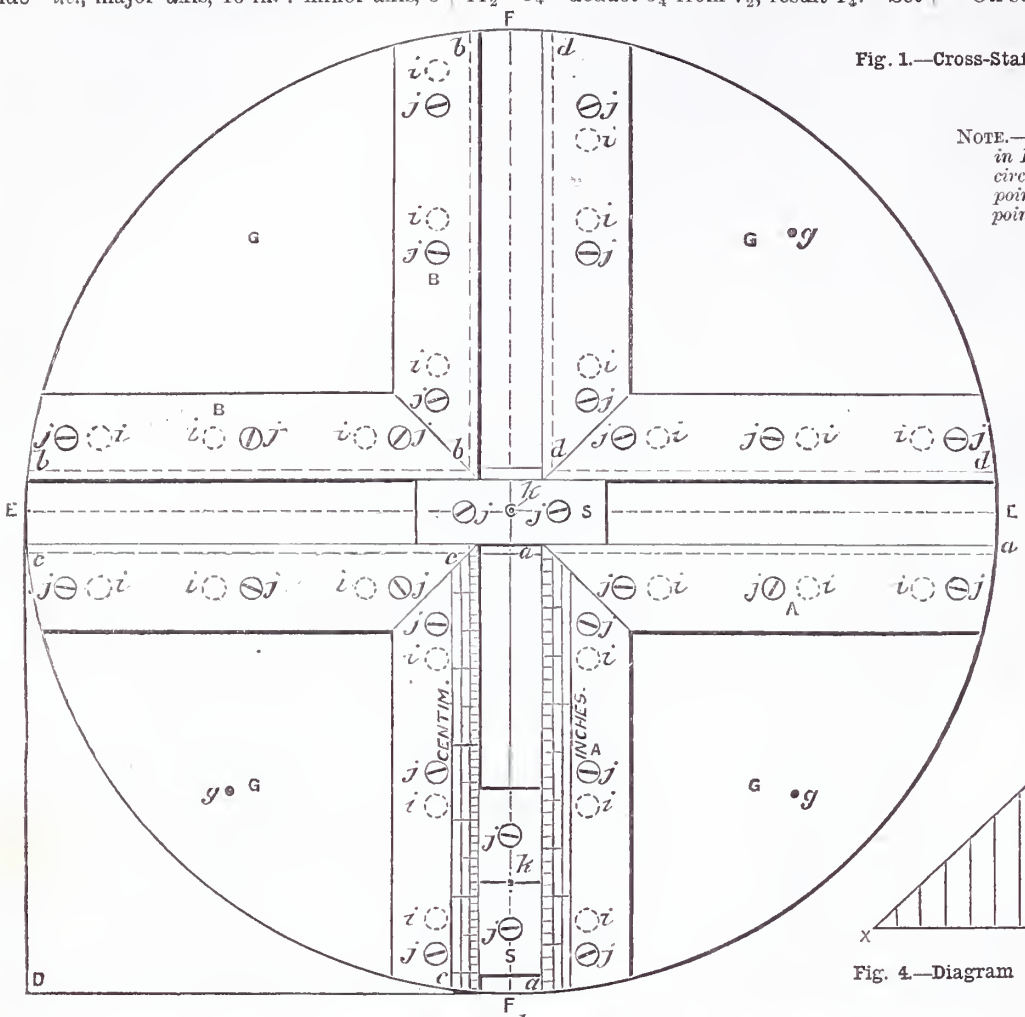


Fig. 1.—Cross-Staff for Drawing Ellipses shown in Plan.

NOTE.—*The intersection of the straight lines* E E, F F, *in Fig.* 1 *is the point indicated by* C. *The small circle within the letter* C, *coincident with the point of intersection of* E E, F F, *represents the point k.*

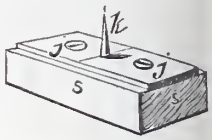


Fig. 3.—Slide.

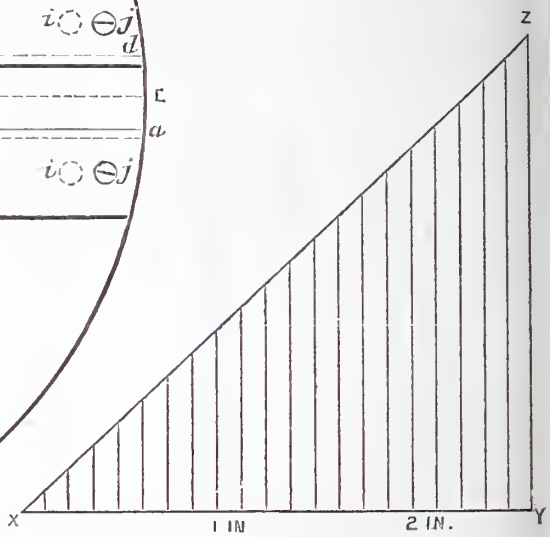


Fig. 4.—Diagram showing Method of dividing any Line with accuracy.

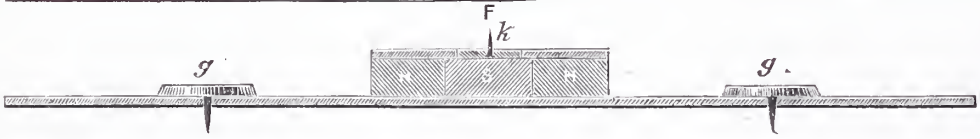


Fig. 2.—Section of Cross-Staff.

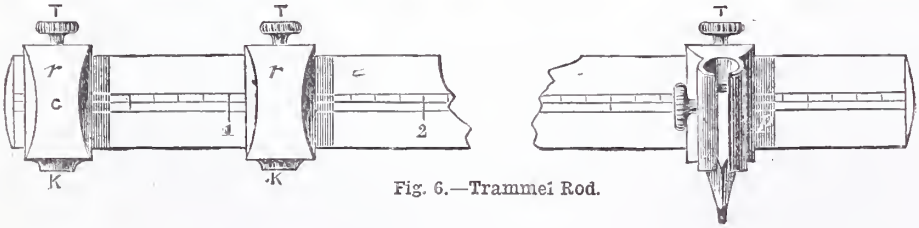


Fig. 6.—Trammel Rod.

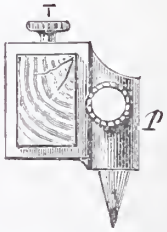


Fig. 7.—Carrier for Pencil and Section of Rod.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

THE BINGHAM SMOKER.

'HERE can be little doubt that the Bingham ; the favourite smoker among English piarists. I read somewhere that nearly orty thousand of them are now in use and iving the greatest satisfaction in every ıse. There are, however, Binghams *and* Binghams, so the amateur mechanic should e very careful in having a real article to opy when he goes to the trouble of making ne. He may rest assured that if he follows ıy instructions carefully he will have a moker of which he may be justly proud, and which will do good service in his battles with infuriated bees.

To bring the details of its manufacture more freshly to my mind, I persuaded myself that my old smoker (of my own make too) would be likely to get out of order in the coming season, and that it was necessary to make a new one. This I accordingly did, and am now describing what I myself made within the twenty-four hours before writing this.

As I am not a professional sheet-metal worker, I probably did some things in a different way to what a tradesman would do, but I think my readers will not lose by this, but rather gain, for they will see how an ordinary amateur with the most primitive tools turned out a capital job.

There can be no doubt that to make a smoker pays. The entire cost of mine, made of the very best tin, was fourpence. The leather, indeed, I got from the saddler, who would not charge, but I think if everything was put down at its highest price, the cost would not amount to a shilling, and I could not buy a similar article for less than 4s. 6d.

A word as to the tools required by us for the tin work, which will be so prominent a feature in the blower and the various extractors, may not be out of place.

First a *snips* will be required for cutting the tin, as to attempt to do so with the family scissors is a most disheartening performance.

Then a *stake*—which is, I think, called a *hatchet stake*—is employed to turn the tin over on, either for wiring the edge or connecting two pieces together with the joint I showed in describing the Clarke firebox. My hatchet stake is simply two feet of so-called half-round iron, which in reality is $1\frac{3}{4}$ in. wide, and only $\frac{3}{8}$ in. thick. This I hold in the vice, and when the edges have been smoothed with the file it does excellently.

Next comes the *soldering iron* or *copper bit*, which, for our work, should be of large size, able to hold a good deal of heat. A few mallets of hard wood and hammers, a punch or two, and odd bits of iron complete my kit.

As to materials for the construction of the smoker, we will require tin, wood, leather, a small bit of $\frac{1}{2}$ in. brass tube, and about 3 ft. of hard brass wire 16 gauge.

I would strongly recommend the best tin to be got. What I used was called *boat tin*, and cost 4d. the sheet, 12 in. by 18 in. It was quite a pleasure to work with it, because of its toughness and ductility. It quite resembled copper.

In Fig. 1, I give a general view of the smoker complete. It will be seen to consist of T, fire tube; F, funnel; G, hand-guard; H, strip to secure tube to bellows; and B, bellows.

The fire tube is $2\frac{1}{2}$ in. in diameter and $6\frac{1}{4}$ in. long. The piece of tin of which it is made ought to be cut accurately square, and with straightedges $8\frac{3}{8}$ in. by $6\frac{3}{8}$ in. The two short edges are then to be turned over a little more than $\frac{1}{8}$ in. from the edges, one being turned up and the other down.

The piece of tin is then to be bent into a cylinder, and the bent edges hooked into one another and hammered down tight, using a piece of thick round iron or steel as a stake on which to hammer.

When the cylinder has been made fairly circular, it will be found to be $2\frac{1}{2}$ in. in diameter. I usually run a little solder along the joint as a precaution, lest in subsequent operations it might open, and I would advise readers to follow my example, as it is very annoying to find the work come asunder just when everything is nearly finished.

Both ends of this cylinder ought now to be quite flat; but if they are not, the file should be used until they are made so; $\frac{1}{8}$ in. at one end must now be turned out all round at right angles to the body of the cylinder, and this can easily be done with the good tin we are using by means of a hammer and the stake, or the sharp edge of a cast-iron lathe bed, which I pressed into service as being more solid. The cylinder will thus be reduced to its final length, $6\frac{1}{4}$ in. Within $\frac{3}{4}$ in. of the flanged end, a $\frac{1}{2}$ in. hole is to be bored through the tin. This I did with a common centre-bit, which, contrary to my expectations, was not injured much.

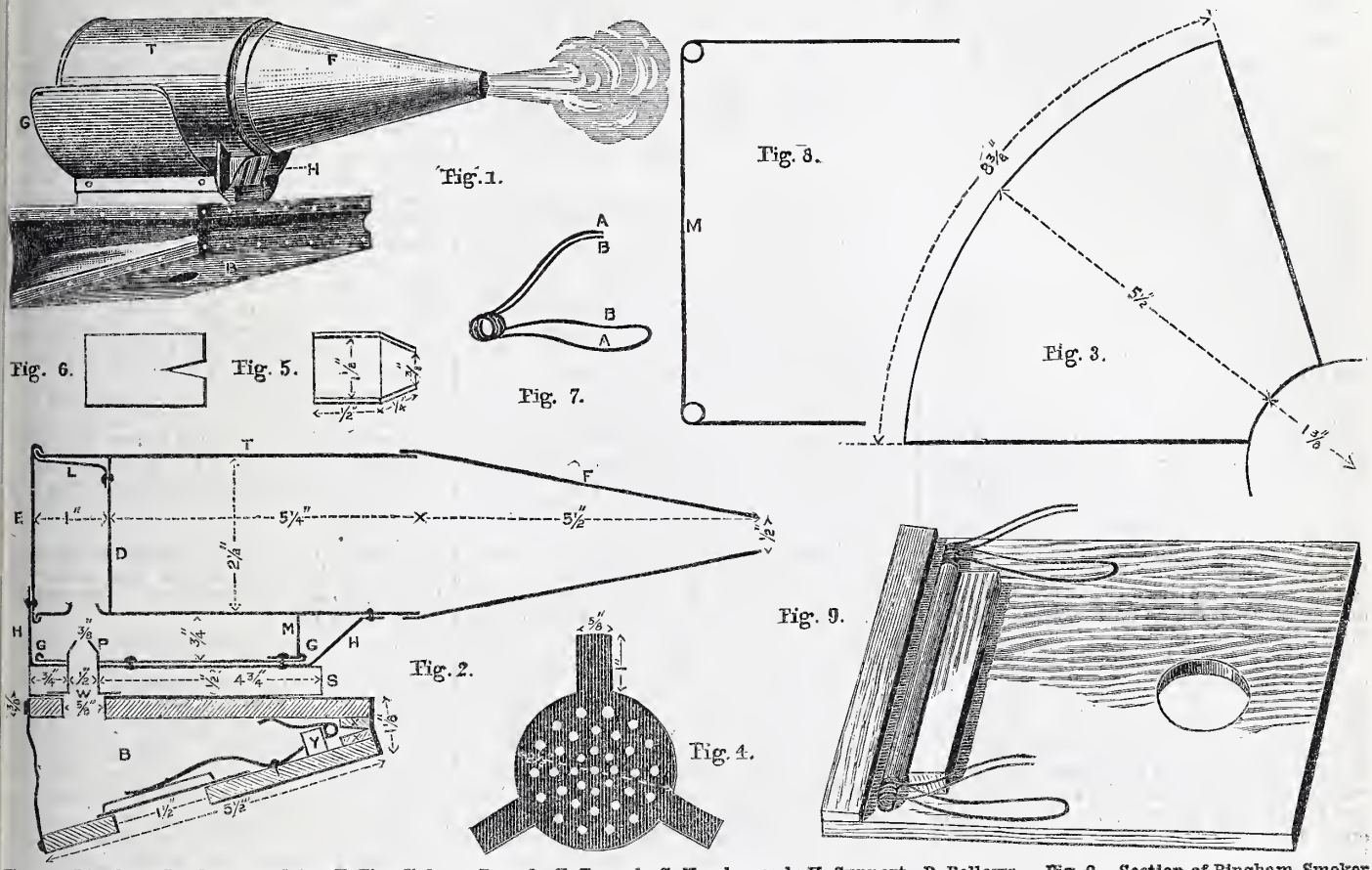


Fig. 1.—Bingham Smoker complete—T, Fire Tube or Barrel; F, Funnel; G, Hand-guard; H, Support; B, Bellows. Fig. 2.—Section of Bingham Smoker. Fig. 3.—Pattern of Funnel. Fig. 4.—Diaphragm. Fig. 5.—Coned Blast Pipe on a larger scale than at P in Fig. 2. Fig. 6.—Nicked Tube for making Blast Pipe. Fig. 7.—Spring. Fig. 8.—Wire for making Spring twisted round Nails. Fig. 9.—Bottom Board of Bellows with Springs in place.

This hole is to be coned inwards as seen in Fig. 2, the object being to direct any of the blast which might impinge upon the sides of the hole inwards into the smoker, rather than between the fire-box and guard. The cone I made with the pane of a light hammer and a little patience.

The end or bottom E (Fig. 2) is next to be cut out of a piece of tin, its radius being just $1\frac{1}{2}$ in., $\frac{1}{8}$ in. of the edge being turned up all round, like a cover of a canister; the flanged edge of the cylinder is laid in it, and the edges turned in to embrace the flange and keep all tight as seen at E (Fig. 2). The turning up of the edge of the bottom I did on the end of a piece of thick round iron which was cut true.

The funnel may next be prepared, a pattern for which is given in Fig. 3. The circles should be scribed on the sheet of tin to the radii shown, the inner being $1\frac{3}{8}$ in., and the outer $6\frac{7}{8}$ in; $8\frac{3}{8}$ in. are then to be measured on the circumference of the outer one, and lines drawn to the centre; the piece may then be cut out, turned up and down at the edges, and connected as for the body tube. The edges which are turned over should, however, be a little bit narrower than in the body, which will make the large end of the funnel wide enough to embrace the tube T. The end of the funnel should be hammered, so as to make about $\frac{1}{2}$ in. of its wide end parallel to fit on the cylindrical body. I also made the body taper a bit at the front so as to make the cone run on easily.

Descending from the body towards the bellows, the next thing we meet is the piece M, which is a sort of additional support to the barrel. It is simply a piece of tin $1\frac{1}{2}$ in. square, having two edges turned down and hammered flat, making it $\frac{7}{8}$ in. wide. It is then bent at right angles, having one leg $\frac{5}{8}$ in. and the other $\frac{7}{8}$ in. long. It is attached to the hand-guard and support H by the short leg, while the long one is hollowed out to fit the curve of the body of the blower.

The next thing to make is the hand-guard, which is a piece of tin $6\frac{7}{8}$ in. by $4\frac{3}{8}$ in. wired all round with thin wire. The wiring is easily done by first cutting small pieces off the corners of the tin, then turning up the edges all round, laying the wire in the hollow made by the turning up and hammering down, so as to completely cover the wire, and leave a nicely formed bead wire; 16 gauge would do nicely for the hand-guard. The hand-guard is bent to a semicircle.

We now come to the support, which is made of a strip of tin $7\frac{1}{2}$ in. long and $1\frac{5}{8}$ in. wide.

Lines must be scribed on one surface $\frac{3}{8}$ in. from each edge, thus marking it into three parts, the centre one being $\frac{7}{8}$ in. wide. At $1\frac{3}{4}$ in. from one end, and at $1\frac{1}{4}$ in. from the other, nick the sides into the lines, and turn over the edges of the end pieces, thus doubling the tin at the ends and making them only $\frac{7}{8}$ in. wide. The centre must also have its edges turned up, but only at right angles, to the middle part, thus making a sort of trough which will fit on the piece of wood (S Fig. 2) that is nailed to the board of the bellows.

The ends of this piece of tin are now to be turned up in the opposite direction to the trough, the short one at right angles, and the longer one at an angle of 135° with the middle part. This last end is to be bent again, a little more than 1 in. from the first bend, so as to lie parallel to the centre part.

We may now proceed to rivet these parts together, for which we will require four little rivets $\frac{1}{8}$ in. thick and $\frac{1}{4}$ in. long.

One rivet connects the support H, the hand-guard G, and the little piece M, all together towards the front, while another $1\frac{1}{2}$ in. from the back holds H and G together. A $\frac{5}{8}$ in. hole should now be bored through H and G $\frac{3}{4}$ in. from the back, again using a centre-bit, and the whole may be attached to the barrel with the two rivets shown. The top of M should be filed hollow to fit the curve of the barrel, and the front part of H hammered to a similar curve.

The holes for the rivets may be either punched or drilled, but the former will usually be found the easier method.

The diaphragm D (Fig. 2) is mostly made of sheet iron, and the legs are sometimes riveted on, but it is much easier to cut it out of the iron at once, legs and all, as Fig. 4. It should be punched with as many $\frac{1}{8}$ in. holes as it can stand. The diameter is just a little less than $2\frac{1}{2}$ in., and the legs are 1 in. long. They will be turned up at right angles to the body. The leg L in Fig. 2 is riveted on.

The only difficulty likely to be experienced in the pipe P (see also Fig. 5) is the coning of the mouth to $\frac{3}{8}$ in. I, however, found it easy to do after having cut two nicks out of the piece of $\frac{1}{2}$ in. tubing as at Fig. 6. I annealed the brass by heating it in the fire, and when cool, was able to hammer the point cone-shaped without much trouble. A touch of solder mended the cut afterwards.

Travelling still downwards we next meet the piece of wood S. As this will bear the whole weight of the tin portion it should be of tough wood. I employed oak, the dimensions being $4\frac{3}{4}$ in. by $\frac{7}{8}$ in. by $\frac{1}{2}$ in. Within $\frac{3}{4}$ in. of one end a $\frac{1}{2}$ in. hole is to be bored to take the blast-pipe; the upper edges are to be bevelled off and hollows cut to take the heads of the rivets in H (Fig. 2).

We next come to the bellows. The boards of this I made of a piece of an Indian tea chest. Teak, I think, is the name of the wood, and it does nicely, being thoroughly seasoned, fairly hard, and of a good colour and grain. Two pieces for the cheeks of the bellows are 5 in. by $5\frac{1}{2}$ in., two other pieces X, X (Fig. 2) are $4\frac{7}{8}$ in. by $\frac{1}{2}$ in., $\frac{1}{8}$ in. thick at the back and rather more at the front, so that when the backs of the two boards are brought together the front joint will not open. The piece Y is $\frac{3}{8}$ in. square and $2\frac{1}{2}$ in. long, and another piece is $\frac{3}{16}$ in. square and $3\frac{1}{2}$ in. long. The wood piece for the valve is 2 in. square and $\frac{1}{4}$ in. or so thick, and this completes the wood.

When all have been nicely planed and rubbed on a sheet of glass-paper, bore a hole for the valve in one bellows board and one at W for the blast pipe in the other. The latter is $\frac{5}{8}$ in. in diameter, and $\frac{3}{4}$ in. from the back end of the board; the former $1\frac{1}{2}$ in. in diameter, and its centre 2 in. from the back end of the board. The burrs which may have been formed in the boring of these holes should be carefully rubbed off with sand-paper. The pieces X, X should then be glued and tacked across the front edges of the boards, and the piece Y on the lower one $\frac{3}{8}$ in. behind X, its ends being equidistant from the edges of the board.

The springs must next be made, and as they are rather peculiar I give a sketch of one in Fig. 7. It will be seen that each spring consists of two wires, or rather one bent in two, and as there are two springs there will be four wires pushing the boards apart.

To make the springs drive a couple of wire nails $\frac{3}{16}$ in. thick into a bit of wood 6 in. apart. Cut the 16 gauge wire $14\frac{1}{2}$ in. long and straighten it, place it against the wire nails, having the ends project equally at both sides, and turn the ends round the nails, one to the right and the other to the left, giving two and a quarter turns to each end, which will leave them at right angles to the middle part as at Fig. 8. Then bend the middle part at M into a round curve so as to bring the coils together and the loose ends lying side by side. Then with a pliers turn down the points to prevent them from sticking in the boards, and give a little bend just near the coil to make it more ship-shape. The ends of the piece of wood which we have prepared, $\frac{3}{16}$ in. square and $3\frac{1}{2}$ in. long, are rounded and stuck through the coils of the springs, and a little bit of thin wire ties them together to prevent them from slipping off. This axle, as we might call it, of the springs is then placed between the pieces X and Y (Fig. 2), and the lower board then looks like Fig. 9.

The valve must be added to complete it. This is a piece of leather 3 in. by 2 in., having the 2 in. square piece of wood secured to one end of it by one tack passing through near its centre. It must not be glued to the wood, for if it were and the wood warped, the valve would not close. Three edges of the wood valve will coincide with three of the leather, and an inch of the latter will project beyond the wood. By means of this tongue the valve is secured to the board with two tacks. A light spring must press very gently on the back of the valve to prevent it from opening unless when the air is drawn in. This can best be made of a bit of watch-spring, which can be procured for nothing from any watchmaker, but a bit of thin hard brass wire would do almost as well; a tack passing through a hole in the watch-spring, or a loop turned on the end of the wire, will fasten it to the bellows board. This spring is shown in Fig. 2.

It would be well to put a narrow strip of leather over the valve and fasten its ends down with two tacks, allowing the valve only about $\frac{1}{8}$ in. rise. This is to prevent the children of the family making a doll of the smoker, and feeding it through the too convenient valve. The hinge may now be tacked along the front edges of the boards. It is a strip of leather 5 in. by $1\frac{1}{8}$ in., and should be glued to the board edges as well as tacked; the tacks are an inch apart.

The springs may next be put in place, and the outer edges of the bellows boards held $2\frac{3}{4}$ in. apart while the leather is being glued on. The edges of the boards will be rubbed over with strong glue, and the leather laid on and secured with a few short tacks. The edges may afterwards be cut flush with the outside of the bellows boards.

As a general guide in procuring the leather I may say that a strip 18 in. long, tapering from $3\frac{1}{4}$ in. in the middle to $1\frac{1}{8}$ in. at the ends, does for the three sides, an inch being left at each end to overlap the hinge.

The bellows ought now to be able to work nicely, but it is customary to put a narrow strip of red leather all round the edges of the boards, and to secure it with small brass tacks.

Before the bellows are put together it will be much better to fasten to the upper board the piece S with glue and a couple of screws from the inside, the holes for blast in both bellows and support being over one another. A piece of wire-gauze W (Fig. 2) should be put between the two,

covering the blast hole in such a way as to prevent ash or einder from the smoker finding its way into the bellows. The contracted piece of brass pipe can now be pushed into place, and the body of the smoker fastened to s with the piece of tin H, which has its edges turned down so as to embrace it; four little screws or tacks will hold it on very firmly.

The smoker is now finished and ready for the fuel, which can be brown paper, sacking, or anything that will smoulder. It should be put in in such a way as to afford passages for the air through it. If it is packed tightly we cannot expect the smoke to travel through the entire length of the barrel.

The form of spring used in the real Bingham entails a good deal of unnecessary labour, and for myself, I cannot see why a spiral spring of the proper strength should not be substituted. Then the front edges of the bellows boards could be brought together, and the four pieces of wood there found could be dispensed with.

I have thus devoted an entire paper to the Bingham Smoker, but it is quite worthy of it, being the only offensive armour we possess. I hope in my next to describe extractors.

MAKING ELECTROTYPE COPIES OF BUSTS.

BY GEORGE EDWINSON BONNEY.

Busts.—When copies of plaster busts have to be made in copper by the electrotype process, special means must be adopted to secure a true mould of the original. This may be done in one of three different ways. (1) Soak the original in linseed oil, let this get dry and hard; coat the surface with blacklead as for electrotyping, and deposit a substantial shell of copper on the outside of the bust. Next saw through the shell at various parts, so as to cut the whole up in sections of suitable size to be used as moulds, and pick all the plaster out piece by piece. Then solder connecting wires to the outsides of the moulds, stop the wires and the outsides of the moulds with varnish, and coat the insides with sweet oil to prevent perfect adhesion of the electro-deposited copper. Place the moulds thus prepared in the depositing solution, and deposit in each a thick coat of copper. When the moulds are taken out of the coppering solution, the original moulds may be stripped off from the inside coats, and these soldered together to form the perfect bust. By this method the original is entirely destroyed. (2) The bust is moulded in plaster of Paris, in two parts, one for the back and the other for the front. The two moulds thus formed are soaked in linseed oil, dried, and blackleaded as for an electrotype, and copper deposited in them in the usual manner. The two halves of the copper bust are then soldered or brazed together. By this method the original is preserved, but the copy is liable to inaccuracies and defective parts. (3) The bust is filled with sand, the lower orifice is closed by pasting a piece of paper over it, and the whole is enclosed in a mass of melted elastic composition. This is slit open when cool, the bust taken out, and the mould thus formed filled with melted wax, which takes the impression of the bust from the inside of the mould. This copy is blackleaded in the usual way, and a thick shell of copper deposited on it to form *the* mould for the true copy of the bust. When this is done, the wax is melted out, the copper mould made watertight, then prepared to receive a non-adherent inside coat of copper, and made to serve for its own depositing vat whilst being lined with a thick coat of electro-deposited copper. Finally, the outside mould is peeled off piece-meal, and the true copy of the bust remains perfect and entire. By this third method the original is preserved, and the copy thus made is formed without resorting to the uncertain results of soldering the pieces together.

As small statues, statuettes, figures of animals, models of fruit, and similar works of art, may be copied in copper by a similar process, and this may be of some interest to the readers of WORK, a few more details of the process may be generally acceptable. For all the processes, a large Daniell battery of at least two 1 gallon cells, or a plating dynamo, will be needed to furnish the necessary current of electricity. For the first two processes, an electrotyping solution of sufficient quantity, and a vat to hold this, will be required. In selecting the vat, choose one which will allow, at least, two inches of liquid above and below and all around the object being copied. For the third process, no vat will be required at the finish, since the mould first obtained on the wax copy will in itself become the vat. For all, a good electrotyping solution will be required, made up as follows:—Dissolve in hot rain water as much sulphate of copper crystals as the water will take up, then to each gallon of copper solution add one quart of rain water, and, finally, add to each gallon of the latter solution from four to five fluid ounces of sulphuric acid. Stir all well together, and filter through a piece of coarse clean calico. More sulphuric acid may be added afterwards if the solution does not dissolve the anode freely. The anode should be of pure electrotype copper, rendered perfectly clean by freshly scouring and rinsing the surface.

When taking a copy of the bust or statue by the first process mentioned, care must be taken to so cut the mould in sections as to leave no signs of disfigurement when the sections are soldered together. A bust may be cut open at the back of the head, and a slice taken out of the shoulders. The parts must not be sprung in getting out the plaster, and care must be taken not to injure or scratch the insides of the moulds. The stopping off varnish may be copal or other good oil varnish, applied only to the outside, and allowed to get hard before placing the mould in the depositing solution. The insides of the moulds are first oiled with sweet oil, and then dried before a fire, before placing in the depositing solution. Care must be taken in stripping off the copper mould not to buckle or otherwise distort the copy. Peel the mould off in little pieces with a pair of flat-nose pliers. Solder all parts neatly together, and hide the soldered joints with gold size and bronze powder.

When taking a copy by the second process, first embed the front half of the subject in sand contained in a box, circumscribe the area of the mould with a rim of cardboard, and smooth the sand level all around the subject. Then take a tuft of cotton, dip it in sweet oil, and lightly oil all the exposed parts of the figure. Next make a mixture of finest plaster of Paris in water, by sprinkling the plaster from the hand into the water, and stirring all the time until the mixture is of the consistence of thin cream. Pour this all over the figure, and thus coat it with a thin coat of plaster, whilst all air bubbles are broken with a feather or a camel-hair pencil. Then pour on enough of the plaster mixture to make a sufficiently thick mould, and leave it to harden. When the plaster is set, turn the mould with its model carefully over, embed the mould in the sand to the level of its edge, brush off any sand adhering to the edges of the mould, and anoint them with oil or with soft soap to prevent the wet plaster of the two halves of the mould from adhering together. Now treat the exposed half of the original in the same manner as the first half, and, when the plaster has set, remove the two halves of the mould from the figure. These must first be dried, then gently baked hard, and whilst still warm smeared with melted wax or with boiled linseed oil, and again made hot to make the wax or oil penetrate into the pores of the plaster, and so render it impervious to the depositing solution. The interior surfaces of the two halves must now be coated with blacklead, to form a conducting film for the copper deposit; several conducting and supporting wires must be connected to various points on the outside edges of each half, and the two halves suspended in the depositing solution until they have been coated with copper to the thickness of $\frac{1}{16}$ in., or even more than this.

The most remote parts of the mould, such as the nose and chin of a bust, will sometimes fail to receive a deposit of sufficient thickness. To remedy this defect, attach a few fine wires to the leading conducting wires, and bring the points of the fine wires in close, but light, contact with the remote parts of the mould. As deposition always commences at those points to which the conducting wires are connected, and preferably those points nearest the anode (at which points also the deposit will be thickest), it will be advisable to bend the anode plates, or so arrange them when placing them in the solution as to bring them close to the most remote parts of the mould, and follow at equable distances its outline.

When the electrotype is complete, it must be removed from the mould, and well washed to free it from copper salts, and then the two halves may be soldered together to form the complete bust. But this part of the operation must be carried out with much care.

In copying busts and undercut models by the third process, an elastic composition is used, which may be made of 12 parts glue and 3 parts treacle, or 8 parts glue and 2 parts treacle, it being a mixture similar to that employed in making printers' rollers. The glue must first be well soaked in cold water until soft, and then melted in a sufficiently large vessel containing a little water. Stir well until all the glue is melted, then well incorporate the treacle. This mixture is very elastic when cold, and will take a fine impression of any engraved or moulded surface. To use it, proceed as directed. First prepare the bust or other model by coating it with oil. If made of plaster, give it a coat of boiled linseed oil, and then set it aside for a few days to harden, and thus render the plaster impervious to the moisture and treacle in the copying composition. Weight the bust by filling it with sand, paste a piece of stout paper over the orifice at the base to keep the elastic mixture from entering there, and suspend it by a piece of wire or string

in an ordinary galvanised pail of sufficient size to allow quite half an inch of clear space all round, above and below. Mark the pail with a piece of chalk to indicate the position of the back (for here it must be slit open after the composition has cooled), and pour in enough of the melted composition to cover it entire. When this is cool, invert the pail on a piece of clean paper, and turn all out on a table.

At this stage of the proceeding the operator will stand in need of an assistant. Slit the cold composition right down the back with a sharp knife. Gently prise open the slit part, and let the assistant hold the mould whilst the model is taken carefully from the inside. The slit will then close up again, and leave a hollow mould inside, of the exact size and copy of the original model. Protect this from distortion and injury by enveloping it in bandages or in folds of tape, and put it back in the pail. Next melt sufficient beeswax to fill the mould, cut a hole in the base, and when the wax is just cool enough to run freely without setting at once, pour it in the elastic mould. This will take an exact cast of the inside, and produce an exact model of the bust in wax. If the wax is too hot, it will melt the composition and spoil the mould; if too cold, it will not run into the remote parts: it should be just at its melting temperature when poured.

When the wax is thoroughly cold and hard, which will take several hours in a cool place, the mould may be opened, and the wax model taken out. This must now be coated with blacklead, conducting wires fixed to it, and prepared to be electrotyped. Copper must now be deposited upon it until it has all been coated with a moderately thick shell, capable of being handled without fear of injury. This done, remove it from the bath, rinse in warm water, and set it aside to drain. Next set it before a fire or in a place hot enough to cause the wax to run out of it into a convenient vessel, and so free the inside from all traces of wax. To quite complete this, pour a small quantity of sweet oil in the copper mould, turn it from side to side until the oil has been made to cover every part, then drain it all out, and finally set it before a fire until all the oil has been driven out, which is shown when the rim of the orifice ceases to soil a piece of blotting-paper. The mould must now be examined by the aid of a strong light to detect any pin-holes in the shell, and these must be stopped with sealing-wax or by soldering, to render the mould watertight.

The mould thus prepared will form the vat in which the finished copy is to be deposited. Solder two or three conducting wires to the outside of the shell, and fill it with the depositing solution. In this suspend the anode of pure copper, taking care that it does not touch the sides of the mould, nor its conducting wires the rim of the mould. This can be managed by hanging the copper to a piece of wood placed across the orifice of the bust. The anode is connected to the positive pole, and the mould connected to the negative pole of the source of electricity, until a thick deposit of copper has been formed within the mould.

The wires may now be disconnected, the solution poured out, and the outer shell of copper removed piecemeal with a pair of pliers, leaving the inner shell complete, and a perfect copy of the original bust or other figure. In stripping off the shell, commence at the lower rim, and pull a piece off with the pliers; the rest will then come away bit by bit, with proper care, until all the shell has been peeled off. The finished bust or statue may then be bronzed, plated, gilded, or otherwise ornamented, as taste may dictate.

By the second process electrotypes may be taken of fish, or of fruit, or of vegetables. By this last process a copy can be taken of any carved or undercut work of art, as well as of busts or statues.

Fig. 32.—Upsetting Bar horizontally.

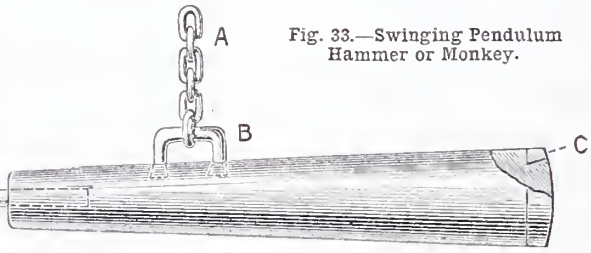


Fig. 33.—Swinging Pendulum Hammer or Monkey.

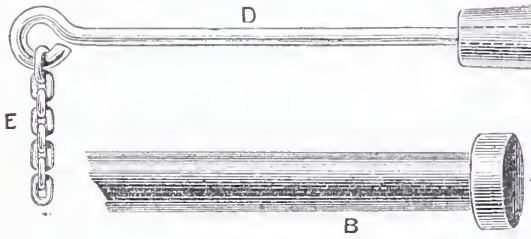


Fig. 30.—Bar with Collar on End.

MODERN FORGING.

BY J. H.

UPSETTING.

ONE of the alternatives of drawing down is upsetting, or jumping up. The terms are almost self-explanatory, signifying that the metal is knocked or dumped up into a mass larger in area than the dimensions of the bar itself.

Upsetting is a slower, more laborious, process than drawing down. A sharp smith will draw down several inches of bar at one heat. But to upset a very moderate mass of metal will require several heats. Hence it is not possible to treat any very large-shouldered portion in this way, but recourse must be had to welding on a ring or collar, or a solid mass of metal, according to circumstances; these being, in such cases, the only practical alternatives of drawing down. The steam hammer does not afford so much aid here as it does in drawing down, because, unless the iron is cut off sufficiently short to go endwise under the hammer, the use of the latter is not possible. There is, however, an appliance found in most shops of average size which, in a lesser degree, fulfils the purpose of the hammer: namely, the monkey, or swinging pendulum hammer, shown in Fig. 33, which I shall notice directly.

The method of upsetting is generally as follows:—Suppose it is required to form a collar A (Fig. 30) upon the end of a bar whose original section is that of B, and without welding the collar on as a ring. We take the bar, enclose the end which is to form A in the fire, but heat no more of that end than the precise amount we want to upset, and keep that portion of the bar which is in immediate contiguity with it quite cool and black by heaping damp coal around it. The end is then raised nearly or quite to a welding heat, and taken from the fire. Sometimes on removal from the fire, and just before upsetting, the extreme face of the heated end is dipped into the slack trough in order to chill it, and so the better prepare it to resist the blows of the hammer; but this is not always done.

The upsetting is performed in one of three or four ways. Thus the bar may be held up in both hands (Fig. 31) in a vertical position, and the white hot end jumped down repeatedly upon the anvil face, or else upon the plate of cast iron, which is often let into the ground alongside of the anvil stand for this purpose. Another way is to lay the bar in a horizontal position upon the anvil face (Fig. 32), holding it in one hand if light, and hammering the end to be upset with a hand hammer. Or if it is heavy, it will be held in both hands, or, perhaps, slung in a chain from the forge crane, and upset with a sledge hammer or hammers. Or, again, when very heavy, it is laid upon the anvil face or upon a levelling block, and the swinging monkey (Fig. 33) is driven against it. The monkey is suspended with a chain A from any convenient beam overhead. Being heavy and drawn back several feet from the perpendicular, and then let go, it strikes the iron with a large measure of accumulated force.

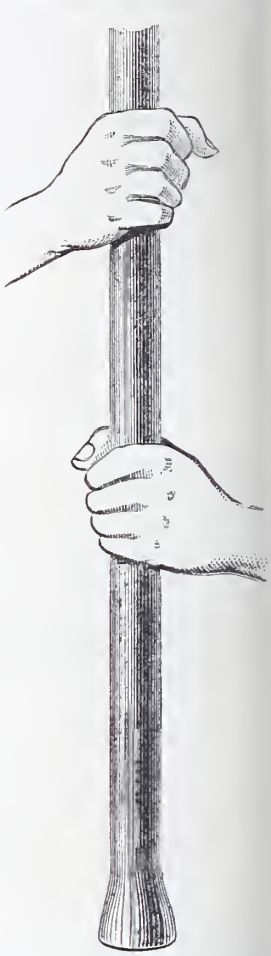
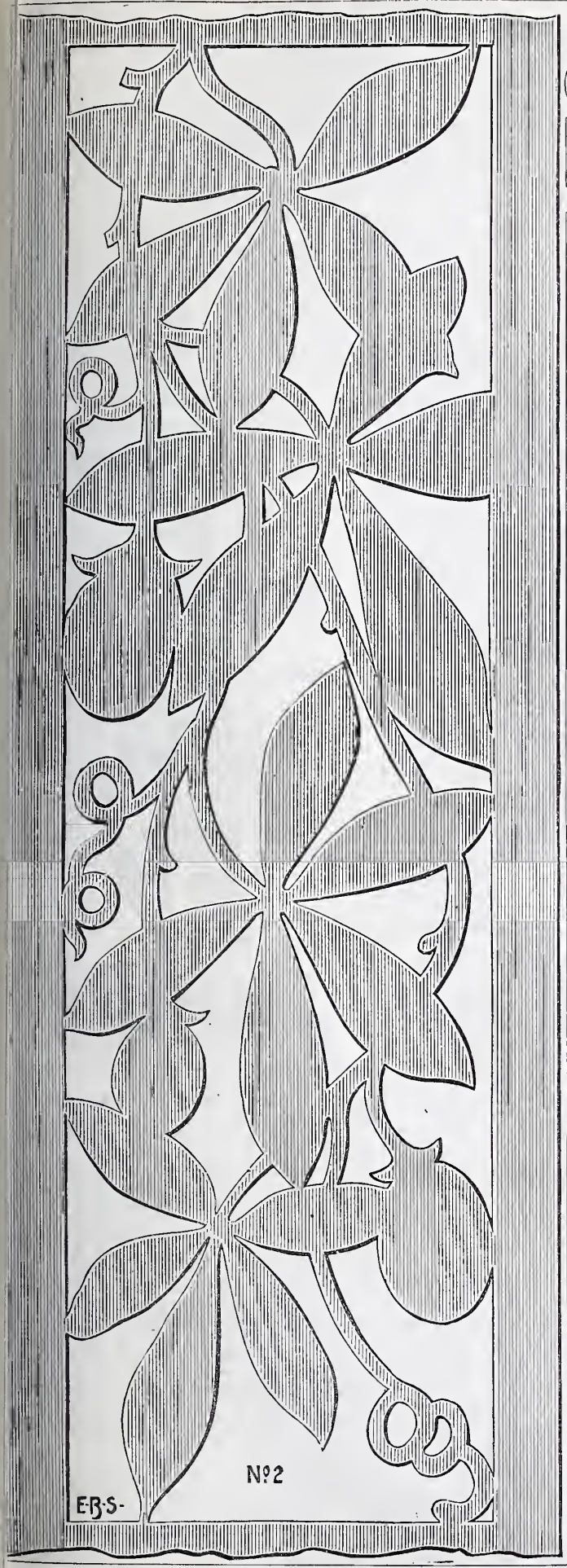


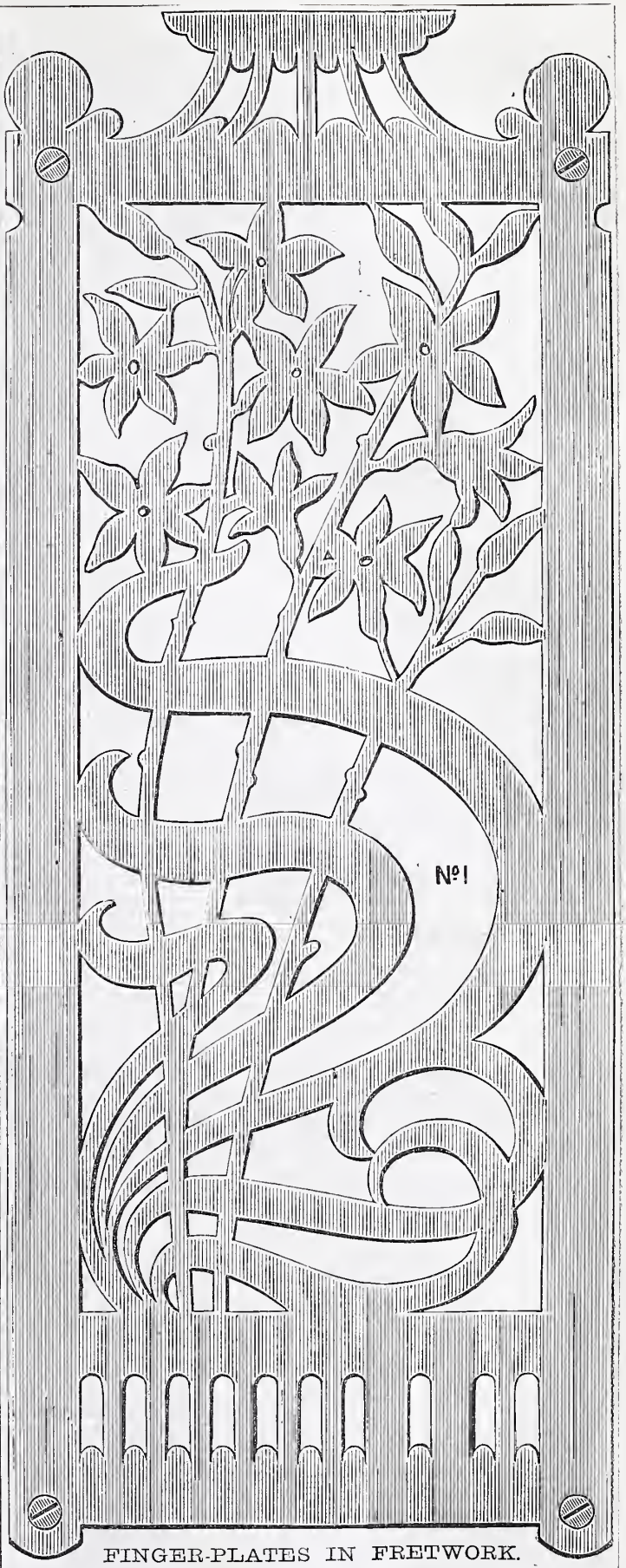
Fig. 31.—Jumping Bar vertically.

The construction of the monkey is as follows:—

It is made of cast iron, and is balanced carefully on its centre of gravity by the correct setting in position of the eye B,

(*Continued in page* 338.)





FINGER-PLATES IN FRETWORK.

The Ends of Finger-Plate No. 2 at Top and Bottom are to be traced from the Ends of No. 1, which forms the Upper Finger-Plate. The Ends should be reversed in No. 2. For Directions of Materials and Colouring, etc., see next page.

which is cast into the bar. The battering end is preserved from fracture, and from too rapid wear, by means of the wrought-iron band C which fits around, and is shrunk into a shouldered recess of dovetailed section. The handle, or porter, D is of wrought iron cast into the monkey. It is provided with an eye, through which a small chain or rope E is passed, by means of which the monkey is pulled backwards after every blow.

Several heats, often amounting to three or four, are required to jump up a moderate mass of metal. The reason is that fairly exact dimensions are not at once obtainable by this method, as in the case of drawing down. The jumped up mass of metal, in spite of much care in localising the heat in that precise position where it is required, is, nevertheless, very unequal, and quite destitute of sharp shoulders. Hence considerably more metal has to be massed together than is actually required in the finished work, in order to allow of symmetrical finish to size.

Upsetting tends to separate the fibres of the metal. It is, therefore, necessary to counteract this tendency by hammering the jumped up portion at a welding heat.

When the metal for the collar is massed in sufficient quantity, then it is finished to a parallel diameter in swages, and the square shoulder finished with a set hammer or flatter, or in swages, and the end with hammer and flatter.

A collar can be also formed upon any portion of a bar situated away from the ends, by localising the heat in the position required, and then jumping up the metal at that particular section until sufficient mass is obtained for finishing to size and shape. And of course any sections, other than those of round bar, can be heated by upsetting, and the spreading out can be performed in one direction more than in others, if required.

TWO FINGER-PLATES FOR FRET-CUTTING.

BY E. BONNEY STEYNE.

It is somewhat curious that amateur fretcraftsmen do not more frequently select finger-plates whereon to display their skill in the use of the saw, for these very useful additions to a door are easy to make and to apply. They can be made pleasantly decorative in effect, and whether left in the natural wood, polished, enamelled, or gilded wholly, may prove not merely ornamental in themselves, but assist in decorating the door they are presumed to protect from the finger-marks so sadly disfiguring its fair surfaces. But to plead for the use of finger-plates is as absurd as to advise the employment of umbrellas in wet weather; the advantages in either case are so obvious, that it is too late in the day to attempt to justify them.

The amateur, who is such an undesirable "weak brother" to the sturdy professional who reads these pages, is at least a well-disposed, harmless creature, who delights in trying his 'prentice hand upon simple joinery, and for the very weakness of his tribe, who regard the requisite fitting together of a fretwork bracket as a feat in joinery that taxes all the resources of their tool-chest, and calls out all their ingenuity, these things should be specially welcomed. For, to affix them with four small screws, or even four brass or pearl-headed tacks, is within the powers of the veriest bungler that ever misused a tool.

Owing to the space rigidly imposed by the size of our pages, it is impossible (while keeping to the useful full-size for a fretwork pattern) to give the larger plate in its actual length. Yet to trace the missing top and bottom pieces from the shorter one, that can be represented in its complete form, is so easy that an apology for the maimed one is hardly needed.

If the door is plainly painted, the plates entirely gilded, or painted with a suitably contrasting enamel-colour, would probably look better than if left with the natural grain. Tastes, however, differ as widely as individuals. Your acme of good taste may be my terrible example of bad, or *vice versâ*, so to avoid dialectic homily, it is best to let the advice of subsequent finish remain unwritten; for advice is so rarely followed that it is a superfluous article to bestow, and in the rare instances when a rash person has followed it, the consequences are not always pleasant to advised or adviser. Yet to insist on the improvement gained by following the lines of the design accurately, instead of at a wavering and uncertain distance, to see that the parallel lines are truly kept, and the external edges shot with a plane true and smoothly, is worth enforcing, also the necessity of choosing very thin wood, lest the whole look clumsy; but the rest may be left to the brains of those who care to work out the designs accompanying this description.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

55.—Brace with Split Chuck for Bits.

This is a brace, apparently of German manufacture, on the lines of Spofford's Patent Brace, an American tool made on the same principle. The chuck, or part which takes and grips the bit, is split longitudinally and vertically for full 4½ in., so that it expands on the insertion of the squared end of the bit in the grooves cut for its reception. It is made in two sizes, supplied at 2s. and 4s. 6d. Buyers, however, should have one of Spofford's make, although it costs more. The form of the brace is good, though not new; and is preferable to the ordinary bit-brace. Spofford's Patent Bit Brace may be obtained of or through any dealer in tools. It is made in three sizes—8 in., 10 in., and 12 in.; sold respectively at 6s., 6s. 6d., and 7s. 6d.

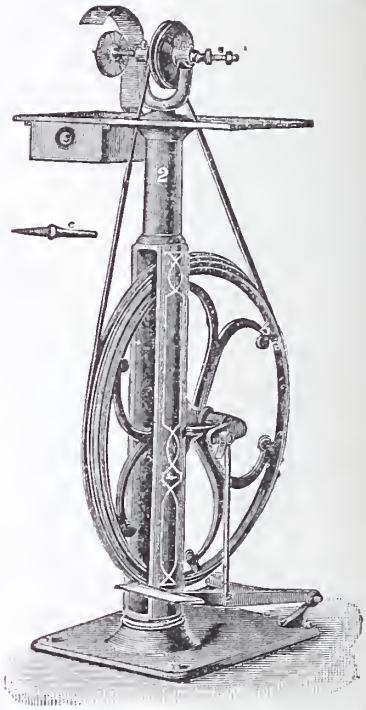
56.—Some Reliable Metal Salts and Their Uses.

I have received from Messrs. W. Canning and Co., Great Hampton Street, Birmingham, some samples of metal salts prepared by them for electro-depositors. Of these, the most notable are the specially pure double sulphate of nickel and ammonia, the cyanide of copper and of zinc, and the carbonate of copper and zinc. The first need only to be dissolved in water to form a nickel-plating solution. The copper and zinc salts are used in making up solutions for copper-plating, zinc-plating, and electro-brassing. The same firm have also favoured me with a specimen of their cast nickel anodes, and specimens of the brushes, bobs, and mops sold by them for polishing metals. These are all well made, out of good materials, and sold at reasonable prices. This firm supplies all requisites for electro-platers, and the famous American polishing compositions now coming into favour with metal-workers.

Messrs. J. and E. Hartley, 13, St. Paul's Square, Birmingham, also send samples of salts, and specimens of scratch-brushes, mops, and bobs made by them. They are all of excellent quality, but those deserving special mention are a circular mop made of basil leather and a calico mop spirally stitched. When two such firms as Messrs. Canning and Messrs. Hartley run each other so close in producing goods of equal quality, we should do a wrong to our readers in attempting to say which is best, both alike being so good. The low prices and the excellence of the materials should tempt amateur and professional platers alike to give up all idea of making their own. It says much for the enterprising spirit of Birmingham when it can turn out two such competitors in good work.

57.—Patent Foot-Power Polishing Lathe.

Country tradesmen who undertake to do repairing and relacquering jobs in brasswork are sometimes put to some expense for carriage, and have to suffer anxious delay in getting the job finished,



Hartley's Foot-Power Polishing Lathe, No. 2.

by having to send it to a long distance for the purpose of getting it polished and lacquered. By procuring one of the Patent No. 2 Foot-Power Polishing Lathes, made and sold by Messrs. J. E. Hartley & Co., Birmingham, and shown in the annexed figure, together with a full set of polishing and finishing materials, all such jobs may be done in the country workshop, and finished with the transparent cold lacquer sold by the same firm. This lathe stands 3 ft. 9 in. in height from floor to centre of spindle. The balance wheel is 26 in. in diameter, has three turned grooves giving three changes of speed, and will run easily up to 3,000 revolutions per minute. Its total weight is about 128 lbs., and the price 70s. Ironmongers, jewellers, silversmiths, plumbers, and electro-platers who have no steam power will find this lathe invaluable. It is shown with a circular metal scratch-brush fixed to the spindle, but this can be replaced with an emery wheel or a polishing mop if desired. The spindle B is intended to hold a circular bob or buff for polishing, but this can be unscrewed and replaced with the taper spindle C if required. It would be found useful in clubs, hotels, restaurants, and other similar establishments where a quantity of plate and other metal work has to be kept clean and well polished. The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

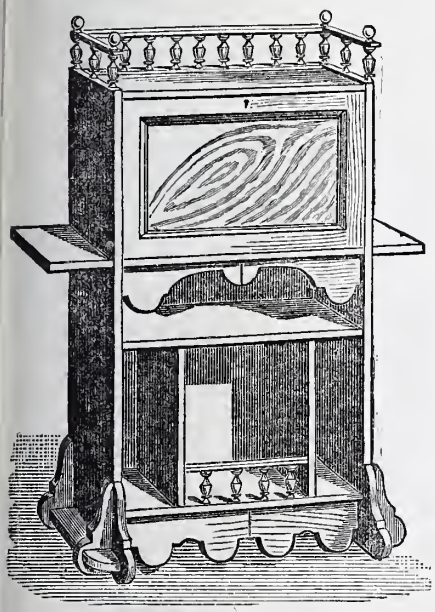
NOTICE TO CORRESPONDENTS.

In consequence of the great pressure upon the "Shop" columns of WORK, *contributors are requested to be brief and concise in all future questions and replies.*

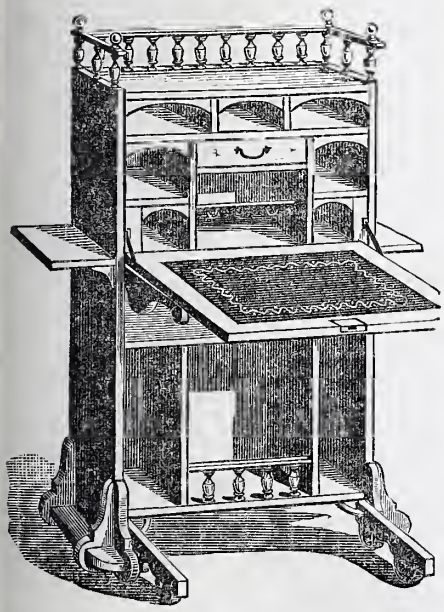
In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Escritoire.—D. B. (*Perth*) writes: "I enclose a sketch of an escritoire which I have just finished. The idea is something after Mr. Gleeson-White's, with a little of Mr. Adamson about the feet. However, I think that in Mr. Adamson's screen secretary, the supplementary feet have to be pulled out



Escritoire Shut.



Escritoire Open.

with the hand, where, in the one I have made, I have introduced a small lever at each side of writing flap, which works a simple combination of springs and levers, for throwing out the feet and supports when the flap is opened and pulling them in when shut. I made it all myself with the exception of the spindles, which I got turned for me from patterns which appeared in WORK, although you may not be able to recognise them from sketch. I have stained it mahogany, and I may say that I have been waiting patiently for the articles on French polishing to appear; if they do not early, I may venture to try my hand, after reading all the answers on the subject in 'Shop.' I am a loom tenter by trade, but sometimes I think I should have been a joiner or cabinet maker, as I enjoy very much working among wood."

Watchmakers' Book.—A. G. L. (*London, N.*) writes:—"In the answer to J. R., *re* 'Publications,' in No. 66 of WORK, 'Britten's Watchmakers' Handbook' is published by the author at the Horological Institute, London, and sold retail by such firms as Grimshaw & Baxter, Goswell Road; Gray, Clerkenwell Green; and Ehnhuus, Soho. Nelthropp's 'Watchwork, Past and Present,' is published by E. & F. Spon."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Spring Hinge.—DISAPPOINTED.—I am sorry your previous letters have received no reply, but there is tremendous strain upon "Shop," and even now you do not enclose your name. You will find it very troublesome to make spring hinges, but you can be supplied with them by Mr. Robert Adams, 67, Newington Causeway, London, S.E. His latest production, the "Crown Victor," is durable and satisfactory in its action.—F. C.

Book on Organ Construction for Use of Organ Builders.—EXCELSIOR (*Liverpool*).—The only work I know of is that by Hopkins and Rimbault. The French work founded on Dom Bedos is not of modern date.—M. W.

Mica.—G. P. (*Edinburgh*).—Messrs. A. Tannahill & Co., 21, Mincing Lane, London, E.C., supply mica for electrical and other purposes, and not only keep stocks of all ordinary sizes, but also cut mica to any shape, size, and thickness that may be required.—ED.

Tools for Engraving on Copperplate.—A. G. (*Burton-on-Trent*).—The form of tools for engraving on copperplate is practically the same as for crest work, with slight modifications. The lozenge graver is most commonly used, whetted to the various angles required by the work in hand, the "setting off" of these gravers being almost *nil*, owing to the flatness of the work. You do not say what kind of work you wish to do; I therefore give a list which, I hope, will meet your requirements, and if any difficulty is experienced in obtaining the tools, my address will be found in Nos. 52 and 53 of WORK.

1 dozen (or less) lozenge gravers.
1 ,, ,, handles for same.
1 steel curved-end burnisher } Handled.
1 ,, triangular scraper } Handled.
1 ,, etching or tracing point } Handled.
Set of three or four sand-bags, or engravers' cushions.
Pitch block for mounting plates on while being engraved.
Copper plates, *ad lib.*
Spring dividers, true straight-edge, and square and rule combined. Arkansas oilstone, oilcan, turpentine, pencil, tracing paper, impression paper, and copperplate printing ink, for impressions to test the progress of the work.

There are other tools used by the copperplate engraver, but the foregoing list will give you a good start. In conclusion, you must be prepared for a few difficulties in connection with the cutting of copper, as, unless the engraver is used to it, he has a difficulty in producing a smooth cut.—N. M.

Engraving Name Plates.—ENGRAVER.—The usual term "graver" is applied to all the cutting instruments used by the engraver, except the "chisel," which term speaks for itself. The general term of "graver" is superseded when the graver is whetted to the form or angle required by the workman—viz., an angle graver, a round-nosed tool, a flat-edged tool, a shading tool, etc. I would suggest that ENGRAVER should take the number of WORK containing the illustrations of the tools required by the engraver, and ask the dealer if he has any such in stock. If you are unable to get what you want in Glasgow, you might write to Messrs. Buck, Holborn Viaduct, London, E.C., or Messrs. Fownley, Bull Street, Birmingham, who, being retailers, would be glad to execute any order, however small. I do not know of any dealers nearer Glasgow. A Boston correspondent writes me that he has made some chisels from the illustrations in WORK, and has used the same with success. I have only to add that these chisels may be made out of disused spindles, which, as a rule, are very good steel, and at times may be bought for 1s. per dozen. I shall be pleased to hear again from ENGRAVER, and of his progress in the art of engraving.—N. M.

Paraffin Lamp Chimneys, etc.—S. W. (*Bristol*).—(1) Unfortunately, lamp chimneys are made principally abroad, either in Belgium or Germany, and English workmen, instead of supporting their English fellow-workmen, are tempted by the cheapness of the imported article to buy inferior stuff, rather than purchase at a slightly higher price a better home-manufactured chimney, better annealed and of better "metal." For anything special, you will have to pay proportionately more, and as I do not know whether there are any glass-blowing firms in Bristol, I advise you, if your directory can give you no better information, to send a tracing and dimensions of the exact shape and size you require to the Whitefriars Glass Works, Temple Lane, London, E.C., for estimate. (2) I cannot at the moment give you any information as to coloured paper window blinds, except those being manufactured in Japan; you might get them from any dealer in such imported goods.—J. W. H.

Boot Varnish.—SLACK.—I do not know of any make that I can really recommend, as the so-called varnishes destroy the leather. Even the Government do not adopt them for the army, either for boots or harness, though I believe Harris's blacking and harness blacking, or Day & Martin's, are as good as any. I can give no recipe.

"To shine the boot, for Beauty's foot,
Why keep your brains a-wracking?
Advised by me, try Harris's B———,
You'll find there's nothing LACKING!"
—J. W. H.

Warped Wood.—STEREO.—From what you say I am afraid the wood has gone too far for any remedy to be effectual. You might, however, try the effect of leaving it on a cold flooring such as that of a cellar. The hollow side of course must be downwards. After it has flattened, which may take a few days, put it under pressure for a time. If it does not keep flat then you may consider the stuff useless. The remedy you have tried ought to have been as good as any if properly applied, and I am afraid you have failed through being in a hurry. The one I advise you to try is more gradual, but in untrained hands the result is likely to be more lasting. As the job you are making is small, could you not plane down pieces which are awkward?—D. A.

Bench Stop, etc.—W. E. J. (*Chippenham*).—(1) A good bench stop for ordinary work can easily be made by making a square hole through your bench and fitting into it a piece of hard wood. This of course is the stop. It must fit so tightly that it will not fall through by its own weight, but not so firmly that a tap or two with the hammer will not move it up or down. (2) The brass must be cleaned thoroughly and then relacquered. Read what has already been written in back numbers on brass work. (3) Certainly, wax polish applied with rags is a creditable polish for fretwork, if the finish suits the style of work. Of course if you want a glossy surface you must use French polish, but for many things wax is at least equally good, and is much easier. A paper dealing fully with wax polishing has appeared in our pages already. No; your questions are not too many, and if in different trades you should put each on a separate piece of paper, but do you not think that before writing it would be well to look through WORK? It would save you waiting for information.—D. D.

Violin Bow.—J. G. (*Abingdon*).—To cleanse the hair of your violin bow, take the screw out and wash the hair with a piece of flannel, soap, and warm water, and rinse with cold water; now put the screws in again, shake the water off, and put the bow in a warm place until the hair is dry. Speaking generally, it is better to have a bow rehaired when it is dirty and full of resin, as usually when that state is reached the beard, or natural roughness, is worn off; when this is the case, resin cannot make the hair bite properly.—B.

Staining Canvas.—NIGER.—You will find it better and more economical to buy the canvas ready prepared, and you can easily do so in your city. If you do not know any one who supplies it, try J. H. Peck & Co., 4, Goree Piazzas. If, however, you wish to try the staining yourself, use creosote.—D. D.

Oil from Cloth.—A. M. (*Hull*).—Rub the greasy parts with a clean rag moistened with benzine. In doing so be careful not to injure the cloth with rough usage. The benzine itself will do no harm, as it evaporates very quickly. Better to do the work in the daytime, as the stuff is very inflammable. If fuller's earth is more convenient try it, though for such a job as yours I cannot give it unqualified recommendation.—D. D.

Drawing, Reducing, and Enlarging.—F. S. (*Almondbury*).—The instrument you inquire about is known as a pantograph. It is to be bought from any artists' colourman or dealer in drawing materials.—D. D.

Compositions for Handles.—J. D. M. (*London, N.W.*).—You and other correspondents must quote the page and number of WORK in your inquiries. You can search your numbers as conveniently as can a busy Editor. When you see anything likely to be of value to you in the future you should act on Dr. Cuttle's advice and make a note of it.

Battery for Telephone.—C. W. J. (*Clapham Common*).—The telephone described in the November part of WORK does not require a battery, as it is a magnetic telephone.—G. E. B.

Electric Light for Laundry.—D. M. L. (*Battersea*).—The workpeople would find the electric light a great boon. Its superiority to gas would be soon appreciated in the ironing room. But the cost would be three times that of gas, and the first outlay greatly in excess of that needed for an installation of gas lights.—G. E. B.

Wire for Medical Coil.—W. H. S. (*Salford*).—A medical coil should have a larger core than ⅜ in. The core should be at least ½ in. in diameter. Wind two layers of No. 18 double cotton covered copper wire on the core for primary, and fill up the bobbin with No. 28 silk covered wire for secondary. Sharp, stinging shocks are not needed, and may be hurtful.—G. E. B.

Tinsmiths' Book.—TINSMITH.—The book you inquire about, "Metal Plate Work, its Patterns and their Geometry," by C. T. Millis, is published by Messrs. E. & F. N. Spon, 125, Strand, and the price of it is 2s. crown 8vo cloth. Thinking that many besides yourself would like to know a little more about it, I give below a synopsis of its contents. Introductory problems: classification of patterns. Class I. Patterns for articles of equal taper of inclination of slant, and made up of (*a*) round surfaces (pails, coffee-pots, etc.), (*b*) plane or flat surfaces (hexagonal coffee pots, baking pans, hoods, etc.), (c) curved and plane surface combined (oval teapots, oblong pans with round corners, equal end pans). Class II. Patterns for articles of unequal taper, and made up of (*a*) round surfaces (tapering pieces of pipe, etc.), (*b*) plane or flat surfaces (hoppers, hoods, etc.), (c) curved and plane surfaces combined (oval and oblong canister tops, tea bottle tops, oval baths, hip baths, etc.). Class III. Patterns for miscellaneous articles (elbows, articles of compound bent surface, as vases, aquarium stands, and mouldings). Useful memoranda on solders and properties of metals. The patterns in Classes I. and II. are set out in one, two, and four pieces, on a short radius method.—R. A.

Gas Engine Slide Ignition. — ONE IN A FIX. —I would strongly advise ONE IN A FIX to keep to the hot tube ignition, as being most simple, and it does not take any power from the engine to drive it as a slide valve does; in fact, your engine would not have power enough to drive a slide valve if you did arrange one on it, as it would be larger than the cylinder, and would look very unsightly. As regards the consumption of gas, I consider the hot arrangement the most economical, though the slide valve may not use so much gas to ignite the charge in the cylinder as the tube takes to keep it hot; the former takes a considerable amount of power to work it, which means more gas consumed in the cylinder. Perhaps you have not got your tube arranged just right; the hot tube should not be in contact with any more metal than can possibly be helped; for instance, it should not be screwed into the cylinder or cover, but an iron washer about $\frac{1}{16}$ in. thick and $1\frac{1}{2}$ in. diameter, or smaller if possible, should be fastened on cover, or wherever tube is arranged, by two or three small screws, having the join made with a piece of asbestos so as to break metal contact as much as possible; the tube should be screwed into this washer and be encircled by a piece of asbestos millboard, leaving a space of $\frac{3}{8}$ in. all round tube. I make a small high-speed gas engine myself which ignites by hot tube as stated; above bore of cylinder, $2\frac{1}{2}$ in.; stroke, 4 in.; speed, 350 revolutions per minute. This engine will give $\frac{3}{4}$-man power on the brake; weight, 60 lbs. —J. S.

Frame Mouldings, etc.—L. J. P. (*Wellingborough*).—We have heard many times of the firm City Frame Company, 29, Basinghall Street, E.C. Price of solid oak moulding a number of patterns, $\frac{3}{4}$ in. wide, 1d. foot run; 1 in. wide, $1\frac{1}{2}$d.; $1\frac{1}{2}$ in., 2d.; 2 in., 3d. I find these as cheap as those of any house; our readers, seeing this, may be able to give us cheaper houses.—G. R.

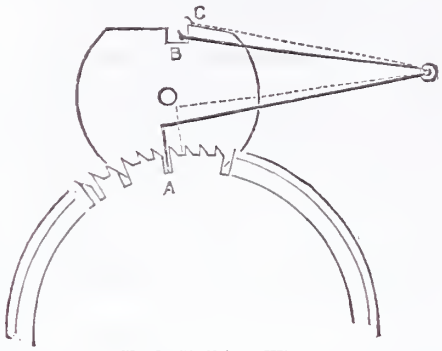
Picture Mounts.—G. B. (*Accrington*).—If your mount is a thick one, usually known as 12 sheet, you need only damp your picture, and glue to mount, and let it dry under a press. The usual manner adopted by the trade is to lay the photograph or drawing upon a wood pulp, which is good and cheap, with glue or starch; when dry, thin round, leaving about an inch of card beyond the picture or opening in the mount, and glue close up to where opening will come; lay mount on, rub down, and let it dry under press.—G. R.

Octagon.—C. S. (*Aldershot*).—To describe an octagon, draw lines at right angles to each other through the centre of a circle and bisect the angles made by the lines thus drawn.—F. C.

Grindstone and Screw.—NO NAME. — Do not attempt to mend a broken grindstone; it will not stand. The internal thread can be cut by a chasing tool in a lathe. See "The Practice of Hand Turning," published by Messrs. Spon.—F. C.

Boiler Cleaning. — F. C. B. (*Battle*). — The boiler you mention is not zinc, but is made of cast iron, coated with zinc by the following or a similar process. Clean the pan thoroughly by scouring and by pickling in dilute sulphuric acid; pass it through a strong bath of aqueous zinc chloride solution, slightly acidified with hydrochloric acid, and then through a bath of molten zinc covered with sal-ammonia. This process is known as galvanising, and the boiler you describe is known in the trade as a galvanised furnace pan. The reason yours marks the clothes is because the zinc coating has worn off and the rust from the cast iron boils into them. It would be cheaper to buy a new one than to attempt to regalvanise it. They are sold according to their capacity—*i.e.*, at so much per gallon, and you ought to be able to get one at 6d. per gallon. Those made of copper are much more money, but there is no fear of their ever marking the clothes, and when they leak they can be repaired, which is an advantage over the cast-iron ones. Copper boilers are sold by weight at about 1s. 2d. per lb., and average slightly over $1\frac{1}{2}$ lb. to the gallon. If you loosen your old pan by pressing up the rim with a screwdriver or chisel, you can easily lift it out; and if you get a new one the same size, you can slip it into its place without the aid of a bricklayer. You can, if you like, cement round the edges with a little Portland cement, but it is hardly necessary. Articles on sewing machines will, no doubt, appear as soon as space can be found for them; meantime I should advise you to get "Sewing Machinery," published by Crosby Lockwood & Co., price 2s., which gives full particulars as to construction and adjustment of sewing machines.—T. W.

Striking Wires.—NO NAME.—The top wire has the end bent at a right angle in a horizontal direction, the bottom one a right angle in a perpendicular direction, and this part drops in the locking or count plate, which is sometimes carried on the great wheel. Sometimes the great wheel itself is used, and sometimes it is a separate wheel keyed to the plate; in any case put this wheel in its place, also the wire and the wheel that has the disc on it, part of which is cut away either in the form of a



Clock Striking Wires.

snail or sometimes simply a notch. Let the bottom part of the wire drop in a long notch or deep cut A of the count wheel, and then bend the other or top part of the wire till it drops about half way down the notch B in the disc that is fixed to the wheel, when you will find it right; but to make sure lift the wire out of the count plate, move forward or backward till it rests on a shallow cut, then see that you can turn the wheel with the disc on it round, and that the hooked wire just frees the top of the notch, as dotted lines C.—A. B. C.

Binding.—C. L. F. (*Brighton*).—Make up your notebooks in sections instead of single sheets, and sew them in the ordinary way instead of wiring them. There is no other method, and it is strange that you did not think of this. Books treated in the above manner will lie perfectly flat when opened.—G. C.

Inlaying.—ROUGH CARPENTER.—Borders and centre pieces for inlaying can be obtained from Messrs. D. Witt & Palmer, Drummond Street, Euston Square, London.—D. D.

Practical Bookbinding.—J. R. (*Huntly, N.B.*). —It is rather difficult to advise you what course to adopt to gain the requisite knowledge to enable you to set up the business of a practical bookbinder. You would certainly require to serve some time at the trade if you wished to be able to do bookbinding as it ought to be done. It is customary to serve an apprenticeship of seven years, and there are a great many duffers in our trade, even after having spent all that time in learning the intricacies thereof. I have not heard of premium apprentices in our trade, but no doubt some binder could be found who, for a consideration, would give you the run of the shop. Personally I would advise you to try to get some one who is a bookbinder to join with you, and in that case you could look after your own branch, and he could undertake the binding. This is the most satisfactory arrangement I can think of; for there is a great deal more in bookbinding than appears upon the surface. Looking at a book when bound, it seems but a trifling matter to bind it—to sew it together and put a bit of leather or cloth upon it. Let me assure you, however, that it is no trifling matter; there are so many details consequent upon the proper binding of a book that only years of practical experience can supply the requisite knowledge of the method of filling in these details. I am sorry that there is no book which I can recommend upon this subject. There are books which have been written and are no doubt considered paragons of excellence in this respect, but as I cannot recommend them for practical purposes it is useless to give the publishers' names. See the articles upon this subject in WORK, the first of which appeared in No. 57, Vol. II. With regard to the necessary tools, etc., please see WORK, Vol. II., page 44. If there is anything else which I can do for you, either now or at any future date, please write and let me know.—G. C.

Sign-Writing Book. — PAINTER (*Sheffield*).— "The Art and Craft of Sign Writing," price 21s., is sold by the Decorative Art Journals Company, 15, St. Ann Street, Manchester.—H. L. B.

Initials on Ivory.—M. A. G.—You had better trace your letters on some tracing paper, and afterwards rub the back of paper with some soft lead-pencil; now lay the paper on the ivory, and go over the outlines again with a sharp-pointed pencil, and an impression will be left on the ivory. Carefully outline with some black colour, and afterwards fill in the various colours to taste. Use fine tube oil colours. You will find useful directions for tracing designs in the various works on china painting; and as to painting on ivory, I should think a deal of information could be gleaned from the shilling handbooks published by Rowney, and Windsor & Newton, on the subject of miniature painting.—H. L. B.

Waterproofing Canvas.—VERITAS.—I can recommend VERITAS to use the following composition as most suitable to his purpose, and more likely to give entire satisfaction. I have found it most successful over a period of more than thirty years. Take one part of yellow beeswax, one part of resin, and two parts of Russian tallow. Melt them in an earthenware pipkin, and stir them well to incorporate the materials. When well melted and hot, pour in one part of spirits of turpentine, and stir it well in, taking great care not to let it catch light or run into the fire. The parts may be ounces, pounds, or any weight most convenient, but they must be well mixed and thoroughly incorporated. To use it for canvas, let it be melted and made thoroughly hot; then with a brush, paint or spread it evenly over one side of the canvas, keeping the canvas exposed to the heat of the fire; and when all has been gone over, take a large flat iron—taking care that it is not too hot—and having placed the canvas on a flat, even surface, iron it all over on the surface which has been covered, and it will cause the composition to be spread evenly on the canvas and to enter well into the substance of the same. One great advantage of this compound is that it has no unpleasant odour, does not crack or peel off, and is flexible, allowing the canvas to be rolled and unrolled without injury; nor does it, like indiarubber or its preparations, decompose and become sticky; nor, like oiled canvas, crack and become rotten.—C. E.

Rubber Tyres.—ECONOMY.—If new rims that have not had rubber before, clean the hollow all round thoroughly, melt the cement in an iron ladle till it runs like syrup or thick cream, and pour a little all round the rim; then put the rubber in place, taking care to have the same side of the rubber uppermost all round; also, if the rubber is somewhat tighter than the rim, pull it a little all round while putting it in place, as it is bad to do all the pulling at one place. The cement will now have cooled somewhat; re-melt by holding the rim over a gas or lamp flame. When the rubber rolls sideways in the rim, and the cement begins to ooze out at the edges, then it is right; go round the whole rim in this way; clean off the superfluous cement after it has hardened. If old rims, melt the cement already in them with a hot poker; put some new cement in if necessary; then put the rubber in place and re-heat as above. Half-inch tyres for wheels 24 in. and 18 in. may be had of Brown Bros., 7, Great Eastern Street; W. A. Lloyd, Weaman Street, Birmingham, or any of the perambulator makers. —A. S. P.

Signboard, "The White Hart." — E. A. S. (*Burton-on-Trent*).—I shall be glad to assist you in every way in my power as regards design for above. I have looked through my prints and cannot find this identical subject, but I think I can photograph a sign outside a public house for you, and this I will endeavour to do and send you a print immediately. In the meantime the following will be useful to many besides yourself. The origin of the sign, the white hart with a collar of gold round its neck, dates from the most remote antiquity. Aristotle, in his history (Lib. IX. Cap. VI.), reports that Diomedes consecrated a white hart to Diana, which a thousand years later was killed by Agathocles, King of Sicily. Charlemagne is also reported to have caught a white stag in the woods of Holstein, and to have attached the usual golden collar round its neck; and another is supposed to have been caught in Windsor Forest. Amongst the oldest inns which have borne this sign is the "White Hart" in the High Street, Borough, London, where, on July 1st, 1450, the rebel, Jack Cade, established his headquarters. This inn was burnt down in 1676, but was rebuilt and is still, I believe, in existence. In 1708 it boasted of having the largest sign in London except one, the "Castle Tavern" in Fleet Street. Charles Dickens has immortalised the "White Hart Inn" by a most lifelike description in his "Pickwick Papers." The "White Hart" was the favourite badge of Richard II., and all his courtiers and soldiers wore badges on their uniforms, trappings, and accoutrements, which was a white hart with crowns of gold about its neck and chains of gold hanging thereon. No illustrations of signboards have appeared in the *Journal of Decorative Art*, which is published monthly at 15, St. Ann's Street, Manchester, price 7d.—H. L. B.

Book on Copperplate Engraving.—J. R. C. (*Bacup*).—I have never seen a work of this description, but I strongly advise J. R. C., and, indeed, every reader of WORK, to collect every scrap of good examples of design, each in his particular line, and paste them into guard books systematically arranged for study and reference. Collections of wood engravings and copperplate engravings, such as ornament, writing, views, etc., if thus saved as they come across one's path and pasted into books, become most valuable for reference in a thousand ways. Examples of every style occur, and tracing these to their origin and period is equivalent to educating oneself in their history. I have such scrap books, commenced thirty-five years ago, which are now simply invaluable to me. Old associations therewith connected are vividly brought to mind, to say nothing of their utility as references.—J. W. H.

Address.—J. J. D.—The Mr. Wood whose address you ask for has retired from business, which I formerly carried on in the Strand (nearly opposite the *Graphic* office) about six or seven years, selling off all his plant, dies, etc. Mr. Mullord, who was his foreman for years, is the most likely person to give you any information. I have not seen him now for about eight or nine years, and believe he resides still somewhere in or near London.—J. W. H.

Artificial Ivory Name-plates for Organ Stop-knobs.—AMATEUR ORGAN BUILDER.—As you say you cannot obtain ivory or bone, and yet wish to make the name-plates for organ stop-knobs ourself, I give you the following recipe for an artificial ivory, which I have found useful for imitation ivory brush backs and other purposes. Obtain a small quantity of isinglass, and mix it with finely-powdered egg-shells and brandy, so as to form a stiff paste. Make it warm, and then pour it into a mould of the desired size. When cold and hard it will much resemble ivory. The paste can be tinted to any shade desired by the aid of a minute quantity of aniline dye or other suitable colouring matter. The mould must be oiled previous to pouring the paste in. Finely-powdered whiting can be used in place of egg-shells. For name-plates on stop-knobs, it would be well to make a circular sinking in the face of the stop-knob and fill it in with the isinglass paste, and finish off level with the face of the knob. The artificial ivory would then be protected from chipping, as might otherwise occur if it projected beyond the face of the knob. The name of the stop could be printed on the ivory with a small camel-hair brush. When used for large surfaces, the ivory paste is laid on with a brush, allowing each coat to dry before laying on another. It is then levelled with a steel scraper and polished in the same way as ordinary ivory.—M. W.

Fog Signal Patent.—FOG SIGNAL.—The arrangement shown in the sketch sent us is ingenious, but in its present form is not adapted to the requirements of railway work. It is frequently needed to explode two signals in rapid succession, and the plan shown does not provide for this. Many people have given a great deal of attention to this matter, but we have not heard with what results, nor can we say how far the plan proposed is novel, as this would require a search of the patent specifications already filed. As this invention would only be used by railway companies, it would be most desirable to have the support of those who could influence its adoption by them; otherwise it would be found a very uphill job to get introduced.—E. D.

Green Ink, Model Yacht, etc.—YOUNG SHIPWRIGHT (*Jarrow*).—(1) It will be cheaper to buy liquid green writing ink than to make it. Judson's "Simple" dyes, whether green or any other colours, being prepared from aniline, will answer the purpose perfectly well. (2) A pad for inking india-rubber stamps can be made by nailing down to a piece of wood ½ in. thick, of the required size, a piece of fine woaded cloth, or printer's blanket, over a stuffing of horsehair, topped with cotton wool, tacking it to the edge of the wood, care being taken to fold the four corners neatly under by means of pleats. (3) If you write to the Model Dockyard, Fleet Street, London, E.C., and enclose 1s., you will obtain a copy of a very capital book on "Model Yachts: How to Make and How to Sail them," profusely illustrated, or their illustrated catalogue, post free 1s., might suffice you. By-the-bye, when writing again, pray observe our Editor's rule, to ask each question on a separate piece of paper, as they might have to be referred in some cases to three different experts for reply.—J. W. H.

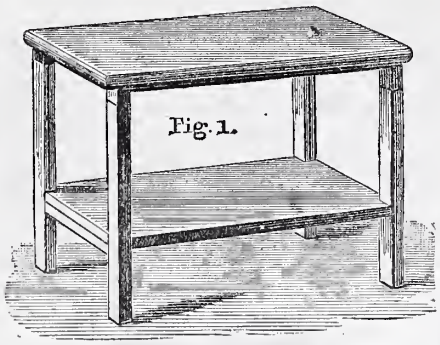
Photographing on Wood.—W. W. (*Dundee*).—Any dealer in your town in photographic chemicals would supply you; if not, write for catalogue to George Houghton & Sons, Holborn, London, W.C., and state what you require.—J. W. H.

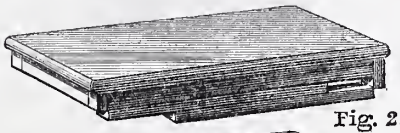
Reducing Crystal Alum to Powder.—PHOTOGRAPHER (*Bolton*).—Pound it in a mortar with a pestle, and sieve through fine muslin, repeating the process with the residue left in the muslin, until all is reduced. Marble pestles and mortars are best. Alum is the double sulphate of alumina and potash.—J. W. H.

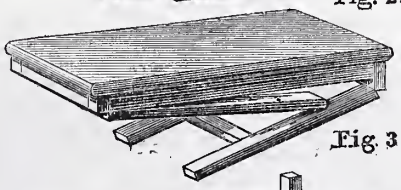
Small Printing Press.—W. W. B. (*Rotherham*).—I recommend visiting sales of printing materials to W. W. B., who might pick up a good second-hand press ("Albions" are usually the smallest) for a pound or two. A quarto (12 in. by 10 in.) would, I think, be big enough. Treadle machines would not be suitable, but hand presses up to 36 in. by 23 in. (double demy) will be powerful enough to do what W. W. B. requires. Write to Salmon & Co., Mary's Parsonage, Manchester, for list of second-hand presses, plant, etc., stating your requirements.—J. W. H.

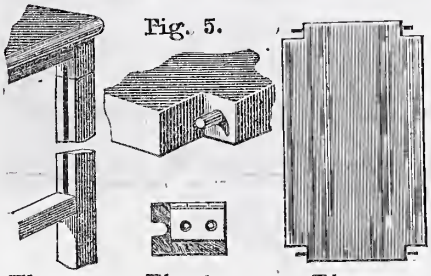
Lucide.—BOTCH.—Camera lucide is no practical use in sketching from nature; it is generally used for copying drawings and such like. It consists of a sheet of plate glass set upright on a board edgewise to the operator, and of any size that may be convenient; the object to be copied is laid down on the board on one side of the glass, and the paper on which it is to be copied on the other; the image will then seem to be reflected on to the paper, and may be readily gone over with a pencil. A modification of this has been made by placing a mirror on one side of the glass to reflect the natural landscape, but the trouble of using it was more than equivalent to the advantages gained.—E. D.

Shut-up Stool.—CLOSE UP.—You say you are a reader of WORK. Allow me to mildly censure you by saying I do not think you are a very attentive one; for in a reply in No. 43, page 684, I have given designs for two forms of stools. From what your friend requires, who, as I understand, is an amateur actor, and whom you say "acts (?) at several places," I should say one of these two would suit him. Pardon me, but I am amused by what somebody called, in reply to Pope's tantalising questions (Pope was deformed), "the little crooked thing that asks questions after acts." You could not have written the letter in your friend's presence, and perhaps you will not be delighted by my quoting it, as he









Shut-up Stool. Fig. 1.—Stool open. Fig. 2.—Stool folded. Fig. 3.—Showing how Stool is folded. Fig. 4.—How to groove each Leg. Fig. 5.—One Corner of Bottom Board. Fig. 6.—Bottom Board. Fig. 7.—Under Side of Bottom Board. Fig. 8.—Section of Leg.

may see it; but, pray, forgive me. It may chance, as you have said "he wants a stool or seat," that you have seen the camp stools but prefer a seat; by this I understand you mean something all wood. So I have designed one for you. You will see by Fig. 3 how it closes. The bottom board is pushed upwards, and one pair of legs folded over the other. Suitable dimensions would be:—height, 16 in.; length, 18 in.; width, 14 in. The top and bottom boards should be about ¾ in. or ⅞ in. thick. The legs must be rather stout. Fig. 7 shows an under view of seat. The right-hand corner blocks must be longer than the left-hand ones, by the thickness of one pair of legs. Each leg is grooved on its inner side as in Fig. 4, and each pair are united towards the bottom by a cross rail, which will support one end of the bottom board. The latter is shaped at each end as in Figs. 5 and 6, small iron pins being driven in where shown; these travel along the grooves, up into the corner blocks, which must also be grooved a little. When the seat is being opened, the bottom board will drop, at the same time pushing open the legs, and it will keep them quite firm. You will find it no difficult matter to fix the hinges, if you will prepare the seat and legs first, and then, turning the seat upside down, place in the bottom board, and put each pair of legs in the position they will occupy when folded.—J. S.

Mouldings, etc.—MIEUX.—You would find what you require if you write or call at the City Frame Co., 29, Basinghall Street, E.C., who keep all kinds of mouldings.—G. R.

Trade Mark.—Z. Z. Z.—The stamped form F, on which the fee of 5s. is payable, is a form of application for registration of a trade mark, and only secures protection so far as it may give a claim to priority. If the Comptroller finds that in his opinion the proposed mark does not clash with any existing trade mark in the same class, the applicant will in due course receive a request to send up a block or electro for advertising in the official journal, that any person who may consider his rights to be infringed by it may enter an objection within a specified time. If no objection be made, the mark will be placed on the register, for which there will be a further fee of £1. This, according to the Act of 1875-77, protects the mark for fourteen years, when, if renewal is desired, the fee will be £2. Mention is made among the definitions of what may be considered to be a trade mark, that the name of an individual or firm (printed, woven, or impressed), a facsimile of a written signature, a distinctive device, heading, label, brand, ticket, or fancy word or words, *not in common use*, are admissible. Z. Z. Z. will see that he can, as he suggests, use his name as a trade mark. A second person similarly named could not, of course, be restricted from trading in his own proper name, but he would be debarred from using the name in such a manner as to be an evident and fraudulent imitation of Z. Z. Z.'s trade mark.—C. C. C.

Dialling.—A. U. F. C. (*Christchurch*) writes:—"I am sure Mr. Yorke will allow me to make a correction in his directions for the use of the sundial. The four days in which the sun is in the meridian at twelve o'clock are:—April 15th, June 15th, August 31st, and December 25th." I have to thank A. U. F. C. for the courteous manner in which he makes this correction. He is right in his emendation.—A. Y.

Enlarging Photographs.—J. L. (*Carlisle*) seems to be confusing photographic enlarging with ordinary drawing. Photographs are not "enlarged in crayons," but finished by this method. Many colourists who devote their attention to the treatment of photographs do this work. For addresses refer to the weekly photographic publications. Pantographs are only used for reducing or enlarging line work.—E. D.

Photo Enlargements.—BROMIDE merely says he fails in getting bromide enlargements, without stating in what the failure consists. The whole process is very easy, and, with ordinary care, there should be no difficulty in securing satisfactory results. A brief statement of the process is this:—The negative to be enlarged is supported at a proper distance in front of the lens; light is transmitted through it by means of a reflector, all other light being shut off except that passing through the negative, the camera being extended to the proper length and the image sharply focussed. The bromide paper is placed in position and the exposure made. Any glass in front of the negative can only be to cause even illumination for the purpose. Ground glass is preferred, but with a reflector this is quite unnecessary.—E. D.

Photographic Materials.—S. W. H. (*Liverpool*).—Hydrokinone developer will keep a moderate length of time, but gradually deteriorates. How long depends on how it is kept. It is always better freshly made, as the action of the air and light tends to its decomposition. The following formula will be found a good one. Make up two solutions; call them A and B.

A solution.

Hydrokinone	100 grains
Sodium sulphite	400 ,,
Water	to 10 oz.

B solution.

Carbonate of potash	300 grains
Sodium sulphite	200 ,,
Water	to 10 oz.

To use, mix equal parts of A and B, just prior to use. Alum and fix as usual. The lenses mentioned are many of them very excellent; have one on approval. Negative varnish.—12 oz. of best shellac and two ounces of sandrac powdered up coarsely and mixed with sand; ½ gallon of methylated spirit, cold; shake up occasionally during a week or ten days, and filter. Or, white hard spirit varnish, diluted to a proper thickness with methylated spirit. The dark colour of the first preparation is of little consequence for negatives, but may be very much reduced by boiling up in a flask with some fresh animal charcoal and filtering.—E. D.

Prepared Paper for Litho Transfers.—B. J. T. (*Tunstall*) asks me how to prepare paper for lithographic transfers (presumably, from his letter, for ceramic work), with other information as to printing them, etc. Firstly, the design to be transferred should be drawn upon stone, the colour stones prepared in the usual manner, but so arranged that the effect must depend solely upon all opaque colours being printed first and the transparent colours on the top of them, so that the opaque colours show through them where they cross, and by no means by printing opaque colours and transparent colours indiscriminately, so that any opaque colour crosses a transparent one to

obtain any particular shade or tone. The reason for this is that when the proof is passed just like an ordinary chromo-lithograph, the order of the printing must be inverted—that is, the last printing in the proof must be the first in the transfer, so that when it is transferred and the paper removed, the first printing—viz., that next to the paper—may be on the top whilst all the opaque colours which in the proof were first printed with transparent colours over them (and in the transfer their order being reversed so that the transparent colours will have been printed under the opaque ones) will, after transferring, be over the latter, as in the proof. I advise, moreover, an extra printing in white after the key—that is, in the transfer, the last printing—which transfers all high lights pure white as a ground, to give the effect that the paper of the proof gives, and which possibly the ware would not be purely white enough to give. Indeed, in decorating any but white ware in this manner, and upon glass, white or coloured (except an "opal-flush" glass), it is imperative to print a white last—especially under (*i.e.*, to transfer under) pale yellows and reds, and all the transparent colours where they are pure and do not cross other colours—for the sake of purity of the general colouring. If to be afterwards glazed, your glaze should be principally lead, so as to flux at the lowest possible temperature, or you will destroy the colouring. Therefore, if you are using gold or ceramic colours, they should be kilned and burnt in first—before transferring your lithograph at all—and after the transfer is on the oil should be dried out gradually or it will run in the glazing kiln. I have often thought of attempting to print in ceramic colours, with oil of tar for transfers for ware; but it must be borne in mind that lithography cannot be printed with any pigments that are either chemically certain to affect the carbonate of lime of which stone is composed, or which are not sufficiently fatty to replenish the greasiness of the drawing on stone upon which the whole process depends. Indeed, the writer once had a most interesting conversation with Mr. Robert (who was then director of the manufactory of porcelain at Sèvres, near Paris) on this subject; and his daughter, whose painting on china was marvellously beautiful, seemed to think it could be accomplished. Here is a most interesting subject for B. J. T., or any other reader of WORK, to follow out. I know of no book that gives any good practical instruction as to transfer lithography; but if I supplement the above description by saying that any composition or coating which is soluble in water and is smooth enough to print upon will answer, such as Paris white and size, with or without gum or gamboge (colour does not matter a bit), as all we require is that when the paper is damped, all the printing shall be left adhering to the ware, B. J. T. will, I hope, be able to succeed in the experiment. If not, write again. There is another alternative which strikes me as I write. Why not employ wood blocks for printing such transfers? You would be quite independent of all chemical difficulties; you could use ceramic colours, oil of tar, or any other vehicle; you could obtain much thicker and more solid coats of colour by surface printing, and thus ensure strong work for burning; nay, more; you could follow out the ordinary manner of china painting by frequent kilning—burning in those colours first that require the greatest heat, subsequently those requiring less, and even a third burning in of those which require a minimum of heat, by making three transfers from the same key instead of one only. The "register," as it is technically termed—that is, the exact fitting of one transfer over another—could be readily obtained with needles fitting into minute holes in the ware at points fixed beforehand. If B. J. T. decides to enter into a course of experiments in this direction, with our Editor's permission I will put myself into private communication with him, and promise to assist him so far as designing and engraving the required blocks are concerned, and the printing of the transfers free of cost if he will do the rest.—J. W. H.

Walnut Spirit Stain.—AMATEUR.—I do not know, and you do not say, for what purpose you want the stain, or whether you merely want a dark polish or varnish which will enable you to dispense with previous staining. I shall assume this, as, if you only want a spirit stain, I must know something more before I can advise you. To darken the polish or varnish, mix some vandyke brown with it. Mind, a coloured varnish does not colour the wood itself, but merely coats it, so that if the varnish gets chipped off an uncoloured patch may show.—D. D.

Engine to Drive Dynamo.—H. G. B. (*New Cross*).—The small dynamo supplied by Mr. Bottone is merely a pretty little model machine that will go easily into one's pocket. The most suitable engine to drive this will be a model steam engine. Next to this in point of suitability would be a small gas engine. As you are favourably situated to obtain good and cheap gas, you would find a gas engine less costly than an oil engine. These are mere novelties of which I know next to nothing—G. E. B.

Granule Carbon Battery.—W. J. P. (*Portslade*).—The granule carbon battery is merely a double fluid bichromate battery. There is much fiction in the report of this battery as quoted by you. No bichromate battery of 5 cells, each 8 in. by 5 in., will furnish enough current to light up a 5 c.p. lamp for forty hours with one charge of solution. Then as to cost of solution. The bichromate of potash itself will cost at least two shillings, and this will only last for twelve hours. I have had considerable experience with this battery, but have not time just now to write an account of it.—G. E. B.

Armature Windings.—F. W. C. (*Stratford*).—I do not see any advantage in having four or more sectors on the commutator to an H girder armature. Two sectors are enough for such a small armature ($6\frac{1}{2}$ in. by $2\frac{1}{2}$ in.). Wind the wire along closely side by side until the spindle is reached, then pass it on the other side of the spindle. Full instructions will be given in an article on the Siemens dynamo in the series of articles on "Model Electric Lights."—G. E. B.

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Pocket Lamp.—A. J. (*Faversham*) writes in reply to W. G. H. (*St. German's*) (see No. 64, page 191, Vol. II.):—"At the invitation of the Editor I send you sketches and description of a small pocket lamp I bought over twenty years ago. Although it does not exactly correspond to the description given by you, you and others may be interested in it. It is made entirely of brass, and oval in shape, and the sketches are full size. A is lamp; B, cover to pull off; C, lamp with cover removed, showing wick and percussion cap holder G and H respectively; D shows base with hinged flap F, and

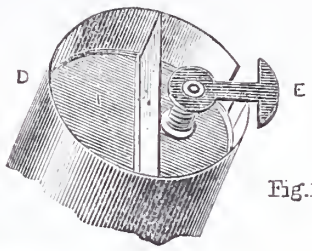


Fig.1.

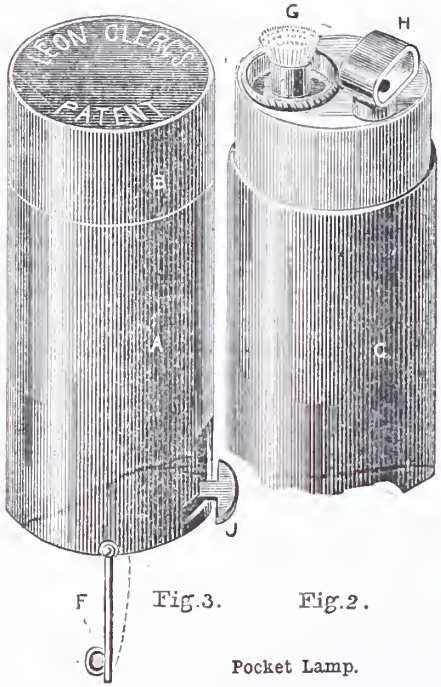


Fig.3. Fig.2.

Pocket Lamp.

remaining part of bottom removed to show arrangement of trigger E, which is actuated by a strong spiral spring concealed within the body of the lamp. A reserve for percussion caps is shown at I. In use the lamp is filled with spirits of wine or benzoline, and a percussion cap placed in the receptacle H. On releasing the trigger J from the bayonet slot, the spiral spring draws the trigger and plunger forcibly up into H, explodes the cap, and lights the lamp. The caps are similar to those used for toy pistols."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—TRIMMER (*Cork*); C. E. M. (*Birkenhead*); W. J. T. (*Gateshead-on-Tyne*); A. T. V. (*London, E.*); G. F. S. (*Camberwell*); F. McG. (*Sheffield*); W. D. (*Bath*); R. W. N. (*Islington*); G.T. (*Clapham Junction*); T. N. (*Newtown*); T. H. W. (*Sowerby Bridge*); E. J. W. (*Camp Hill*); D. N. (*Eastbourne*); S. E. (*Camberwell*); R. A. (*Islington*); W. W. T. (*Leeds*); IMPROVER; A. C. (*Frome*); J. T. C. (*Hull*); J. T. (*London*); G. J. A. (*Birmingham*); T. W. (*Hackney*); A. F. (*London, S.W.*); D. J. C. (*London, E.*); J. M. (*Dundalk*); J. H. E. (*London, W.*); J. L. & CO. (*Birmingham*); A. R. (*Scorrier*); W. H. W. (*Leyton*); W. F. (*London, S.W.*); W. V. (*Birmingham*); CAMANALISH; R. W. (*Ruspidge*); C. W. (*Kensington, W.*); B. A. B. (*Hampstead*); J. B. F. (*Brixton*); H. J. B. (*Cirencester*); J. M. (*Midhurst*); E. M. (*Peterhead*); APPRECIATING SUBSCRIBER; G. H. (*Birmingham*); E. G. (*Sheffield*); MEMO A.; H. J. A. (*Dover*); J. McK. (*Lisburn*); F. H. (*Streatham*); C. W. B. (*Plymouth*); J. W. D. (*Manchester*); A. E. R. (*Manchester*); F. H. B. (*Liverpool*); J. D. C. (*Brighton*); R. D. (*London, E.*); F. C. H. (*London, S.E.*); WOULD-BE PHOTOGRAPHER; P. F. Z. (*Hammersmith*); W. L. (*London, N.E.*); G. D. (*Epping*); LOCO; G. J. (*Weybridge*); ELECTRICIAN; H. A. M. (*London, E.C.*); H. C. (*London, S.W.*); A. C. (*Birmingham*); W. G. O. (*Manchester*); A. J. P. (*Westminster*); F. R. H. (*Andover*); W. McA. (*Cockermouth*); F. H. (*Streatham Hill*); J. H. W. (*Leytonstone*); R. M. (*London, S.W.*); SCOT; A. M. L. (*Duneason*); F. J. W. (*Ipswich*); A. S. (*Fulham, S.W.*); J. P. (*New North Road, N.*); H. S. (*Redcar*); A. F. (*Hampstead, N.W.*); J. B. (*Hoxton, N.*); J. P. L. (*Stepney, E.*); W. G. B. (*Bermondsey, S.E.*).

"WORK" EXHIBITION

(1890-91).

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in page 290 (No. 70) of this Magazine:—

For Design for Medal.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

For Design for Certificate.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

If any Competitors wish to submit a Model in Clay, Plaster, Wax, etc., as a Design for Medal instead of a Drawing, they are at liberty to do so.

Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

Prize Competition.
Medal (or Certificate, as the case may be.)

A Motto must be affixed to each Drawing, and the name and address of the sender enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted to three competent judges, who will select those that are considered most worthy of prizes.

The Prize Drawings will become the property of Messrs. CASSELL & COMPANY, Limited, who will return all Designs made by unsuccessful competitors to their respective owners carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced in WORK in due course.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Water-Proof Advertising Paper Letters and Figures in all Colours and Sizes.—Sole and Original Manufactory, 17, Arthur Street, New Oxford Street, W.C. Agents apply. Sample sheet gratis. [9

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [11

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6

French Polishing, Ebonising, Staining, etc. thoroughly and efficiently taught; post free, 1s. 7d.—POLISHER, 17, Midland Buildings, New Street, Birmingham. [1

Fretwork, Carving and Repoussé Work.—Catalogue of all requisites, 700 illustrations, 6d. each.—HARGER BROS., Settle, Yorks. [13

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

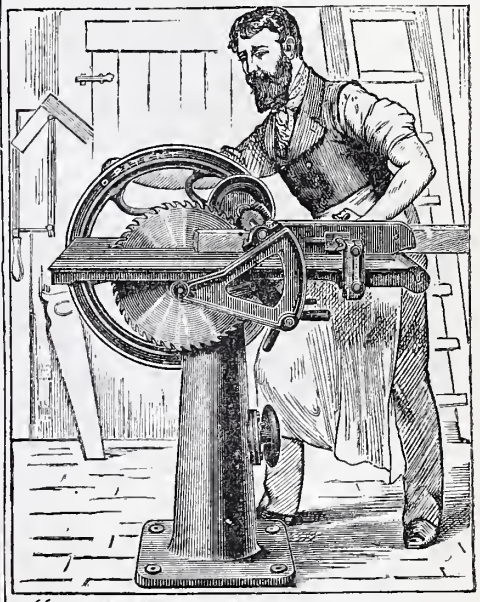
Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.
SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

PRICE, TALBOT & CO., LIMITED,
LATE DALE & Co.,
26, LUDGATE HILL, LONDON, E.C.

Cassell's Classified Catalogue

will be sent on request post free to any address.

Cassell & Company, Limited, Ludgate Hill, London.



"THE LEYTON"

New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

TOOLS TOOLS
MOSELEY & SON.
323. HIGH. HOLBORN.
200 PAGE-CATALOGUE
BY POST 6D
ORDERS OF 10/- CARRIAGE PAID

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

STERN'S
PUMILINE LINIMENT

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

NOW READY. Price *5s.*

Strange Doings in Strange Places.

Complete Sensational Stories by FRANK BARRETT, MAXWELL GRAY, JOHN BERWICK HARWOOD, A. T. QUILLER COUCH (Q.), R. E. FRANCILLON, G. MANVILLE FENN, F. W. ROBINSON, FITZGERALD MOLLOY, CHARLES GIBBON, FLORENCE WARDEN, RICHARD DOWLING, THEO. GIFT, Mrs. EDWARD KENNARD, M. BETHAM EDWARDS, J. K. LEVS, HENRY FRITH, MAY CROMMELIN, and Major ARTHUR GRIFFITHS.

Cassell & Company, Limited, Ludgate Hill, London.

Cassell's "Japanese" Library of Popular Works.

Printed on thin paper; bound in Japanese style; covers in Water-Colours from Original Designs. Twelve Vols., price **1s. 3d.** each, nett.

HANDY ANDY.
OLIVER TWIST.
IVANHOE.
INGOLDSBY LEGENDS.
THE LAST OF THE MOHICANS.
THE LAST DAYS OF POMPEII.
THE YELLOWPLUSH PAPERS.
THE LAST DAYS OF PALMYRA.
JACK HINTON, THE GUARDSMAN.
SELECTIONS FROM HOOD'S WORKS.
AMERICAN HUMOUR.
THE TOWER OF LONDON.

*** ***For Travellers, Tourists, and all to whom economy of space is a desideratum, this Library will meet a long-felt want.***

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

MELLIN'S FOOD

For INFANTS and INVALIDS.

OSCAR VINCENT COOKE.

"*Holly Cottage, Shirwell, Barnstaple.*
"*March* 1, 1889.

"*I send you one (photo) of my baby boy, Oscar Vincent Cooke, he having been fed on your Food for the last twelve months. Being obliged to resort to the feeding-bottle, I was recommended by my doctor,* 'MELLIN'S FOOD.' *I think you will see by the condition of the child it will speak well of its excellency, and cannot be too highly recommended for infants.*

"*Yours very truly,*

Ann Cooke

Samples, Pamphlet, and Prospectus post free on application to

G. MELLIN,

MARLBORO' WORKS, PECKHAM, S.E.

Bovril Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

SPRING CLEANING.

? How do you do? WITHOUT JUDSON'S DYES? 6d. POWDER AND LIQUID.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic **WEAKNESS** speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the ***Thousands of Testimonials*** received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place).

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

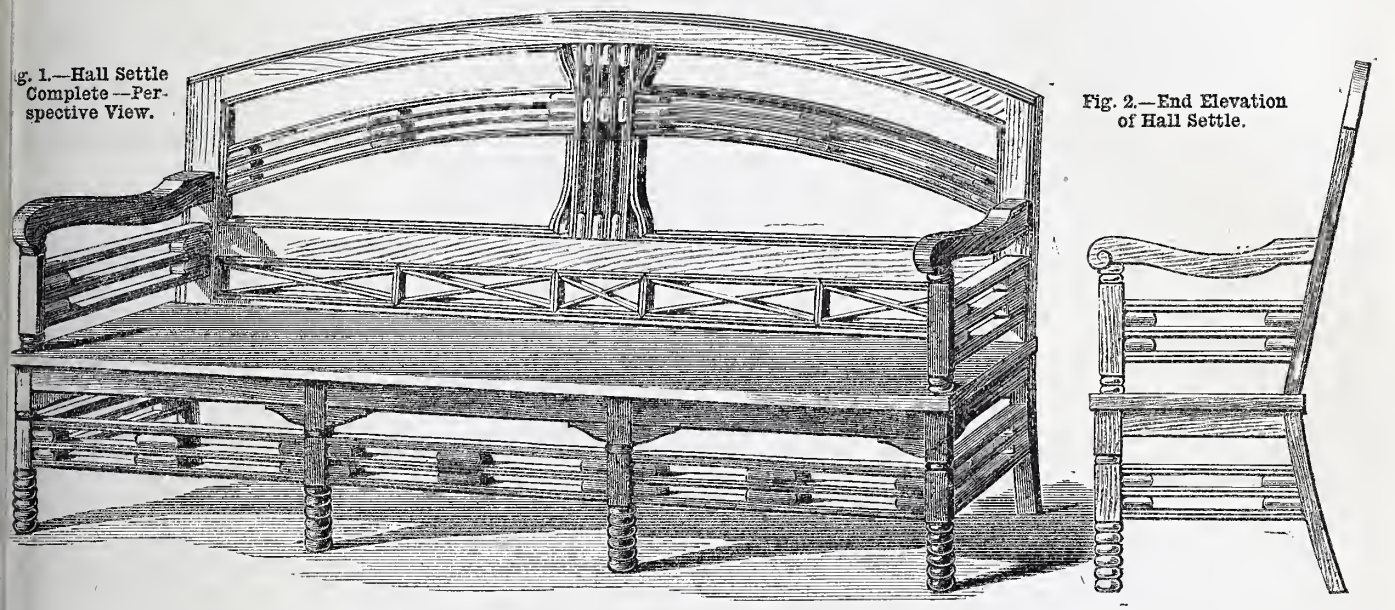
WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 74.] SATURDAY, AUGUST 16, 1890. [PRICE ONE PENNY.



g. 1.—Hall Settle Complete—Perspective View.

Fig. 2.—End Elevation of Hall Settle.

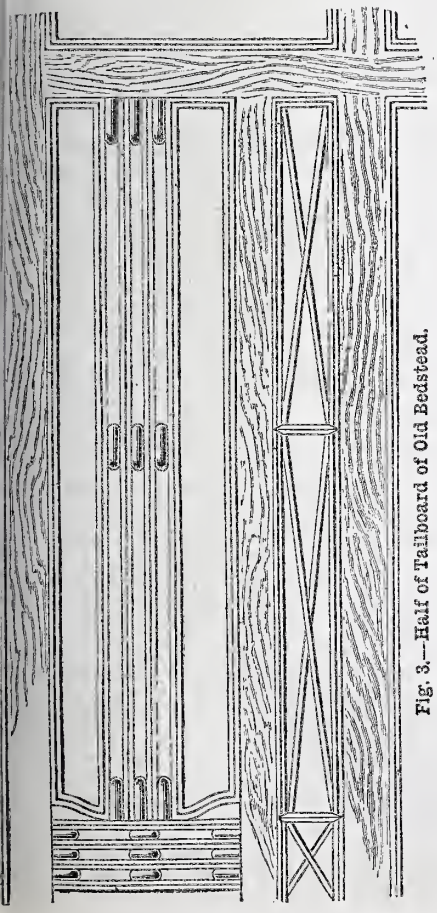
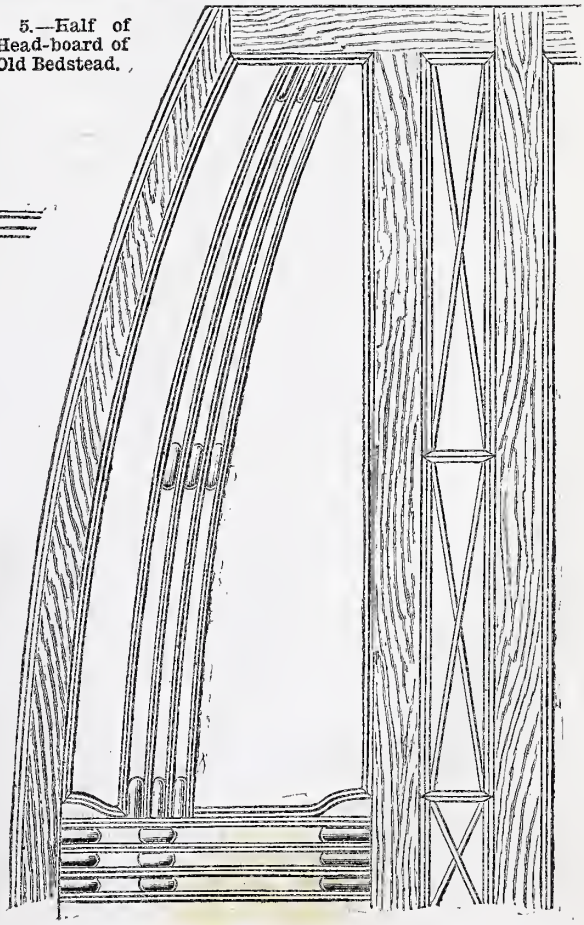


Fig. 3.—Half of Tailboard of Old Bedstead.

Fig. 7.—Upright of Arm.

Fig. 5.—Half of Head-board of Old Bedstead.



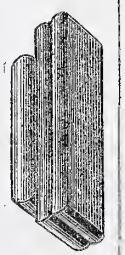


Fig. 6.—Reeded Pattern.

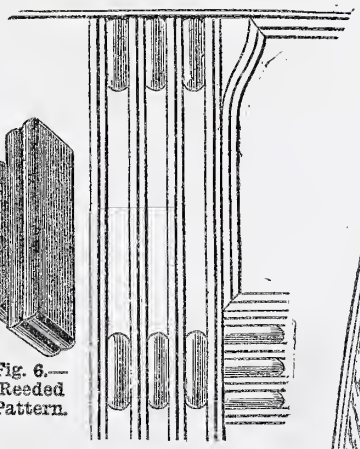


Fig. 4.—Detail of Ornament.

A HALL SETTLE.

FROM AN

OLD BEDSTEAD

OF THE

SHERATON PERIOD.

BY

E. BONNEY STEYNE.

A HALL SETTLE:

AFTER AN OLD BEDSTEAD OF THE SHERATON PERIOD.

BY E. BONNEY STEYNE.

WAITING for an omnibus at a corner of the Kensington High Road, some few weeks ago, a fine piece of joinery of the Chippendale period attracted my attention. There was just time to see it was a dismantled bedstead when I had to climb the swaying steps and bid it a last farewell, from the lofty if economic perch from which so many town-folks survey the metropolis daily.

Throughout the day the fascination of that discarded piece of furniture kept haunting me, and by the afternoon became so irresistible, that, forgetting prudence, daring even the oration on my extreme folly in buying a thing with such awful suggestiveness of zoology as an old bedstead, I turned in at the first telegraph office and wired to the vague address, for I knew neither name nor number, nor even the street in which the shop was situated. Just as I had done so, I met a friend who lives near me—he being also an innocent lunatic upon old furniture—who at once volunteered to leave his 'bus in passing and secure the treasure. How he did so, and how when I called to pay for it—in gold, look you!—a curious chain of mistakes and uncircumstantial evidence, based upon wrong identity, nearly landed me in Her Majesty's keeping as a dynamiter, would take too long to tell. Besides, in real life there is not that artistic climax which should cap a good story. Yet, in sober truth, the first result of my purchase was to be regarded in the neighbourhood I pass daily as a dynamite conspirator who had eluded justice. This to one who is not an expert at pistol-shooting even, who never began his career as a head executioner by decapitating a guinea-pig, and who has so far blown up no one, except metaphorically, is naturally a haunting experience, that could no more be kept out of this paper than I could induce the powers that be to afford shelter indoors for my purchase when it arrived at my house.

Looking carefully at the really beautiful workmanship of this discarded couch, one realised how, in spite of all changes of fashion, whole-hearted and honest effort survives long after specious imitations succumb. When one passes the tempting windows of the furnishing emporiums to-day, and hazards a guess as to the probable duration of most of their tempting handiwork, the conclusion is appalling. Hardly one article in a hundred is likely to outlast a century, even supposing it has careful treatment; for nearly everything to-day pretends to be more important than it is—not with the old sham of veneer: we are too honest for that—for it deceived no one—and we have no wish to be found out in our own impostures. The dishonesty of to-day's work is rather to be noticed when you attempt to pull a drawer out of its place and it sticks, or coming out with a jerk, displays craft of the packing-case order in a piece of furniture with a façade adapted for a drawing-room.

The old mahogany furniture was often veneered—a disgraceful pretence that every one will condemn with dignified indignation; but its parts out of sight, were of good wood, well seasoned, neatly wrought and excellently finished. Now the front may be of polished pine, its honesty as transparent as its varnish, but the coarse deal and yet coarser workmanship of all that is hidden are surely as deadly a sin as ever veneer could be.

The old furniture well veneered made no pretence at being honest. If it deceived any one into thinking that planks of such superfine grain could be lavished upon one article of furniture, they had their own folly to blame for the misconception. But its descendant vaunts its honesty, and with machine-made mouldings, carvings if not machine made actually, yet produced by division of labour, that in its arithmetic forgot to include brains, and divided them out of existence—yet poses as a virtuous example of pure, unadulterated craft.

The old bedstead could supply a text for a never-ending homily upon sound workmanship, but the society of to-day cannot be expected to abandon its craving for profit upon any abstract quest. It all comes to a question of so much extra per cent. for the capitalist, or so many less hours labour for the artisan.

But if, as one imagines, the readers of WORK (some of them compelled, perhaps, to join in the manufacture of goods for the market to earn their income), in leisure hours turn to constructing furniture for their own homes—or the skilful amateur who spares not time or material to gain a good result—these may find a store of useful hints from this one salvage of the past.

It is hardly likely that anybody will care to construct a bedstead in wood. Many reasons, sanitary and social, have expelled the wooden variety, and replaced it by metal. But for tables, couches, and chairs, for all sorts of cabinet work, the motive of the panels illustrated will be found easy for adaptation.

The furniture that I made in fancy from this old bedstead would fill a small house. Tables, chairs, a modernised bedstead, a settle, overmantel, and a few others never came from theory to fact, except one settle made from the head-board, the rest of the structure being at present unused. There is enough timber left to build a house; certainly one beam of the half-dozen at least could be warranted to smash a settle of the shop window order by its dead weight.

The posts of the bedstead were of too gigantic a scale to be suitable for furniture, and readers of WORK do not need to be told that "Bedpostesses," as the old folks call them, are not to be used for cutting up. They will supply material for another article in WORK later on.

The head-board—I know no other name for it—was built up of a curious mixture of framing and lattice-work common to the period of its make, but rarely used at any other, and apparently suggested by Chinese originals.

This joinery, although requiring neatness and patient care, demands nothing but skilled mechanism, and may be wrought to perfection by those unable to cope with intricacies of the Chippendale style, and still less able to undertake the carving or inlaying that belongs to the Adams period.

The motive of the whole design is a fluted rod in effect—and possibly in reality—two rods with simply rounded edges laid side to side. These are strengthened by simply rounded pieces of the thickness of the double rod, but without fluting, as shown in Fig. 5. By the use of these thin rods the bent portion of the design becomes easily practicable. The idea of this work is well adapted for other furniture.

In the settle, having decided on creating new legs, a design (modified from the bedposts) of simply turned rings, stopping in a square to admit the rods, was found in keeping. The arms were borrowed from an old example of an earlier period that was easily modified to suit the worker's taste.

Rods treated as those of the back were added between the legs and below the arms. The crossed work of the panel was also, like all the rods used, of the reeded pattern seen in Fig. 6.

The seat was made of framework from the laths of the bedstead, and covered with a loose cushion; in the sketch a plain wooden seat is indicated as more suitable for use in a hall.

The whole work in a dark rosewood looks exceedingly well, the new mahogany used being stained and polished to match the older portion.

A CHAT ABOUT PHOTOGRAPHIC LENSES.

BY WALTER E. WOODBURY.

WHEN we decide to take up Photography, either for pastime or profit, the most difficult task that confronts us is the choosing and purchasing of a lens or lenses. It is the most important part of the apparatus. The lens makes the picture; the camera is, comparatively, of no importance at all; it is merely a light tight box, fitted with arrangements to bring the lens nearer to, or farther from, the plate, and to alter the position of the latter. Of course, cameras can be purchased to any amount of money, but it is not a difficult task to choose one. It is an easy matter for even a beginner to judge whether the workmanship is good, and any instruction book will tell him the different movements it should have.

But with lenses it is a different matter entirely. We see only a few pieces of glass encased in a brass tube—a simple enough looking contrivance. We have two shown us—one can be had for a few shillings, while the price of the other is seventy-five pounds. Perhaps, to our mind, the cheaper one possesses the best appearance. But it is not that we want; will it do the same work? Certainly not; hence the vast difference in the cost. But this is the difficulty; it is necessary, therefore, that the intending purchaser should possess a little knowledge of photographic optics. When he first contemplates the purchase of a lens, he he is confronted with such words as "Achromatic," "Rectilinear," "Wide-Angle," and such terms as "Depth of Focus," "Working Aperture," etc., which floor him somewhat.

It is the object of the writer to explain to the best of his ability the principle of photographic optics, and the meaning of the words and terms mentioned.

Now, first to give some idea of the use of having a lens, because we know that it is possible to make a fairly good picture without. Let us enter a darkened room, and having bored a hole through the shutter of the window, and bevelled off the edges so that it shall not be tubular, we find on the wall opposite an inverted image of the scene outside. For the sake of simplicity, let us take one object—a tree. From every point in the tree a ray of light emanates, passes through the whole, and lights up the screen with its own colour. The accompanying sketch (Fig. 1) shows the direction of the rays and how the image is inverted. We have

ere a perfect camera obscura, and one at might be made practical use of in otography but for one reason: the hole the shutter must have some definite ze. If it be very large, then every spot in e screen opposite would receive light om all directions, and the images overpping each other, the picture would be it poorly defined. The smaller the hole the sharper the definition, so that, as as already been mentioned, not at all bad ctures have been made with an aperture ade with the prick of a needle in tinil or other suitable substance. But the fficulty that now presents itself is this: we make the hole very minute in order to t a sharply defined image, we have to crifice so much light that our image is it faintly visible, and the sensitive plate ed in photography would have to be exsed for a great length of time.

What we want, then, is to enlarge the le, and to place in it a lens. The effect of is will be that, having a larger aperture, e obtain more light, and, notwithstanding e fact that the hole is considerably larger, l the rays of light will meet at a point, as own in Fig. 2, which illustrates the mplest form of lens. By means of this ns we may obtain a fairly good picture, but, the same time, the laws of optics have to considered, and very many kinds of comicated combinations of lenses have been ade for various kinds of work. But still, wever complicated these combinations may —and the reasons of combining different nses will be hereafter explained—yet the incipal object is the same: namely, to oduce the effect shown in the drawing st referred to. It is necessary to bring a t of parallel or diverging light rays to point.

Lenses may be defined as transparent edia bounded by spherical surfaces, of hich the intersection is a line without nsible thickness. They may be divided to two classes: *i.e.*, convergent and dirgent lenses. Convergent lenses are those hich are thicker at their central part than their margins. In Fig. 3 we have three ustrations of this kind of lens: the bi-conx (A), the plano-convex (B), and the convent meniscus (C). Divergent lenses are, on e contrary, thinner at their central portion an at their margins. Fig. 4 shows us ree kinds of divergent lenses: the binceave (D), the plano-concave (E), and the vergent meniscus (F).

All photographic lenses are constructed ith one or more of these lenses, either mented together to form a combination, adjusted at a distance from each other in e tubular case.

Jean Baptiste Porta, who was the inventor the camera obscura, first used as a lens plano-convex one, the convex side being rned towards the ground glass or screen on which the image was thrown. The sult of using a lens of this description ould be the complete distortion of the age. Thus, if we were to photograph series of lines or squares, as in Fig. 5, e resulting image thrown upon the screen ould be as in Fig. 6. This is termed istortion. In photographing a landscape which there are no lengthy straight lines, is distortion would, to an unpractised ye, be imperceptible; but when we have chitectural subjects to deal with it will easily understood that this defect would very serious. Another thing with regard a lens of this description: it was soon ound out, on the introduction of the guerrotype process in 1839, that, although it was suitable for camera obscura pictures to view with the eye, yet, when used for photographic purposes it was of little use, for the reason that the chemical focus was different to the visual: that is to say, that when the picture upon the ground glass is sharply focussed to the eye, the effect upon the sensitive plate was to give an unsharp image. This defect is termed "chromatic aberration." It was then necessary to render the lens achromatic, which is a term often used, and the student will better understand its meaning. It was found that this chromatic aberration could be destroyed or neutralised, and the lens thus made achromatic by joining two lenses of different dispersive power and of different material, the convergent lens being made of crown glass, and the divergent of flint glass. These are cemented together with Canada balsam. Two forms of achromatic lenses are shown in Figs. 7 and 8; the letters C and F denote crown and flint glass.

Another defect which occurs in lenses (and in purchasing it is absolutely necessary that the student should know that these defects are corrected) is what is termed "roundness of field." In making a photograph, we require to throw a sharp, perfectly true image upon a flat screen. Now this is, in reality, an impossibility. It will be seen, on reference to Fig. 9, that the screen should have a concave form equal to the curvature of the field of the image. The points A, B, C in the distant plane are very nearly equidistant from the convergent lens, D. It will be evident that the images of these three points will be formed, at distances from the optical centre of the lens, nearly equal to the principal focal length. If, therefore, the image is thrown upon the plane H E, the sharpness of the points A and C will be sacrificed. The field to receive the image shape, must be curved. There are several ways of counteracting this defect of curvature or roundness of field, and to give what is termed a "flat field," although it is but comparatively flat.

I find that I have had to make use of two terms: *i.e.*, "optical centre" and "the focal length"; and it will be necessary before going farther to explain the meaning of these.

In every lens there is a principal axis and an optical centre. The line A A′ (Fig. 10) is the principal axis, and situated in this axis there exists a point, through which every ray passing through it does not deviate; this point is called the optical centre of the lens. To find this optical centre, Dr. Monckhoven's plan is as follows: through the centres of curvature A A′ of its surfaces draw two radii, A B′ and A′ B, parallel to each other, but oblique to the axis, A A′; then join their extremities, B B′; this line will cut the principal axis at C—which is the optical centre. It must be understood that this applies only to single lenses. In combinations there is no optical centre, nor any point at all analogous to it. I have shown the position of the optical centre in a double convex lens: it is inside the glass. In the case of a plano-convex lens, it is situated at the centre of the face of the back surface, while in a meniscus lens it is outside the glass and behind it. Another method of determining the optical centre of a lens is as follows:—

If r be the radius of the front surface of the lens, s the radius of the back surface, and t the thickness of the lens, then the distance of the optical centre measured along the axis of the lens from the centre of the face of the front surface is equal to $\frac{rt}{sr}$

The focal length, or focus, as it is more often called, is the distance between the centre of the lens and the ground glass when a distant object is sharply focussed. In the case of a double combination lens it is measured from the stop, or diaphragm, which is placed in the centre: thus, we refer to a lens as having a focal length of ten inches, or ten inch focus. We now know the meaning of focal length and focus. We have next to find out the meaning of what is termed "depth of focus," and also the use of stops or diaphragms. Briefly, then, the depth of focus of a lens is its power of giving a clear image of objects at unequal distances. When we take a camera, and erect a single combination focus upon a landscape, it will be at once apparent to us that we can advance or withdraw the ground glass to a slight extent without altering the focus of certain objects, whilst we bring into focus others placed at a different distance. Depth of focus varies with the aperture of the lens. By aperture we refer to the opening of the lens which admits light. When a stop or diaphragm is used, it is the diameter of the opening of this, otherwise the diameter of the opening of the smallest of the combination of lenses; or if all be of the same size, then the whole of the front one is calculated. As we have already pointed out, the depth of focus varies with the aperture of the lens, and also with the distance of the objects. Some lenses, however, possess greater depth of focus than others.

The stop is a piece of blackened metal, with a central aperture placed between the two combinations back and front of a lens. There are usually a number of these, with apertures of different diameter. They are generally separate from the lens, but a more convenient form is that known as the Iris diaphragm (as shown attached to the lens, Fig. 11), or another is the Waterhouse diaphragm (shown in Fig. 12). They are much more convenient than the loose ones, which are apt to get lost. These stops, or diaphragms, and the aperture of the lenses are all numbered, or referred to according to their width of aperture in comparison with the length of focus of the lens. Thus, for example, we have a lens the focal length of which is found to be ten inches: the aperture of the lens is two and a half inches, or one quarter the focal distance. Therefore we say that the lens is working at f 4; now if we place in the lens a stop with a diameter of a $\frac{1}{4}$ of an inch we are working at f 40, or one-fortieth of the focal length; this stop is then marked f 40.

We now come to the angle of the lens; the width of angle of a lens differs according to the purpose for which it is intended. Fig. 13 represents a very wide angle lens, and Fig. 14 a narrow angle one. The wide angle lens is constructed for the purpose of making photographs of subjects which you wish to photograph entire, but cannot get far enough away to do it with an ordinary lens. But the employment of this kind of lens is never to be recommended: firstly, because it gives images different to those seen by the eye; and secondly, because to obtain sharp definition a very small stop has to be used, and it is consequently at most a very slow lens. Fig. 15 shows the exterior view of this kind of lens.

Let us now consider the question of rapidity in a lens. By rapidity is meant the relative time required for exposure of the image

with different lenses upon a plate of known sensitiveness. This rapidity varies very considerably, even with the same subject and same light, and it is based entirely upon the relation between the focal length and the aperture, independent of size; thus, if two lenses were tested together, the one has a focal length of 10 in. and an aperture of 2½ in., and the other is considerably larger; it has a focal length of 40 in. and an aperture of 10 in., yet the aperture in both cases is one-fourth of the focal length, termed *f*4, so that by the rule already given the time of exposure of an equally lighted subject upon an equally sensitive plate would be precisely the same in both cases. By this means it is always very easy to tell the relative rapidity of one lens or stop with another; we have only to square the denominator of the fractions *f*4, *f*8, etc., when we will have the same exposure; thus, if we are working with a stop of *f*4, namely, one that is one-fourth of the focal length of the lens to which it belongs, and we desire to use *f*8, we square these two numbers, *f*4 and *f*8, and get 16 and 64 respectively, so that they are as 16 to 64; or, in other words, if with the stop *f*4 we required an exposure of one second, we should with *f*8 require an exposure of four seconds.

The use of the stop, therefore, is to regulate the passage of the rays of light through the lens, to increase the depth of focus, and to correct the roundness of the field. The smaller the aperture the sharper the resulting picture, and the greater the depth of focus; but we must also remember that the smaller the stop the lesser the amount of light admitted, and, consequently, the longer the exposure requisite. The object in using these stops should be to secure the greatest amount of light together with the sharpness necessary to produce a satisfactory picture. We first focus on an object at a moderate distance, and beginning with the largest, insert each stop until we bring the other objects into focus. We now have some idea of the principle of a lens, the qualities it should possess, and its use. We must next consider the principal ones now in the market, how they are made, and what they are made for.

The first we have to consider is the simplest: the single combination. This lens is also known as the "landscape," "view lens," "meniscus," and "achromatic." It is composed of two glasses only, cemented together, as in Figs. 7 and 8, the glasses being of different material so as to be achromatic, as already referred to. This kind of lens is the cheapest, and is very good for landscape work; but we have already seen that it would be of no use for architectural subjects. It possesses an advantage over others for landscape work only, in consequence of its having but two reflecting surfaces, and thus gives a more brightly illuminated picture, and a flatter field.

But by purchasing a lens of this description, we are unfortunately tied down to landscape work, and if we desire to include a house or building in our view, the consequence is that we get a distortion of the straight lines, as shown in Fig. 6. We will therefore pass on to double combination lenses. Under this heading we include Portrait, Universal, Rapid Symmetrical, Rapid Rectilinear, Wide Angle Rectilinear, and Portable, symmetrical lenses. The advantage of a double combination rectilinear is that it is constructed to give straight lines, while if we choose we can remove one of the lenses and use the other as a single lens, the advantage of which has already been explained. The rapid rectilinear is the most popular lens of any, and has had a variety of names given to it, which it will be as well for the reader to know. They are: Rapid Doublet, Aplanatic Doublet, Rapid Symmetrical, Rectigraph, Orthopanactinic, Panorthoscope, Planographic, Hemispherique, Euryscope, Straight Line, and True View. All these lenses are constructed on the same principle, but of course those of such makers as Ross or Dallmeyer are superior in the quality of the

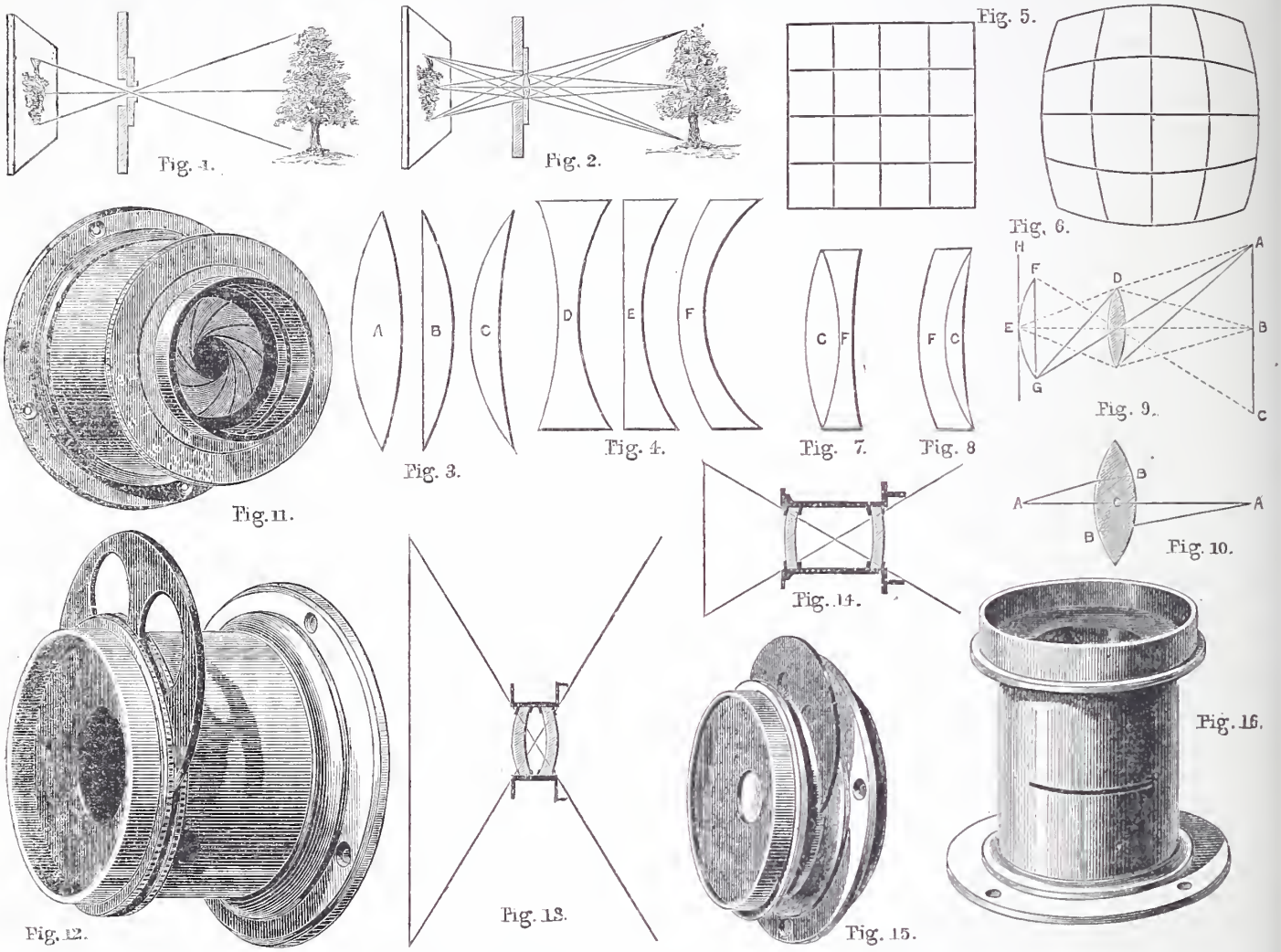


Fig. 1.—Diagram showing Direction of Rays of Light and Reversion of Image. Fig. 2.—Simplest Form of Lens. Fig. 3.—Convergent Lenses—A, Bi-Convex; B, Plano Convex; C, Convergent Meniscus. Fig. 4.—Divergent Lenses—D, Bi-Concave; E, Plano-Concave; F, Divergent Meniscus. Fig. 5.—Series of Lines or Squares to be photographed. Fig. 6.—Result obtained by Plano-Convex Lens. Figs. 7, 8.—Achromatic Lenses. Fig. 9.—Concave Screen desirable for Photographic Image. Fig. 10.—Axis and Optical Centre of Lens. Fig. 11.—Diaphragm for Lens. Fig. 12.—Waterhouse Diaphragm. Fig. 13.—Wide Angle Lens. Fig. 14.—Narrow Angle Lens. Fig. 15.—Exterior View of Wide Angle Lens. Fig. 16.—Rapid Rectilinear Lens.

material and in the grinding and setting of the lenses; the outer case is nothing. With a lens of this description it is then possible to make pictures of views, buildings, and groups, and is one that is recommended to beginners. Prices will differ according to the maker; for instance, Dallmeyer's price for a whole-plate lens of this description is £9, while another maker charges £3; but the former is undoubtedly worth treble the latter, so if the beginner can afford it he should always purchase from a good maker, or if not, and he is recommended to take a cheaper one, he should take it on trial only. Never purchase a second-hand lens unless you are an expert photographer, and know what you are buying.

I have said that the rapid rectilinear lens already described is suitable for buildings, but it very often happens that we require to photograph interiors or a house in a narrow street. As we cannot get far away from it with an ordinary lens, we should in the latter case succeed only in photographing the doorway perhaps. Here comes the advantage of possessing a wide-angle lens, as shown in Fig. 13, and the principle of which I have already explained. I have also pointed out the advisability of using it only when compulsory. Although it is a useful adjunct to a photographer's kit, its possession is not absolutely indispensable.

We next come to portrait lenses. The principle upon which these lenses are made is to get rapidity; consequently, they have little depth of focus. They can only be used for portrait work, and are the most expensive lens, as much as £75 being required for the largest size. The amateur will not require a lens of this description: he will find that he can make fairly good portraits with his rapid rectilinear (Fig. 16), although the exposure is considerably longer.

In purchasing a lens, we require to be assured that it is achromatic, that it is rectilinear, and that its average power is sufficient for our camera. If the light from a lens is thrown upon a large screen, it gives a circle of illumination, the brightest and most uniformly lighter part of which is from the centre portion to a certain distance towards the edge; after this the light gradually fades away. Now we measure off the largest photographic standard size that we can get in the uniformly lighted part, this being the covering power of the lens. Many lenses sold will not cover the plate they are stated to do: this must be seen before completing your purchase, otherwise all your pictures will possess a black shade at the corners, the lens being unable to cover them with its illumination, or, in other words, its covering power is much smaller than indicated. It is always as well to buy a lens a size larger than the camera you are going to use it for; thus for a 10×8 in. camera, a 12×10 in. lens will give nicer and better covered pictures.

A word or two on the keeping of lenses, and I will close. A lens should be kept when not in use, in a bag of chamois leather of the best and softest kind, and when taken out for use, the glasses should be gently polished with an old silk handkerchief and stood in a warm place. It is impossible to insist too strongly on the necessity of taking care of lenses and of keeping them safely housed—if the expression may be permitted—perfectly clean, and scrupulously bright and well polished. To secure the ends that will be the outcome of such keeping no better plan than the one given can be devised.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

CASTING IN PLASTER.

THE MANUFACTURE OF PLASTER — DIFFERENT KINDS AND THEIR USES — AN EXAMPLE IN WASTE-MOULDING — INNER AND OUTER MOULDS — SEPARATING FROM THE CLAY MODEL — WASHING THE MOULD — MAKING THE CAST — CHIPPING OUT.

HAVING considered the operations involved in modelling in clay, we may now pass on to the next process that demands consideration, namely, casting in plaster, and this part of my subject it is fair to suppose will prove more generally useful than modelling in clay, and appeal to a far larger circle of workers.

Whilst it remains in the clay a model is more or less a source of anxiety. It needs constant care; it may suffer from too much drying or too much wetting; frost may injure it; and any accident which happens to it can only be repaired by a repetition of the slow labour with which it was originally formed. But when cast in plaster it is tolerably safe from everything but accidental breakages, and even these it is possible to mend quickly and effectually. No wonder therefore that the modeller should always desire to see his work in plaster as soon as possible.

Plaster, called for distinction "Plaster of Paris," is made from gypsum or alabaster. This stone is formed of sulphate of lime—that is to say, of lime in combination with sulphuric acid and some 22 per cent. of water. To make plaster, the water is driven off by burning and the stone reduced to a powder; and it has the property of once more hardening into a kind of stone when again mixed with water. The discovery of this quality in gypsum made an epoch in the history of the arts. Its distinctive name is owing to plaster having first been brought to this country from the gypsum-works at Montmartre, near Paris. The stone

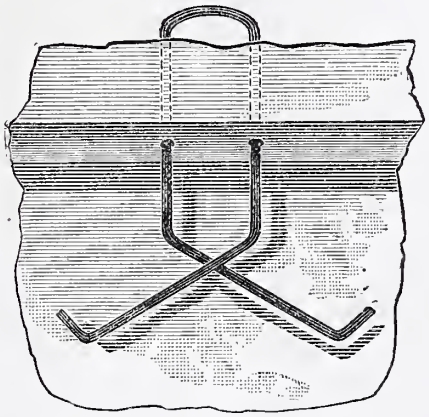


Fig. 18.—Wire Loop arranged in Mould.

is found, and has long been worked, in many parts of our own country, Derbyshire being now one of our chief sources of supply.

To prepare plaster, the alabaster is calcined, and then ground in a mill. Three qualities are sent to market. *Coarse* ordinary plaster is only to a certain extent to be called white; it is rather a very light brown, and is full of minute dark specks, caused by iron and other impurities. Builders use it for various purposes, and in the work before us it is employed, on account of its cheapness, for "backing" moulds and casts. *Fine* plaster is made from picked stones; it has a good white colour, and is chiefly used in the casting of figures. *Superfine* plaster is made from stones picked with especial care, and from which every speck of impurity is cut away. The supply of this is limited. It is dazzlingly white, and is chiefly used for "facing" such small casts as are to be protected by glass. Plaster is sold retail by the bag of 14 lbs., or the half-bag of 7 lbs., and wholesale by the sack of 2 cwts. Coarse may be bought at any colourman's at 5d. per bag; fine at any plaster moulder's, at 1s.; and superfine at the more important figure moulder's only, at 3s. per bag. Coarse and fine are to be bought by the sack at much lower rates; superfine is rarely bought in quantity.

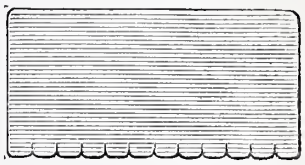


Fig. 19.—Plaster Drag (Scale, half size).

The power of setting in plaster depends on its freedom from moisture. It sets rapidly whilst fresh; but as it can rarely be kept without absorbing moisture from the air, its power of setting gradually decreases, and is after a time lost. Any attempt to cast with plaster thus spent will result in failure, and in the ruin of the model. Unless, therefore, the moulder has reasons for feeling sure of his plaster, he will do well, before using it, to try a little, and observe whether it sets properly, and how soon. Quite fresh plaster, though in a general way desirable, is not perhaps the best for a beginner, as the rapidity with which it sets may hurry him too much over operations with which he is not familiar. In tins which fit so closely as to exclude all air, plaster may be kept good for years.

To give an example of casting in its most simple form let us presume that the relief of the Apollo, supposed in a former paper to have been modelled by us, is about to be cast. Our imaginary modeller, who is now to be our imaginary moulder, having laid the model (which, it will be remembered, is in relief, on a clay slab) flat on its back, will probably blow water over it with his mouth in that manner described on a former page as calculated to shock the sensibilities of the fastidious; but in no other way could he moisten the whole surface so regularly, so gently, and so completely. This moistening freshens up the work, adding to the apparent finish, and making the plaster spread over the clay more freely; but if so much water has been thrown on as to remain in pools in the hollows, the sponge must be used to remove it, or the plaster would not set properly in these hollows.

It is desirable, for reasons which will appear hereafter, that the inner mould—that part of the mould which comes next the model—should be tinged with colour. Some use ochre or similar pigments, but nothing is better or more easily mixed than common ink. A smaller quantity suffices than of anything else, and instead of softening, as most other colours do, it seems to harden the plaster. As much water as will be required for making the whole of the inner mould is first tinged, and with this the plaster is mixed; this insures uniformity of colour. The tinge should be but a very slight one, just sufficient to make a clear distinction between the coloured mould and the white cast; much colouring matter might stain and disfigure the cast itself.

Taking a handful of plaster, the moulder sprinkles it into a basin two-thirds full of the coloured water. This is done carefully with the hand, that he may detect and lay aside any lumps, etc., which may occur. The plaster, falling on the surface of the water, becomes gradually soaked, and sinks, and the sprinkling is continued till, instead of sinking, the plaster begins to stand in a heap above the level of the water. This shows that no more plaster is needed.

This is the proper way of mixing plaster: the gradual saturation from below expels the air quietly, without causing bubbles; also, by this method, the moulder is able to see when exactly the proper proportion of plaster has been added to the water.

The mixture is now beaten up with a spoon. If he were beating superfine, for very delicate work, he would probably use a silver spoon, as least likely to cause discolourment. There is a proper way of beating plaster. The moulder puts the bowl of his spoon to the bottom of his basin, and by moving it rapidly with a circular motion, and without bringing it to the surface, he makes the mixture thoroughly "boil up." He avoids bringing the spoon-bowl to the surface, lest it should carry down air with it, and cause bubbles; for air-bubbles are enemies of which he stands specially in dread. When the plaster is well mixed, he skims off and throws aside any bubbles or scum that may have arisen, and his plaster—which is of about the consistency of cream—is ready for use.

With his spoon he throws it over the model, dashing it into all hollows and undercuttings, so that no part of the clay may be left uncovered. Into places which he cannot otherwise reach, he blows the liquid plaster with a pair of bellows.

All these operations have to be gone through rapidly; and if his plaster is very fresh, the moulder will have to bestir himself all the more, or it will set too quickly for him. Having emptied his basin, he hastily swills it out, and mixes a second supply, proceeding as before, till about ¼ in. of plaster covers every part of the model. He does not, however, care that it should have an even surface, for some little lumps and irregularities will serve to bind it to the outer mould.

The inner mould has now been formed, and whilst it is setting, the moulder occupies himself with mixing a little clay and water, so as to make a sort of "duck puddle." This he brushes over the inner mould when set, to enable him to separate the two moulds when he requires to do so, otherwise they would form into one mass. Here and there, however, he leaves a little island of plaster undaubed with the clay-water, for he does not wish the two moulds to separate too easily.

The outer mould, with which the thin inner one is now to be covered, he mixes with plain water; and when this has been spread to the depth of another ¼ in., he will pause for some five minutes for it to set, for it is now time to strengthen the mould with irons. These are desirable, partly because in setting and growing hot the mould has a tendency to warp, and partly because the use of irons gives the necessary strength with far less waste of plaster. Those who do much moulding, keep by them a quantity of thin iron bars, bent in all possible directions, for the purpose; but old window-bars, or any odd pieces of iron that may come to hand, will suffice. After these have been laid on the mould, more plaster is added to embed them, especially towards their ends. To his outer mould our moulder will probably give a general thickness of about ¾ in.

Whilst making the earlier parts of his mould he will have used fine plaster; but for "backing up," or perhaps for the whole of the outer mould, he will have contented himself with coarse.

The plaster, if good, will have set quite hard in half an hour, or less, and he will then proceed to separate it from the clay model. This is to be done rather by persuasion than force. If he works the mould gently backwards and forwards with his hand, some little chink between it and the clay is sure to appear; into this he pours water, and continues to work the mould. After a little while the water softens the face of the clay, the chink opens wider and wider, and presently mould and model come easily apart.

In the case of a model in very low relief, if this is done carefully, the mould may be removed without in any way injuring the surface of the work beneath. The writer has repeatedly taken more moulds than one from the same model. But this will scarcely be done with our Apollo; for, though the great bulk of the clay will come out intact, certain locks of hair and other projecting parts will remain sticking in the mould, and will have to be picked out.

The mould is now washed, which must be done thoroughly, but without disturbing its face. Our moulder will use a soft sponge and plenty of soap. If there are hollows not to be reached by the sponge, he will use a soft brush in them (sable or camel-hair); and if he can, he will swill his mould by placing it under a good stream of clean water, as from a tap.

Many people have an idea that, to make the cast leave it, every mould needs to be greased. Such is not the case. Plaster in a liquid state will not adhere to that which is hardened if the latter is *thoroughly* saturated with water. Nor will liquid plaster stick very firmly to hardened plaster which is quite dry; it is to plaster partially wetted that it sticks fast. The mould which we are watching has been so completely soaked in cleaning, that we may feel quite sure it will leave the cast properly. There is generally more reason to fear that a fresh mould like the present will leave too freely, in which case it may bring off projecting bits of the cast with it. A stale mould—one that has been made for some time, and allowed to become dry—though, of course, it would be well soaked before being filled, rarely leaves so readily as a fresh one. When practicable, it is better to use a mould at once.

Our moulder will make provision for hanging his cast up. A simple way is to insert a loop or loops of copper wire into the plaster slab which forms the background. Holes, therefore, should now be bored through the edge of the mould, and the wire arranged somewhat as shown in Fig. 18. The wire will then be safely embedded in the plaster when the mould is filled.

The actual making of the cast—the filling of the mould with plaster—is quite a simple operation. For the work in hand, our moulder will face with fine plaster. This he will mix as previously, only using *plain* water; and when mixed, he will pour it into the mould, which he will gently rock and move from side to side, so as to make the liquid plaster flow to every part of its interior, and coat it all over. A second basinful, forming a second coating over this, will perhaps give a sufficient facing of fine; and if so, his after-mixings can be of coarse, till the cast is backed up to a sufficient thickness. This may perhaps be 1¼ in., for it is desirable to have such strength as will bear the blows of the mallet in the coming "chipping-out." A little superfluous thickness may easily be scraped away, but a breakage is a vexatious thing.

After the mould is filled, some employment may be found in smoothing down the back of the cast. A small steel drag, like that shown in Fig. 19, and which any one can make for himself out of some odd bit of flat steel, is most useful for this purpose, as for some others. A small mason's trowel is also handy in making up the back of a cast, and other uses.

He will soon find the cast hard enough for chipping-out. His tools will be a blunt chisel (one with the edge rounded off on the grindstone) and a mallet. It is well to be provided with chisels of two or three sizes. After he has chipped out and released the irons, he will probably be able to break off his outer mould in a few pieces, and by a few strokes. Yet he should be warned not to be too hasty. If it comes off in very large pieces, it may bring portions of the inner mould with it, and that will endanger the cast.

As he clears away his outer mould the use of the clay-water will be apparent, and also, to some extent, that of the tinting. If ink has been used, the inner mould will be of a light bluish-grey, and from this the outer mould will readily part, owing to the film of clay between them, whilst the difference of colour will prevent his driving his chisel into one in mistake for the other. The chief use of the colouring is, however, to distinguish the inner mould from the cast itself.

For clearing away the inner mould, it is well to fix the relief almost upright, that the chips may readily fall away. Our moulder now proceeds warily. He holds his chisel at almost right angles to the surface; this brings away the pieces of mould cleaner, and is less likely to bruise the cast than a sloping position. He is sure not to find his mould of one exact and uniform thickness throughout, and he must deal his blows accordingly, or his chisel may go too far and enter the cast. So far as possible, the inner mould should be made so thick all over as to bear a moderate blow. A soft clean brush is used to remove any small fragments of chip which do not fall way, and hollows are best cleaned out by blowing into them with the bellows.

The cast, as it emerges from the dull grey mould, will give no small delight to the young modeller, as he recognises his work in this new, and hard, and snowy white material. Every touch that he has given to the clay—even the most minute markings—he will see reproduced with absolute fidelity. He will find the work of chipping-out a most agreeable, and, indeed, fascinating one, and will grudge to leave it for a moment, till he sees the whole model uncovered.

To the experienced worker, perhaps, the interest may not be so intense. He has no fears as to results, knowing well that when the operations of casting have been properly performed, the cast cannot fail of being on the whole satisfactory; yet clearing away a mould is pleasant work at all times.

WAX-ENDS: HOW TO MAKE THEM.

BY J. C. KING.

Of course inquirers know that they can go to a shoemaker and get taught how to make a wax-end, but surely, if an efficient reply be given, it tells every reader of WORK who cares to know, and saves so many the trouble of going to a shoemaker's to learn. It is just that desire to learn from the best source that prompts the question in these pages; even though writing the letter on a matter like that of "wax-ends" would be about as much trouble as learning from a shoemaker to do it from seeing it done. We want knowledge not selfishly, but that others may share it—at least, I hope so. We seek to *learn*, as well as be *taught*.

In discoursing about the making of wax-ends, the first thing will be to show *how to do it*.

To make a wax-end, get your hemp or flax, coarse or fine, just as you want it for light or heavy work, the flax being used for the finest work, the hemp generally for rough strong threads. Open your ball from the middle; if you commence from the outside, the ball soon becomes a loose "harl," and the fibre will be linked and ruptured in trying to draw out a bit of straight thread. You have to decide how many "ply," or threads, you want in your wax-end; you may use one or many. Now you must take a brief lesson in textile technics before you can begin. Your flax or thread, you will observe, is spun in the same direction as the hands of your watch turn; bear this in mind, or you cannot make a wax-end with certainty. This speck of knowledge you apply at the starting of your job, to unwind the twist of the thread; to break it or cut it would spoil the job at starting. There is one simple way to unwind adopted by all wax-thread makers. It is to draw, with the right hand, the fibre of flax or hemp with a rolling motion *upwards* on the right leg above the knee, which is raised about horizontal—the hand being wetted slightly with the tongue to give adhesion to the thread—the left hand holding the thread between the thumb and finger to prevent it turning. The palm of the right hand is used to unroll, the drawing up the leg being for about four inches at each stroke, the thread being lifted and shifted down for each starting stroke of unwinding; when expert at it, two threads of hemp or flax can be unwound at the same stroke, keeping them apart for about the space of half an inch as they roll on the thigh. After three or four strokes of the hand on the thread, it will be as in the accompanying sketch, A being the part held by the thumb and finger of left hand, B the unwound filaments, from two to three inches in length. Now comes the only really technical nicety about the job—the separation of the thread at this flossy bunch in such a way that the two ends shall be pointed bunches of filaments, each about 3 in. long. Now for another little lesson in textiles. The spun thread would sustain perhaps 20lbs. pull; the unwound thread is parted by little gentle snatches of the fingers, of less than an ounce at each snatch, to part the bunch of flossy thread. The fibres were held only by what is known as imbrication, or overlapping of the particles one on the other, and by what is also practically known as "felting" in fibres that cling to each other by imbrication, of which wool is one of the most tenacious, and horse-hair (mane or tail) and bristles the least tenacious, except one end of the bristles. You notice the left hand is the feeder and holder, the right the operator. Having detached, say, four feet of thread with one flossy end, you want both ends of each "ply" to be equally fine drawn to a point, so you serve about six or eight inches of the other end the same: that is, you waste that much to effect unwinding and pointing. You have now three flossy pointed ends. You lay one on the end still on the ball of hemp or flax, and draw the threads between the left thumb and finger till of the same length; then lay the thread to be unwound on the right leg as before, and unwind and separate in the same way as with the first. Arrange that both threads are not quite the same length from end to end. This you can only be sure of after some practice; but by holding the two threads half an inch apart between the thumb and fingers of left hand while you unwind it will ensure accuracy. If one thread should by chance get rolled over the other in unwinding, they will not cling together to hurt. You hold, not only the first, but all the threads on your leg as you unwind, but just out of the way of the one you are unwinding, or let the unwound ends hang from the left hand loosely. You will now find you have two or more complete threads, and an end to start another length, which you work off in the same way, not laying the threads out of the left hand for a moment, merely keeping them from getting entangled at the ends in measuring off and unwinding. Suppose you have four "ply." You draw them all straight through the fingers to close them up slightly. Then you lightly draw the wax down the threads you hold in the middle with the left hand; this is done quite lightly, and one stroke does both ends of the thread at once; shift it in the hand a little, so as to do that part in the hand omitted at first waxing. This waxing must not be excessive, or it destroys the imbricating properties of the fibre: only just enough to give a slight sticky adhesion. Now comes the winding, called "winding a wax-end." Like the waxing, it is done on both ends or lengths from the middle of the thread at once, the middle being finished by shifting to do it. A hook, or button-stud in a table, is used to loop the thread over, and the doubled thread is kept apart by the finger and thumb of the left hand and the "lay" of the thread on the right leg. They must not touch each other, so as to roll over one another. The threads are rolled *downwards* now to wind one strand of fibre into the other, the rolling place on the threads being just where the flossy ends start, nowhere else. This winds the fibres into a spun thread of four "ply." You alternate the winding and the waxing, drawing the wax softly over the flossy ends so as not to clog them, or tear the delicate filaments off into the wax; these you have not wound at all yet, and barely waxed. The bristle, which at one end is seen to be split up into three fibrous ends, is laid in this flossy point for about two inches, and rolled downwards on the leg, with alternate waxings and rolling; both ends, if wanted, are bristled at the same time, and, by the same hand rolling, incorporated into the wax-ends. That quarter of an inch of the thread that took a loop over the hook or button is not omitted in winding or waxing. Both right and left hands are used to hold the wax in drawing the thread through them, to smooth any unevenness, and ensure a thorough saturation of wax into the thread by hand warmth; surfacing with wax only would be useless: in fact, it would not be a waxed thread. The wax must slightly fill the fibres. If needles are to be used instead of bristles, the thread is pointed by waxing and winding, but not too compactly, for more winding and imbrication has yet to be done. The needle (mostly blunt-pointed) is threaded, and the end drawn about three inches through the eye, and folded back on the thread. This folding is rolled and waxed right up to the needle, but the needle is not waxed; a little gets on, but must not stick to the steel, as the fingers are used to clear off any particle of wax at once; the draw of waxing is done just the reverse way at this folding, being *from* the needle always, and not towards the point. So as to keep the fingers clean for free working, a small piece of soft leather, about $\frac{3}{4}$ in. by $1\frac{1}{2}$ in., is folded, and in the nip of the finger and thumb of either hand rubbed up and down the wax-end, even up to the needle eye, without fear of shifting the folded end. When done, it should be round, firm, and smooth as a violin string. To prevent it sticking together when rolled into a loop of about 6 in. diameter, tallow the fingers, and lightly surface the wax-thread with tallow. This is sometimes done before using the thread at work. In this state it may be packed away for use at any time.

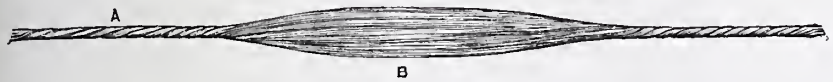


Diagram illustrating Method of making Wax-Ends.

Now a parting word may be said to show why I have explained fully how to make a wax-end. WORK goes to such places as on board ship, out on the pampas of Buenos Ayres, the Cape, Australia, and New Zealand, for I send my copies, when read, to those parts; so that such information is of value where a shoemaker could not be found at once to tell how to make a wax-end, where, perhaps, the settler beats the "Phormium Tenax" into fibre, or the herdsman the "Ramee" to repair his boots or saddle. He might like to know how he may best make a wax-end, by using any gum near at hand for wax, and perhaps feel glad that WORK is not written above his wants — the fault of most practical, but out-of-reach-knowledge, publications; whose managers need reminding that the millions want to learn about time and life-pressed wants, although they admit, in the words of Ernest Jones, the poet of work—

"We plough and sow—we're so very, very low,
That we delve in the dirty clay;
'Till we bless the plain with the golden grain,
And the vale with fragrant hay.'

CHIP CARVING:

ITS APPLICATION TO DECORATIVE PURPOSES.

BY M. E. REEKS,

School of Wood Carving, South Kensington.

Figs. 1 and 2 show decoration suitable to a shelf of a bookcase; they are essentially horizontal treatments. Fig. 1 is very simple, and does not require much explanation as to its setting out; the line round the semicircles should be marked in with the veiner. The centres, where necessary, are marked × and lettered C. The student, of

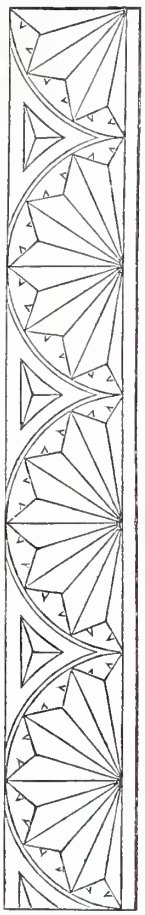


Fig. 1.—Decoration for Edge of Shelf.

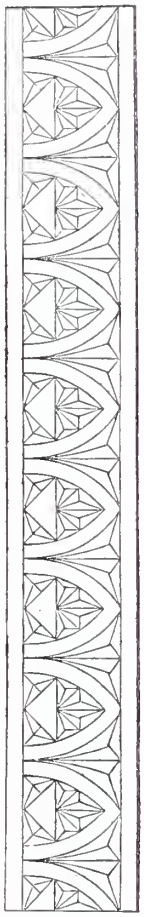


Fig. 2.—Decoration for Edge of Shelf.

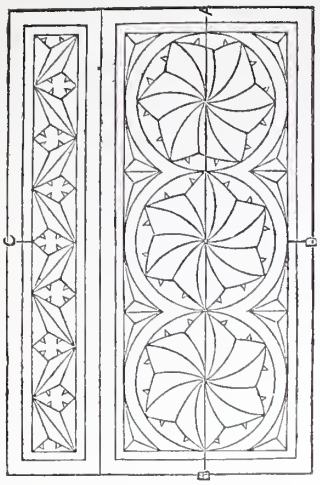


Fig. 3.—Decoration for Edge of Standard of Shelves.

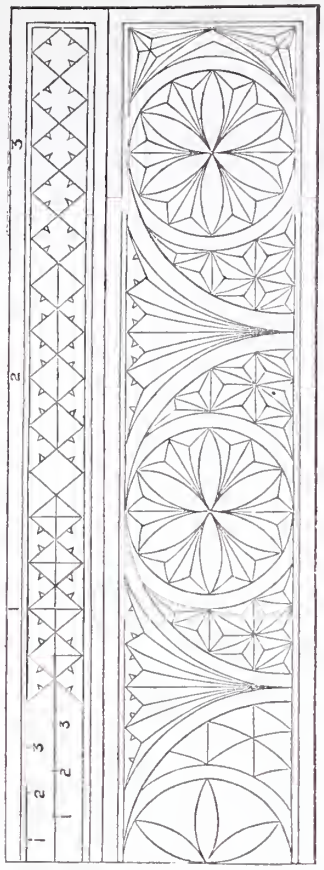


Fig. 4.—End of Box.

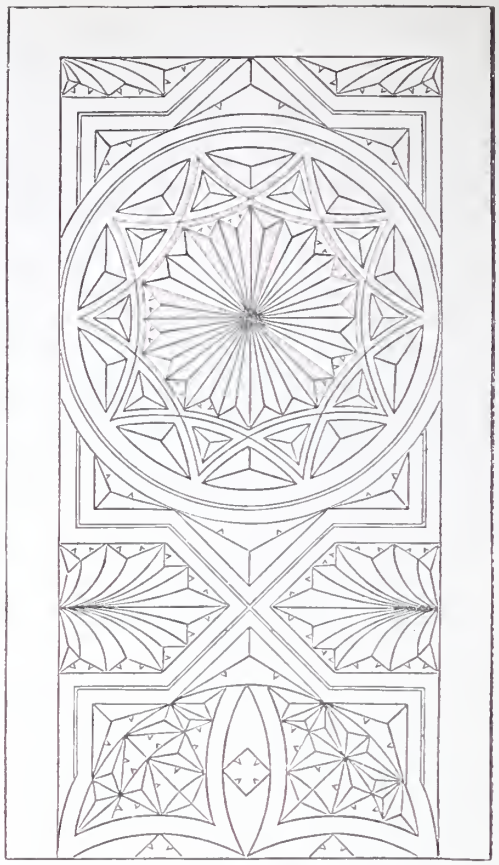


Fig. 5.—Half of Front of Box.

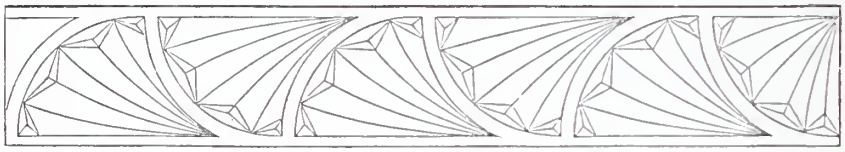


Fig. 6.—Half of Top of Box.

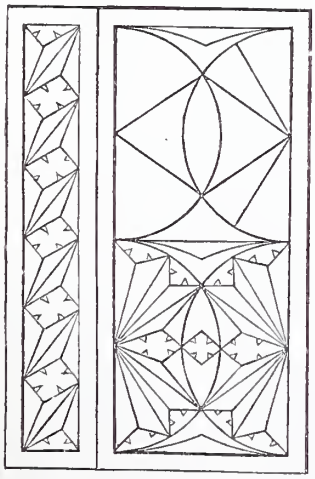


Fig. 7.—End of Box.

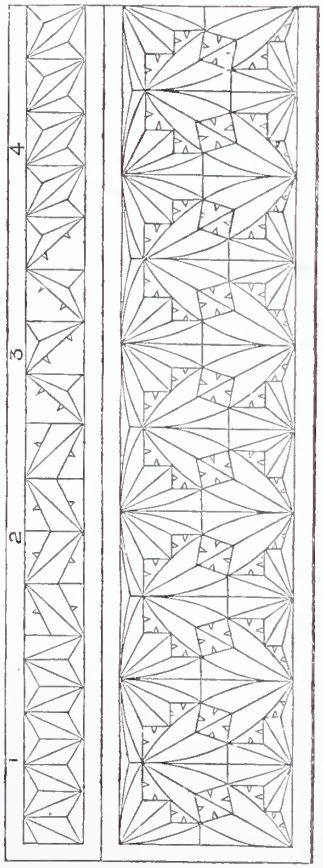


Fig. 8.—Half of Front of Box.

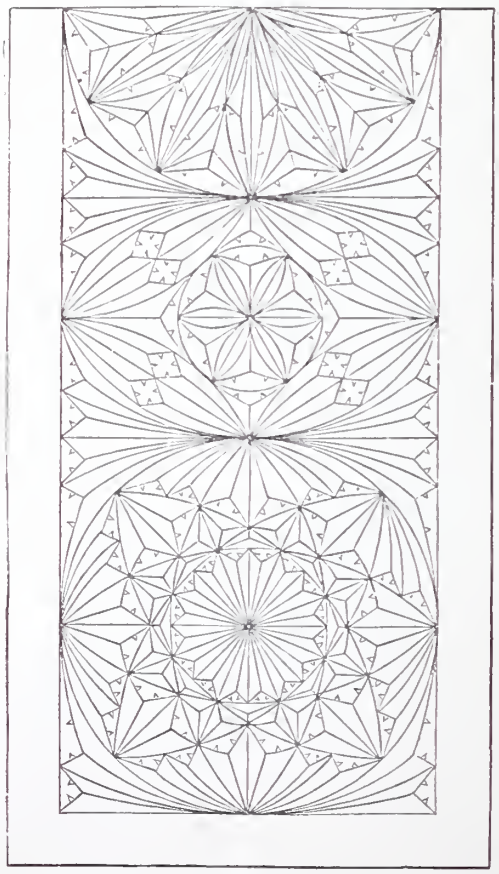


Fig. 9.—Half of Top of Box.

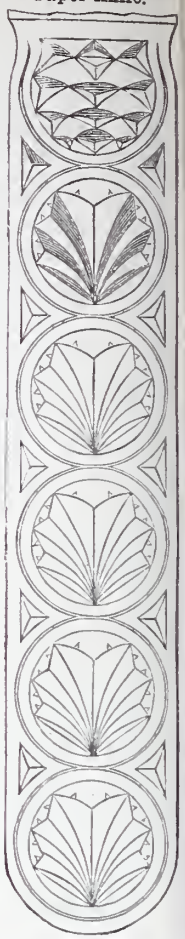


Fig. 10.—Handle of Paper Knife.

Fig. 11.—Handle of Paper Knife.

course, must fit in the pattern to the length of the shelf. This is easily done by finding the centre of the shelf. Supposing the shelf to be 2 ft. in length, the centre line would be 1 ft. from either end. On this line will fall the centre of the semicircle; then describe the others on both sides until you reach about half an inch from the end; and if there is no room to finish with a semicircle, as at B in Fig. 12, or with the quarter as at A, the space must be filled up with what are known by chip carvers as "fans," which can be made to fill any sized space, as in Fig. 12 at C. The small triangular spaces are left in the surface of the wood, with little nicks cut out on each side.

Fig. 2 is set out as at D, in Fig. 12—triangles—the parts marked X, X, being left solid. All that has been said about starting from the centre of the shelf and finishing at its ends, in Fig. 1, applies equally to this pattern. Both these patterns would look just as well turned the other way up; I mean the points of the equilateral triangles being up instead of down, as shown at E in Fig. 12.

Fig. 3 shows a decoration suitable to a vertical treatment, though it may also be used horizontally. At F in Fig. 12, I give the skeleton or working lines, and, in this case, it will be better to start the setting out from the end instead of the centre, and make the last fan either slightly longer or shorter than the others, if the space needs it. Describe the quarter-circles, then, with the same radius from the marked C X, and inserts points 1 and 2. The lines must then be drawn in by freehand from these points to their meeting-point, A. In this pattern the small triangles may be left solid with the little "nicks" taken out of the side, or else cut into pockets as shown in the pattern.

Fig. 4 is the end of a box. It requires nothing further to be said about it, except that it should be started from the centre lines of the box, viz., A B and C D, and that the circles should be divided into six by the method shown in my first paper.

Fig. 5 shows the long side of a box. Patterns 1, 2, 3 on the border of the lid show three different patterns which are all set out on the same lines; in No. 1, the upper and lower triangles being solid, and the centre one sloped towards them, leaving two ridges. No. 2 has only one ridge in the centre. In Fig. 3 the squares in the centre are solid, and the upper and lower sets of triangles sloped down to them.

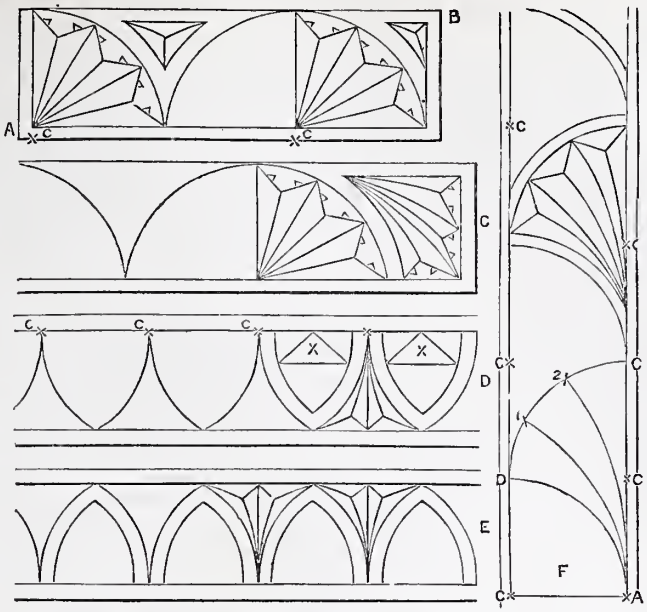


Fig. 12.—Exemplification of Modes of Setting Out Figs. 1, 2, and 3.

In setting out the pattern on the side, start from the centre of the box.

Fig. 8 shows a treatment for the front of a box where no plain bands are left; but I think this is not so good in effect. The setting out needs no explanation, being simply a series of semicircles interlacing with little solid triangles and squares.

Fig. 7 is another design for the end of a long box, or for all the sides of a small box. One half is left without putting in the detail, and shows the way to set out the pattern.

In Figs. 6 and 9, which, I may add, exhibit decorative work in chip carving for the tops of boxes, two ways of treatment are shown; that in Fig. 6 being with plain bands, and that in Fig. 9 without any bands at all. As they are both somewhat elaborate, I give in Figs. 13 and 14 the best method of setting out the principal parts of the design shown in Fig. 9, and in Figs. 15 and 16 the mode of setting out the leading features of the design given in Fig. 6. Fig. 13 is founded on an octagon or eight-sided figure, and exhibits the ornamentation of the circle to the left in Fig. 9. Fig. 14 is based on a hexagon, or, I may say, on a dodecagon or twelve-sided figure, and shows the principle of setting out the ornamentation of the semicircle to the extreme right in Fig. 9, which, indeed, when repeated, would form the central part of the *whole* design for the top of the box. Fig. 15 shows the setting out of the quatrefoil, the half of which is shown to the extreme left in the design for ornamenting the top of a box, as shown in Fig. 6, and Fig. 16 the setting out of the decagon or double pentagon shown in the complete circle to the right of the design in Fig. 6. Both the quatrefoil and the pentagon or decagon, call it which you will, have plain bands. But the bands of the quatrefoil are left without any marking whatever, and those of the pentagonal design have a vein or line running along the centre of the bands, and taken out with the veining tool.

In these elaborate patterns, after ruling the centre lines on the boxes themselves, it will be well to set out the patterns on paper (as in the case of the pentagon here shown, the centres of some of the arcs come far from the figure itself, and cannot be found on the box), then measure off the points required from the paper on to the

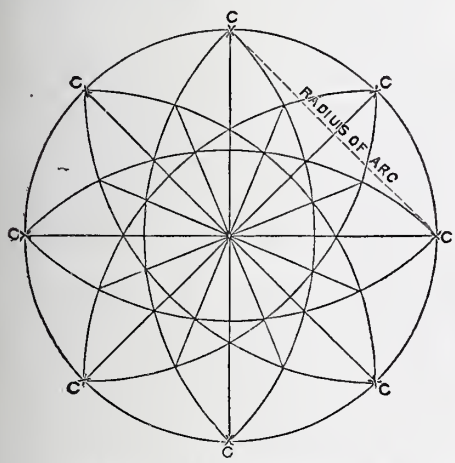


Fig. 13.—Setting Out of Octagon in Fig. 9.

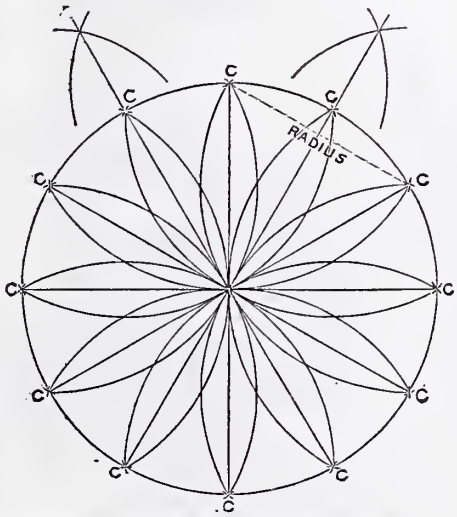


Fig. 14.—Setting Out of Double Hexagon in Fig. 9.

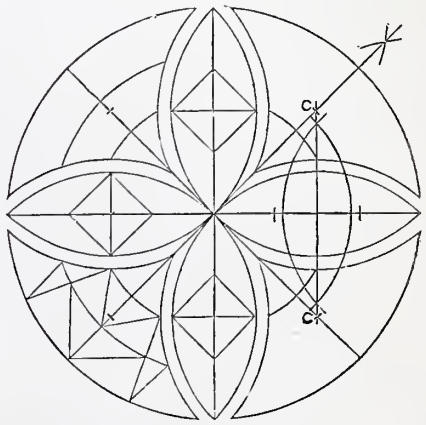


Fig. 15.—Setting Out of Quatrefoil in Fig. 6.

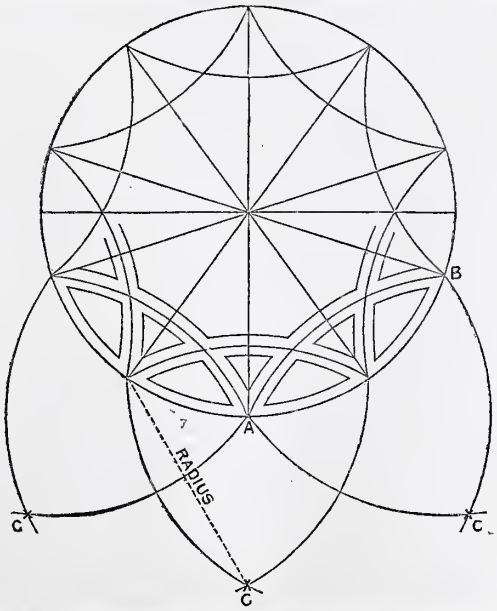


Fig. 16.—Setting Out of Double Pentagon in Fig. 6.

wood, and trace the curves, as A B, from centre C X in lower right hand corner of Fig. 16, on to a little piece of tracing paper with a black pencil, and then, reversing the paper so as to get the pencil side on the wood, go very carefully over the curves with a pointer or tracer; but, whenever possible, get the centres on the wood so as to do the arcs with compasses. Use the method described in my first paper for constructing the pentagon. The star in the centre of this pentagon is a decagon or ten-pointed one; this is obtained by dividing the pentagonal divisions into two.

Figs. 10 and 11 are paper-knife handles. They would very well bear being worked to a larger scale. Fig. 10 is quite simple, and needs no explanation; and Fig. 11 also, though it looks more elaborate, is easily set out, as I have worked the centres for the arcs.

I have now said all that is necessary to enable any reader of WORK who wishes to follow up this desirable method of surface decoration to do so with satisfaction to himself, and, I trust, to all to whom he submits his work.

MEANS, MODES, AND METHODS.

CEMENT FOR AQUARIUM.

SOME few months ago I required a simple and inexpensive cement for the inside of a combination fern-case and aquarium. Putty and red lead, separately or in combination, I resolved, from experience, to avoid, because, though they are often recommended by workmen who probably know of no other cementing medium, they are more suitable for external work, and are injurious—at first, at any rate—to the fish or other inmates of an aquarium. Pitch I had used, but found that in hot rooms it was apt to run a little, and that when under water it soon got foul, and tainted the water, to the detriment of the fish.

Then I remembered having seen somewhere or other a recipe for cement, the details of which I had forgotten to jot down. Not knowing the exact proportions of the ingredients, I experimented first, using *quantum sufficit* (as the old recipes put it) of each, and the result, to my surprise, was a success.

Into a medium-sized saucepan that had been discarded by the cook I broke up about ½ lb. of common resin, and when melted, stirred in about three tablespoonfuls of plaster of Paris, and finally one and a half tablespoonfuls of linseed oil. (My own impression now is that the original recipe said boiled oil, but the cement as given above did for my purpose very well, and as such I give it for what it is worth to readers of WORK.) When it was all quite fluid, I tried some, and found that it set almost at once.

For stirring it, a piece of stick or a wooden spoon is best, as a common kitchen spoon which I used in my first boiling disappeared entirely except the handle, and was absorbed or assimilated into the cement without leaving any trace.

This cement would do admirably, in my opinion, for sealing up pickle bottles, ink bottles, and Leclanché cells. I have used it for stopping up knot-holes in wood, mixed with sawdust of the wood in question to colour it, and when mixed with coarsely-broken bottles, for stopping up rat-holes; also as a temporary cement for water-cans and pails that have sprung a leak and cannot be repaired on the spot.

H. J. L. J. MASSÉ.

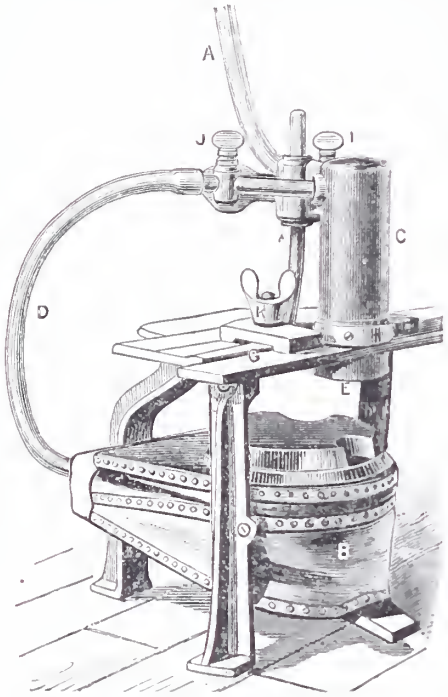
OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

58.—DUNCAN'S BRAZING MACHINE.

I HAVE much pleasure in inserting the following communication from Mr. Thomas Duncan, 305, Manchester Street, Oldham. I have no doubt that the machine itself is good and useful, and that the work done by its aid is reliable, but, being without experience of it, I cannot offer positive testimony as to its value; and, therefore, give Mr. Duncan's remarks, with an engraving of the photograph that accompanied them:—

"Being a regular purchaser of your valuable paper, I have noticed that there have been occasional references in the answers to correspondents in 'Shop' to the old method of brazing band saws by means of the tongs.



Duncan's Brazing Machine.

"This is a process at once producing bad results, and one which is wasteful of time, compared with the process I have invented, and which, with your permission, I wish to introduce to your notice. I believe that a reference to this machine in that part of your journal entitled 'Our Guide to Good Things' would prove of use to some of your numerous subscribers. I have been selling the machine for the last five years, and it is now in constant use in the largest engineering works, railway carriage works, shipbuilding yards, etc., in England, Scotland, and Ireland, in which it is saving both time and money.

"The simplicity and certainty of the process, the economy of time it effects, combined with the comparatively small price of the machine, render it a most valuable adjunct in any workshop where band saws are used. The price of the machine is 28s. I can forward on a machine for your inspection should you wish it, but I believe that the enclosed photograph and the following description of method of working will be sufficient.

"Connect the machine with a gaspipe by the rubber tube marked A in photo. The tube D conveys air from bellows B to burner C.

"Fill the recess E under burner with pieces of unslaked lime or asbestos.

"The two ends of the saw are to be prepared in the usual manner (mentioned by your correspondents), filing them and overlapping two teeth. Wrap the overlap tightly with fine iron wire, overlaying the same with fine brass wire, and with a coat of water and borax the saw is ready. Place it on machine with the joining under burner, the back edge close against the planed edge of machine G, so that the saw will be straight when brazed; place the two clips on it and secure with thumbscrews K.

"Turn on gas by tap attached to burner, apply light under it, and fill the bellows with air, admitting it gradually to burner by the other tap J. The object now must be to obtain a white heat on the lime or asbestos, and it is most important that neither more nor less gas is used than is required to combine with the air in the burner. If there be too much gas the flame will spread outside under the burner, in which case reduce it gradually until a white heat is seen on the lime or asbestos. A greater quantity of gas does not produce a greater heat.

"With a little practice a man need not be more than ten minutes after breaking a saw and having it ready for work again."

59.—SOME USEFUL BOOKS, PRICE LISTS, ETC.

I must endeavour to mention some of the books and price lists, which, if books had eyes, would be looking reproachfully at me from the position they now occupy on my study table. Space, unhappily, by the want of it, prevents in any and every case any lengthened notice.

(1) "**International Annual of Anthony's Photographic Bulletin.**"—A charming volume in paper cover, containing 490 pages of text, comprising several short articles on a great variety of subjects connected with photography, 156 pages of advertisements, a "Portrait Study" by C. F. Conly (printed on N.P.A. extra brilliant albumen paper), and about twenty plates by various processes from negatives by well-known photographic artists, besides numerous wood engravings in the text, of which the best to my mind is "Bellagio," by the Collotype process. And all for 2s.! It is an American production, but the London publishers, if I may call them so, are Messrs. Iliffe & Son, 3, St. Bride Street, London, E.C.

(2) "**Encyclopædia of Photography.**"—Messrs. Iliffe & Son also send Parts 1 and 2 of "The Encyclopædia of Photography," by Walter E. Woodbury, published at 6d. It will contain, it is said, over 1,000 references, and be illustrated with above 200 explanatory sketches and diagrams by the author. Judging from the parts already published, the "Encyclopædia of Photography" will be a most useful vade-mecum and book of reference for photographers when completed.

(3) "**Lights.**"—This is an introduction to the science of optics, designed for the use of students of architecture, engineering, and other applied sciences, by Mr. E. Wyndham Tarn, M.A. architect, and author of various works on building, geometry, etc. It is clearly written, and illustrated whenever necessary by carefully-executed diagrams. It forms a volume of "Weale's Rudimentary Series," and is published at 1s. 6d. by Messrs. Crosby Lockwood & Co., Stationers' Hall Court, London, E.C.

(4) "**The Practical Patentee.**"—A monthly journal for inventors, etc., at 1d., published by Mr. E. W. Allen, 4, Ave Maria Lane, London, E.C. I cordially recommend it to the notice of all correspondents of WORK who have written or are going to write to me about inventions, patents, and patenting, etc.

(5) **Messrs. Grimshaw and Baxter's Price List.**—I have received from Messrs. Grimshaw and Baxter, 33 and 35, Goswell Road, London E.C., a useful descriptive price list of lathes, tools, machines, stocks and dies, and other appliances kept by them at their General Mechanics' Lathe, Tool, File, and Material Warehouse, at the above address. It will be found useful by machinists, as many machines and appliances not to be found in ordinary tool-dealers' price lists are here mentioned and priced.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

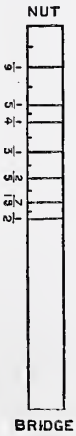
NOTICE TO CORRESPONDENTS.

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

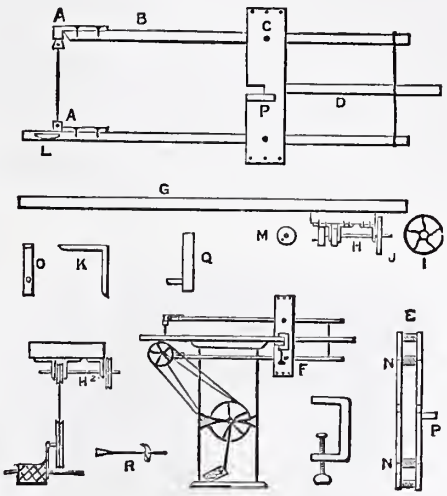
I.—Letters from Correspondents.

Sheet Metal Work Book. — Aliquando writes:—"Tinker (see Work, p. 191, Vol. II.) must not put to me words I did not use. I did not say Warn's book was 'practically useless.' On the contrary it has done excellent service in its day, and Tinker himself speaks of the immense benefit it has been to him. But if his run of work had been of much variety, he would certainly have himself discovered some of the deficiencies, errors, and impossibilities of the book, its general slovenliness, and the entire absence of principles in it. On page 9 Warn shows how to get the pattern for a flue article (frustum of cone, not 'frustrum' as Warn always has it), when top and bottom diameters and height are given; he does not, however, show how to draw the pattern when the height is not given, but instead, as is usual, the flue. In enunciating his problems, Warn's enunciations are general; yet he takes always a particular case, and his constructions will not apply generally. Take, for instance, and almost at random, the tapering oval body, of page 19, the hip bath, of page 53, and the sitz bath, of page 55. In the two latter there is this assumption, that the ends and sides, if produced, must meet in one point. Tinker should get a hip and sitz bath, turn them upside down, and note if the sides and ends, produced, will meet in one point; he can then judge if these baths of all sizes will do so. In the case of the rectangular tapering top, or tray (or hood), of page 23, though each side may in practice be at a different angle with the horizontal plane, these angles, according to Warn, must be one and the same. In the pattern for a tapering piece of pipe, on page 33, elevation lines are used as if they were true lengths, entirely falsifying the construction. The case of two cylinders at an oblique angle, of page 35, has been dealt with fully by myself and others in the *English Mechanic*; to its pages I must refer Tinker (March to June, 1889). Again taking up the tapering oval body, of page 19, this is a body formed of two equal portions of oblique cone frusta (see Millis's 'Metal Plate Work, its Patterns, and their Geometry,' pp. 168-9), and as the pattern for the frustum of an oblique cone cannot be formed of arcs of circles, Warn must be wrong. In all unequal tapering bodies, such, for example, as bath patterns, tea bottle and canister tops, if the radii of the arcs forming any portion of the tops and bottom are equal, Warn's methods do not apply. And in tapering bodies, equal or unequal, where the sizes of top and bottom approximate at all, Warn is utterly useless, for his centres would be in the next shop, or street, or town; he has no short radii methods whatever. Millis uniformly gives these methods. Tinker must not suppose I have supplied him with an exhaustive catalogue of Warn's 'numerous errors,' for, as per his request, I have only pointed out a few. But if he wishes it, and our Editor can afford the space, I will go fully into any one that Tinker may select of the problems which I have here either directly or indirectly indicated, as the matter of accurately striking patterns in metal plate affects a very large body of working men. This reply of mine to Tinker concerns G. J. P. (*Manchester*), who (Work, June 21, p. 223) has inquired as to a tinman's pattern book, and Plumber (*Slade*) (Work, June 21, p. 225)."

How to Fret a Banjo.—F. H. (*Streatham*) writes:—"I am not saying that J. G. W. (see Vol. II., page 292) is not right in dividing the neck of the banjo into eighteenths, but a banjo so fretted would not sound the correct notes; and after what the Editor essayed on page 287, 'Means, Modes, and Methods,' I take the liberty to offer my method to find the right distances of the frets. Take a strip of paper the exact length from the nut to the bridge, and about an inch wide; fold it in half, and mark the distance of $\frac{1}{2}$ on the neck of the banjo, and then fold the length of paper in three, and mark off from the nut $\frac{1}{3}$, and if you fold one third into three it will give you the ninths; mark off from the nut $\frac{1}{9}$; fold the paper again into four, and mark off $\frac{1}{4}$, and with a little trouble, you can fold it into five, and then mark off $\frac{1}{5}$ and $\frac{2}{5}$, then fold one fifth into three and it will be a fifteenth, mark off $\frac{7}{15}$; the diagram will give you the right distances as I have marked below. Divide the other half of the neck in the same way, and divide between these marks, and it will give the half tones near enough."



Fret Machine.—J. A. C. (*Plaistow*) writes:—"I have seen a good many designs for fret machines in 'Shop,' but I think mine beats them all, although those in 'Shop' are very ingenious. I am only an amateur myself; I have tried to draw out a design of a fret machine I made myself; the design is entirely my own invention. I bought a sewing machine bottom and made a top to it—cost 1s. 6d. A are the clamps I bought; B, the arms, are made of ash (I made them myself; also C, which is common deal). D, stretcher; E gives a front view of C; G, machine top; H, gear to drive the arms; I, front view of small fly-wheel; J, side view; K, a bracket, of which I had three, for bearings; L is a piece cut out of the arm that works under the table (see Q),



Fret Machine and Parts.

side view; M, front view; O, front of K; F, machine ready for action; P is a side piece I screwed on to C, to hold the same to table, G, with clamp; N N are pins for arms to work on. I can unscrew M from bearings (which is an oak bung of a barrel with a nut let in), and, taken off the table, an ordinary table is produced. When I can afford it, I shall make it a turning machine; I have only to fix the turning gear on top of the table, without disturbing the machinery below. H² is the works under the table; it shows more plainly Q, which causes the up and down motions of the arms; R, bit for drilling. Now as to cost of this machine. I bought the bottom of the machine for 1s. 6d., which I don't suppose can be had very often at the price, but I should think it could for about 4s. or 5s.; the woodwork, say it cost me at the most 3s., makes 4s. 6d., and bearings and saw clamps a friend of mine made me for 4s. 6d.; total 9s. I have got a good substantial machine, convertible into fret-turning, drilling, grinding, and a table."

II.—Questions Answered by Editor and Staff.

Clock Faces.—Goldril.—The dials you mention are, I believe, electro plated in a great many cases; in others, treated with nitrate of silver, the fine surface being got up in a lathe; or in some cases, called in the trade engine turned, then plated or silvered; others are polished, then dipped in the acid bath as for lacquering, then silvered. You might get a good mat surface on your copper dial by *breaking* a rod of iron, say, about $\frac{3}{8}$ in. diameter, and case-harden the broken end, and, using that as a punch, well hammer all over the surface; then silver it and varnish it.—A. B. C.

Battery for Electric Scarf Pin.—J. C. (*Newcastle-on-Tyne*).—A small dry battery, suitable for this purpose, was described on page 748, Vol. I., of Work, in reply to Asca (*Newcastle-on-Tyne*). The number in which it appeared is No. 47, published on February 8th, 1890. I shall have something to say on pocket accumulators for this purpose in my forthcoming articles on "Model Electric Lights."—G. E. B.

Making a Patented Article for Private Use.—Noli inquires whether he may make a patented article, not for sale, but for use in his own business. Without professing to give an opinion on a point of law, which is out of our province, we think that on consideration he must see that he cannot do this without injuring the patentee. If he may make one article, there can be no reason why he should not make more than one. Every man who makes a patented article lessens the market of the patentee by one. If every man made the article for himself, the patentee would have no market whatever. No man may do that which injures the property of another; and for every wrong, English law is supposed to have a remedy.—C. C. C.

Metal Plate Pickling. — J. W. (*Ashton-under-Lyne*).—I never heard of such a book. The only pickling of metal plates with which I am acquainted is that practised in the tin plate works, in dilute hydrochloric or sulphuric acids. You appear to be acquainted with this, as you mention spirits of salts. But if not you can find the method described in Percy's "Metallurgy," page 726, Bloxam's "Metals," page 265, or any standard work on metallurgy.—J.

Casting Zinc Rods.—Zinc Rods.—You can make the mould out of a piece of gas barrel split in two equal parts by means of a hacksaw or slitting file. File the insides smooth and smear them with tallow, then coat with blacklead; bind the two halves together with wire. Plug up the lower end with clay, and in this insert the copper connecting wire to be cast in the rod. Melt the zinc in a plumbago or a fireclay crucible, and flux it with resin; stir up with a green stick, and skim off all dross before pouring the hot metal into the mould. This should be made very warm before the metal is poured into it. If you follow these instructions your rods will not crumble.—G. E. B.

Gesso Work.—A. S. T. (*Bishopsgate*).—A second article on this subject appeared in Work, No. 41; this apparently has escaped your notice. The third you have already seen, and a fourth and concluding one appeared in No. 52. If you follow the directions given I think you will find there is no difficulty left unsolved even for beginners. Buy two tins of gesso composition and liquid at the Society of Artists' Studio, 53, New Bond Street. Directions for mixing are on the tins. After a trial, if you find you require any further explanations I shall be pleased to answer any questions you send.—E. C.

Dulcimer Strings.—Anxious.—The dimensions you give for a dulcimer would be those of a C instrument, and would require stringing with Nos. 10 and 9 brass, and 9 and 8 steel wire. No. 10 would be used for the first six notes, remainder No. 9 brass; No. 9 steel for the first six notes, remainder No. 8. No special music is written for the dulcimer, any that lies in a fairly easy key being playable by ordinary performers and almost anything by skilled ones.—R. F.

Tyre Cement.—W. E. R. (*Southgate*).—I have not a good recipe for cycle tyre cement, neither would I care to make it though I had. Good tyre cement is to be had of all the cycle makers and dealers, at a shilling a pound. W. E. R. might make it a little cheaper, but the mess would not be worth the trouble unless he were going to make it to sell. Any of the London cycle dealers will sell it. I get mine from W. A. Lloyd & Co., Birmingham.—A. S. P.

Bookbinders' Materials.—G. L. (*Sheffield*).—Regarding the above I have received the following: "Bookbinders' materials, a skin or two of leather, 5 or 6 lbs. of millboards. Head band, marble. Paper, thread, etc." Signed G. L., written on a scrap of paper 4 in. by 4½ in., perforated at one side and numbered 1 at the top left-hand side. Now I ask, in the name of common sense, what does the fellow mean? Has G. L. mistaken Work for a funny paper, and sent the above as a contribution to the "Sphinx" column. I have never been very successful in solving enigmas or drop-letter words, so I will not make the least attempt to solve this, certainly a drop-word letter this time. If it is the prices of the above articles, I could easily give them if the information was asked for, or if I had the least chance of finding that it was wanted. I need not waste your space, Mr. Editor, in trying to solve the problem, I will simply give it up. There have been one or two grumbles over vague questions in your columns already, so I will say nothing more about the one before me. Just allow me to say, however, that it is a real pleasure to answer questions which are put in a pointed manner. If querists do not put their wants in a definite form, we cannot be expected to play the part of the clairvoyant, and give them definite answers. In the above Irving Bishop would have no chance.—G. C.

Bright Silver Plating.—W. C. (*Hornsey*).—A bright deposit of silver may be obtained by adding a solution of bisulphide of carbon to the plating solution, but this must be used by an experienced plater if immediate good results are to be desired. You must feel your way by experience before you can make sure of getting a bright deposit on any article placed in the solution. The small copper hooks may be plated tolerably bright by first paying attention to the preparatory polishing. Get them bright, and then only deposit a thin film of silver on them. A thick coat will be dull on leaving the vat, and must be polished afterwards. Unless I saw the hooks, I could not say whether it was practicable to polish them or not.—G. E. B.

Incandescent Electric Lamp. — Electric. — A complete illustrated description of an incandescent electric lamp was published on page 428, Vol. I., of Work. There will be more about these to follow in due course of time. The lamps cost from 4s. 6d. to 5s. each, and can be had from any dealer in electrical sundries.—G. E. B.

Dog Kennel.—(*Coatbridge*).—The best kind of dog kennel is patented, so that to describe it would be useless. Surely if you can manage to do the necessary carpentering you do not require a description of such a simple thing as a dog kennel.—D. D.

Polish.—A. R. (*Gravesend*). — Get some good black stain, such as is used by French polishers. Stain the wood with it, and when dry the articles only require to be polished in the ordinary way. With small round articles you will get better results by polishing them while in the lathe. You cannot do better than use beech, though almost any kind of wood will do. Use up waste bits unless you have a great number of knobs, etc.—D. D.

Ebony Stain.—A. G. P. (*Hastings*).—You will find it much better to buy this than to attempt to make it, both on account of price and quality.

However, if you wish to try proceed thus: Boil some logwood chips in water to make a strong decoction which must be applied warm to the work. To turn it black go over again with vinegar in which iron filings have been left for some time. The acid you allude to is probably hydrofluoric. Apply to any chemist for quotation.—D. D.

Water Motor. — W. H. H. (*Huddersfield*).—Messrs. Gwynne & Co., engineers, Hammersmith, London, may supply what you require.—F. C.

Frame-Making Tool. — READER. — What the trade usually use for frame making are: (1) Mitre-cutting block for roughly cutting the moulding at 45°, and tenon saw; (2) shooting-block and plane for planing the angles; (3) a vice, bradawls of various sizes, a hammer, glue pot, glue, and brads of all sizes. In regard to Booth's mitre-cutting machine, I have it, and find it a very good, compact machine; it does its work well, and dispenses with block and shooting, etc., as also the cramps: they have their good sides as well as faults. All sizes would be required, as a 4 in. cramp would not grip 1¾ in. stuff. Syer's patent also does its work admirably well. But, for to supply you your answer complete, and upon more practical judgment, I have been in two of our largest frame-making factories, where I saw from fifteen to twenty men joining up frames, and they all agreed nothing beats the old-fashioned blocks and vice as first above detailed. These men get paid so much per hundred frames, and they consider it a bad week if they do not each one make 700 to 800 frames, about 1 in. wide. You may with practice do the same with either tools, as what one likes best one can handle most dexterously and expeditiously.—G. R.

Books on Frame Making. — THEO. — I know of no book of complete instruction on picture framing, and all its branches; I think none exists. Practice with your tools would make great advance. For photo stands, try Houghton's, High Holborn, London.—G. R.

Mounting Velvet. — W. W. (*Elswick*). — The best method to mount velvet on cards:—Glue the card over with strained glue and a good brush, so that the hair does not come out; let it lay a second so that the glue does not get through the fabric if thin; lay stuff on card, and rub gently down the way of pile; then trim round centre and outside, and snip cuttings about half inch apart; then glue close round centre and outer edge, turn bit by bit over, and stick down. In fastening plate, either glue to rim or you can get some brass tags at ironmongers', which you could screw on by sticking a block of wood on reverse side, where screws would pierce; by this method plate can be removed at will.—G. R.

Steel Castings. — FREEMASON. — Try Samuel Osborne & Co., Clyde Steel Works, Sheffield, or Hadfield's, Hecla Works, Sheffield. But there is such a pressure of business just now that firms will not look at orders that they would accept at other slacker times. Even orders weighing in the aggregate several tons have to bide their time for execution. I do not know anything of the demon motor. Why not write to the advertiser?—J.

Tinplate Churn.—J. F. (*Elgin*).—I give you herewith sketches and dimensions of a churn that I think will suit you; it is exactly like one I made a few months ago for a dairyman, and it gives great satisfaction. You can, of course, vary the sizes to your liking. Fig. 1 shows a general view of it; you will see that it is D shaped, with a foot fixed on, flat cover, and cranked handle. To make it, proceed as follows: Take two 20 by 14 plates and square them up to 13¾ by 15, set your compasses to 6⅞ in., and make a line 6⅞ in. from one end of your stuff, and from this line describe an arc or semicircle; this will give you the shape of the sides. Mark them both exactly the same; notch the top corners the same as you would a saucepan for wiring, then turn up an edge all round (except the top) on both of these sides; now bend a strip of zinc round inside the edge just thrown up; this will give you the length to cut the body piece. I forget the exact length, but it is easily ascertained. This you will have to make in two pieces; they will be, as you see marked in sketch, 7 in. wide. Groove them together, and well and smoothly solder, bend round to shape and tack to one side; tack in several places, and then slip on the other side and tack that in the same way; then solder them all round, wire the top with about No. 9 wire, and the body is completed so far. The part that forms the foot will scarcely need much explanation to one in the trade; it is made in four pieces, wired round the bottom and soldered to the churn body. Make a rim for the cover 1¼ in. deep, and throw off an edge of ¼ in.; pane your cover on to it and solder all round inside, to prevent the cream getting between the rim and the cover. The wire of the body and the foot also would be all the better for being soldered round. Make a handle for the cover as shown, and let it be a good width and size and solder it on; this handle will, when fixed on, materially stiffen the cover and assist in keeping it flat, as square covers like this have a tendency to wind or warp, as no doubt you are aware. This completes the description, with the exception of the dasher and spindle. To make the arms of the dasher you will want eight pieces of tin 1½ in. wide, and a little less than the diameter of the churn measured across the centre line, say 13 in.; now fold four of these pieces in the machine or on the hatchet stake as if you were going to wire them; then cut $\frac{1}{16}$ of an inch off the other four pieces and fold them in the same manner; they will then be just the size to slip in the other pieces, forming a kind of flat tube, as it were; make two of these and then halve out the other pieces to lap across them so as to make two crosses. Before forming any of these pieces, punch a $\frac{1}{16}$ in. hole through the centre of each piece for the spindle to go through, then solder all up and ram a little paper down each end, and solder the ends; be sure to get them water-tight. Then make eight similar pieces to connect the two crosses with—these need not be cut quite so wide; when made, fix them as shown in sketch, one about ¼ of an inch from the end of crosspieces, and the other 2 in. apart from it (see Fig. 2); all this must be fixed exactly square and true, or it will not work properly. Through the holes just mentioned slip a piece of tinned brass tube $\frac{7}{16}$ in. inside; let it project ¼ of an inch one side and solder just flush on the other side of dasher, and on the side where the tube is left flush solder a tinned brass or iron nut tapped $\frac{7}{16}$ in.; this nut should be ¼ in. thick, and you must so regulate the length of the short pieces connecting the two crosspieces, that the dasher, when fitted up as just described, will just slip easily between the sides of the body, so as to leave as little side play as possible. The bushes for the spindle to run in are the next consideration, as one

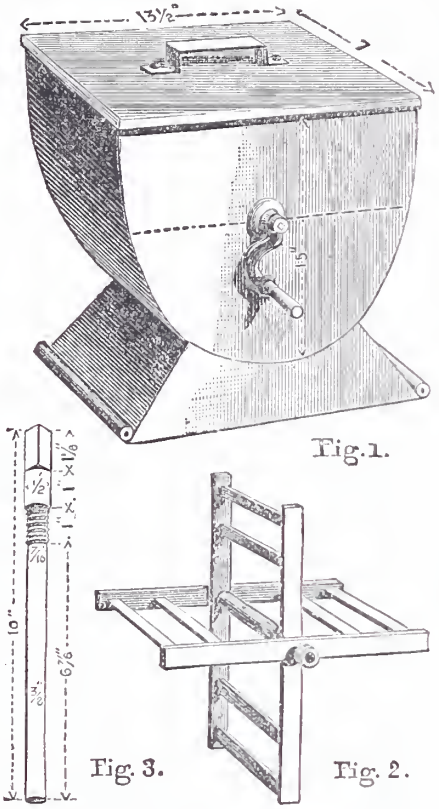


Fig. 1.—Churn. Fig. 2.—Churn Dasher. Fig. 3.—Churn Spindle.

end of the spindle will be ¾ in., and the other ½ in.; get two pieces of brass tube that will just allow those two sizes to slip in; a good fit must be made; it would be best to have it rather tight and grind in with emery powder. These pieces of brass tube need only be ¾ in. or ⅞ in. in length. Then take two pieces of sheet brass $\frac{1}{16}$ in. thick, cut two circles 2½ in. in diameter, and drill two holes in them, one for each size tube, and solder them in, letting them go ⅛ in. through the brass plate. Now make corresponding holes in the churn body—the centre mark where you struck out the body will be your guide; be very careful to get the holes exact or it will not work properly. Then fix the bushes in, the long part of the tube outwards of course, and solder round inside and out. Now the spindle: this should be cut 10 in. long out of ½ in. round iron; you will, I expect, have to get it made (see Fig. 3); let 6⅞ in. of it be turned down to ⅜ in., 1 in. with a thread to fit the nut in the dasher; 1 in. to fit the largest bush, and the remainder squared up for the handle to fit on. The handle calls for no further remarks than that it may be fixed on by drilling a hole in the spindle after tapping it on lightly, and putting a pin through the hole. Both handle and spindle should be tinned. To set working, simply place the dasher in the churn, put the spindle through, wind it into the nut on the dasher till it comes to the shoulder at the end of the thread, when you will be able to turn it round. When done with, hold the dasher with an end, and unscrew the handle and spindle with the other. I hope this description is full and plain enough. I might have given more details, but must have some regard for the space in "Shop" and our Editor's request to be brief.—R. A.

Fixing Lamp.—PEEPING TOM.—I should not use a lamp in a workshop that had a glass reservoir for fear of accidents, especially if my hobby were wood working, as yours is. A good back lamp to hang on the wall with an inch burner can be bought for 1s. 6d. or less, but, in any case, you will want your reading lamp mended; so here is a cement that is said to be impermeable by petroleum or kerosene. Boil three parts of resin and one of caustic soda in five of water; this composition forms a soap which, when mixed with half its weight of good plaster of Paris, forms a strong cement which sets hard in three-quarters of an hour (Spon's workshop receipts). I may say that I have many lamps pass through my hands to set in their sockets and to set the tops on, and I never use anything but best fresh plaster and mix to the consistency of cream. I carefully clean all paraffin from the parts to be united, roughen the nib of the lamp with a fine file, and very, very seldom have one back again. I have two lamps in use that were set three years ago, and are as firm as ever, showing that if properly used there is no better and more convenient cement than plaster of Paris and water.—R. A.

Tinplate Patterns.—J. G. (*Tottenham*).—This correspondent asks to be informed of the easiest way of getting out patterns for tin and zinc plate working. If J. G. had specified the kind of pattern he required, I would have tried to accommodate him, but to fulfil his request I should have had to write a book. I think readers of WORK should exercise a little discretion, and remember that while information on points of practice will be willingly given, it is too much to ask questions that to answer would involve a descriptive account of a whole trade or profession. To give the best answer I can to you, however, let me say that patterns of most articles in general use will be described and illustrated in the pages of WORK in due course; also that if you will specify what you are really in want of I will do my best to give you advice as far as the limits of "Shop" will permit.—R. A.

Cast Shadows in Sign Writing.—G. E. D. (*Watlington, Oxon*), J. J. D. (*Bournemouth*), B. W., and E. G. H. (*Minehead*).—When drawing the letters which appeared in my article on "Sign Writing" (see page 713, Vol. I.) I was fully prepared to receive the strictures which others and yourself have made regarding the cast shadows. The fact is that no attempt at true perspective was made, but a purely conventional rendering of the same was followed. The cast shadows as shown in diagrams sent by yourself, B. W., J. J. D., and others, is in perfectly true perspective, and, as I have said, mine is a conventional rendering of the shadows only. I have already pointed out in my earlier chapters that true perspective should not be followed in sign-writing practice, and gave there my reason; at the same time, some sign writers put in the cast shadows as pointed out by you in your diagram, whilst others follow my method as shown in my letters. It is, in fact, a matter of taste and not a question of true perspective, nor a geometrical problem. Mr. W. Sutherland has defended this same subject long before to-day, and in one passage he says, "It is said in reference to picture painting that we should paint objects as we see them, and not as they really are. Neither the one nor the other of these propositions apply to letter painting, because we do not paint them either as we see them nor as they are, but as they best answer our purpose." The kind of shading shown in my letters gives to them force and distinctness, and answer every purpose, whilst in many cases, if the true laws of light and shade were followed, there would be great loss of beauty and symmetry of appearance. I do not say my readers are wrong—for they are right—neither do I say I have made a mistake, for I had carefully studied the question long ago. If my readers wish to go further into this matter I must refer them to the *Journal of Decorative Art* for February, 1883, where they will find the whole matter fully argued.—H. L. B.

Crystoleum Pictures. — H. C. (*Todmorden*) writes:—"In the first part of his instructive article on 'Crystoleum Painting' Mr. Beckerlegge mentions cornflour for mixing of paste. I have tried cornflour mixed with boiling water, the same boiled, and have mixed a little starch with it for the purpose of affixing photo pictures to glasses. Each attempt has been met with failure, for when the picture and paste get dry the water seems to have been absorbed into either the paper or glass, leaving the flour on the glass in streaks. Will Mr. B. be kind enough to give me instructions how to make the pictures stick to the glass, so that when dry they will be permanently held there?"—If H. C. will ask his mother or wife, if he has one, she will show him how to make starch. Cornflour is nothing but the finest of starch; this being so, what need is there to mix "starch" with it? To make the paste proceed as follows: Take a tablespoonful of cornflour and mix it with cold water—not hot; let it be perfectly free from lumps. Pour boiling water on it, stirring it the while. This flour will make about half a pint, more or less. If the boiling water has not turned it quite clear, it means that the starch cells have not all burst. Put it in a clean pan and gently boil it until it gets clear, when it will be properly cooked. Now what does H. C. mean by the water being absorbed either by the paper or glass? The water simply evaporates, and if the work is properly done the paper when dry can only

be removed by scraping it away. I have some by me, done years before the article appeared, and the picture is as firm as enamel. The point of failure is, I suspect, here: the paste has not been properly squeezed from between the paper and glass. Until this is done the surface of the picture will appear in certain lights covered with minute silvery specks; these mean that there is not contact at these points between the two surfaces. If the picture gets dry before these are all removed, soak the picture for a few moments in warm water, and again proceed to work out the paste in the manner described in the article. Attention must be paid to the surface of the picture before applying the paste so that all grease is removed. If this is not done the picture will never stick to the glass. Has H. C. neglected this? Nothing has been discovered that will put the surface in better condition than licking with the tongue. Benzole or oxgall would do, but these are not better than the means referred to. If H. C. will look over the article again he will see that I have laid stress on these several points. If he will attend to these I am sure he will succeed. I shall, however, be pleased to answer any other question in "Shop."—O. B.

Name and Address Plates for Patented Article.—M. R. (*Glasgow*).—I should say what you require are small sheet brass plates, with your name and address stamped on from a die, and which are attached to the wooden article with two or three brass gimp tacks. If these will do, write to Mr. W. Tylar, 57, High Street, Aston, Birmingham, mentioning my name (H. L. Benwell), and he will probably supply you wholesale, or give you the address of someone in his town who executes this work. Enclose stamp for reply. These plates look neat and pretty, and may be attached to metal articles of all kinds with a little solder. I can also give you address of makers of ivory tablets.—H. L. B.

Tinsmiths' Machines.—STANNUM.—The American machines are no better in their working than our English make, and I do not think they are anything like so substantial in wear and tear. They are got up more to please the eye by appearances than for actual durability. The bar folders and paning-down machines are, as you observe, about equal. But Messrs. Rhodes & Son now make an improved paning-down machine with an adjustable table for holding the work up to the rollers whilst paning down; this, however, is more expensive than the ordinary form. I do not think there is much advantage in having a "hold down" attachment to guillotine shears when used for cutting sheet metal. It would be required, no doubt, for cloth or paper, but if it had been a necessity or even an advantage I think there is very little doubt that Messrs. Rhodes would have recognised the fact and adopted it in their machines. I think, myself, that with the machine in good order no "draw cuts" would be likely to occur. With regard to the combined paning-down and bottom-closing machine, I presume you refer to the Olmstead Leamer. This is a valuable machine for manufacturing purposes. It will set down and double seam the most difficult kind of work, light or loose bottoms, without the assistance of the hand up to xxxx stuff if the machine be properly set before commencing. It can be used for either round or oval, straight or flaring work, and though, as you say, different sized discs have to be used, it does not mean that you must use a different one for every sized article any more than you would in knocking up by hand use a different size mandrel or head, and the cbanging of a dise is a mere nothing. You ask the use of the deflector: it is to prevent the springing of the bottom after soldering. Space will not permit of further descriptions of this machine, but you can get a circular from Messrs. Rhodes, giving full particulars of its uses and directions for working. I can only repeat here what I have said before—that I have found Messrs. Rhodes most courteous to inquirers respecting their tools and machines; and if, as you say, you want to purchase machines, I am sure that if you state exactly what you require they will be very pleased to give you their advice and experience.—R. A.

Paper, Pigments, and Colours.—IRIS.—I hope the answer already given to £ s. D. will have proved worth waiting for. If you take so much interest in this and kindred subjects, why don't you master the "House-painting" series of papers? they were written for reference for all similar cases to yours. Respecting your second query, "Terra-cotta, No. 5," on Aspinall's card, is similar to ordinary oxide paint of a deep purple red tone. Three or four pounds of this dark oxide red, in paste, that is ground in oil, would do a goodly number of sashes. Care must be taken that all blisters are removed, and the sills watertight previous to painting. One coat of oxide, if properly used, would cover on any colour, but if the old paint is at all perished, you should give a previous coating of white lead paint, made to a lead colour by adding common black. If you give the sashes a final coat of "outside copal" varnish it will repay cost. If not varnishing, have the oxide mixed with driers and boiled oil with a little varnish to harden and help preserve the paint. Such colour as you indicate is very suitable, especially if you have vegetation about the house; otherwise, dark bronze green, made from green and black, or a little yellow added to black and varnished, is a good wearing treatment for sashes. Your doors, if not grained, might be in several shades of the sash colour. Panels, as sashes; styles, much darker by adding black; and the panel mouldings, black, with a very little red mixed in it, finished, of course, with a coat or two of outside copal varnish.—F. P.

Wedding-Ring Making and Polishing.—INDEX.—The inquirer asks, 1st, for method and tools to make wedding-ring; 2nd, mode of making buffs for polishing same. I will start with the presumption that you have your gold already in a strip, say one-third larger in section than your finished ring is to be. The shape in section that we desire in the finished article is as in Fig. 1, so our aim must be to get the gold as near that shape as possible. The best way is to make a swage—that is, a piece of iron or steel, with a groove cut across it the size and shape of the bolder side—then hammer the gold strip into it. If you have no swage, then get it this shape in section, *i.e.*, Fig. 2, with the corners knocked down, and from either of these conditions, proceed to draw it through a draw-plate, with holes the shape of Fig. 1. This is *not* half round, for that form is objectionable, on account of the sharp edge. In this draw-plate the gold is drawn smooth and true to the desired size either by the aid of a draw and bench, if stout, or, if

Fig. 1.

Fig. 2.

of small size, by gripping the plate in a firm vice, and pulling the wire through the holes with a pair of draw tags and by your own strength. If but one or two occasionally are to be made, then we can do without the draw-plate by paying much more attention to the form produced by the hammer, its regularity, its smoothness, etc., both before and after turning up into a ring. When the wire is the proper size, then cut it to the lengths required, and bend it up, if stout, by the aid of a bending block, ring-triblet, and mallet; if thin, then smooth pliers, or pliers protected with sheet-lead will suffice. After obtaining a good join, solder it with an alloy such as this:—1 dwt. of your 22-ct. gold, 2 grains of silver, 1 grain of copper. After soldering, get it clean in pickle (see page 649, Vol. I., of WORK), and then get it round on the ring-triblet with a wooden mallet. After that, fill it up if it is necessary, and then we can polish it. As to the emery and glue buffs you write about, I have noticed that our polishers do not use them, but prefer the tools and method as follows:—First remove all the file marks of both inside and outside with water of Ayr stone and water; secondly, obtain, or make, two buffs, one flat and one round, for the inside of the ring. These are only buff leather glued to sticks, either of round or flat wood as the case may be. With these, which are charged with powdered pumice-stone and oil, or crocus and oil, we get a nice smooth surface. Next clean the ring by washing in soda and water, or anneal it. Then gild or colour, and finish by burnishing with a steel or stone burnisher, lubricated with soap and water. These are but the steps and names of tools and material, which will probably suffice, as you are a watchmaker. If the description is not clear enough, write again for the particular details you want to know, and I'll do my best to explain more fully.—H. S. G.

Telephone Communication.—E. P. B. (*Penge*).—I am very sorry that I cannot answer your questions fully in this column, for the simple reason that it would occupy too much space. I will, however, try and set you right in a few points. You ask, "Can a microphone be used to intensify transmittal of speech?" In a telephone circuit the microphone is the transmitter of speech, or any sound, for that matter, made in its vicinity. The intensity of the sound, in ordinary circumstances, is more directly dependent upon the receiver. Generally speaking, the sound made at the

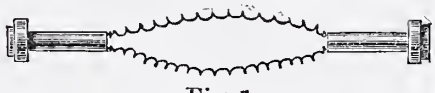


Fig. 1.

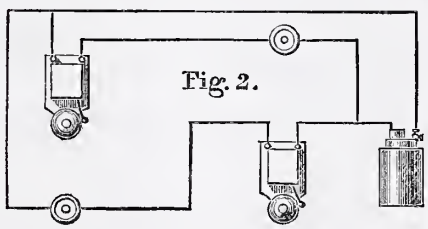


Fig. 2.

Fig. 1.—Telephone Circuit—Two Receivers to be used alternately for Speaking and Hearing. Fig. 2.—Bell Circuit, showing Method of connecting up for Reply, using one Battery only.

transmitter is loud enough, but the receiver sometimes has a very bad fashion of whispering so low that it is almost impossible to hear it. Hence we have loud-speaking telephones—*i.e.*, receivers which speak out well the words spoken at the other end. I have already given sketches of connections between the various parts of a telephone circuit in WORK, which you should look up and apply to your own instruments. Receivers are not generally used to speak into, as you seem to think, in telephonic systems; in fact, the term implies the very opposite. In the meantime, I would advise you, if you intend to set up communication between two rooms in your house, to make two receivers like those figured and described in WORK, and join them together, as Fig. 1, and use them alternately as transmitter and receiver. For the circuit you must use covered copper wire. If the receivers are well made they should speak well enough for your purpose. You could run another wire between two bells for calling attention alongside your telephone wire. In the bell circuit you must have a battery and two pushes (see Fig. 2). This is the best I can do for you; in the meantime, see replies to other queries about switch board, etc. I cannot tell you the best tool to bore telephone cases in the lathe, but I think the method described in the article is simple enough, and suits the purpose.—W. D.

Paints and Varnish for Tin Ticket Writing.—A. S. G. (*Hull*).—Write to Messrs. Brodie and Middleton, oil and colourmen, Long Acre, London. The tin tablets you refer to are mostly printed in enamel by special machinery and then stoved. If you refer to such as grocers use to place on their goods, a mixture of paint and varnish is used, and Messrs. Brodie and Middleton will supply with the suitables for your purpose both in colours, varnishes, and brushes.—H. L. B.

Sketch of Initials.—F. J. (*Preston*).—If you refer to any ornamental copy book, which can be bought for 2d., you will find the letters you require in various styles. Copy those. Possibly you will be able to work them into a monogram.

Steam Launch.—Will B. F. (*Birkenhead*) kindly send his full name and address to the Editor of WORK?

Scene Painting.—REGULAR READER (*Dalston Lane*).—Doubtless some papers on "Scene Painting" and other stage matters will be given if it is found that there is sufficient demand for them. Write to S. French, 89, Strand, for 6d. handbook on the art.

Gilding on Glass and Embossing.—A PAINTER.—It would occupy two or three pages of WORK to give even the simplest instructions in this art, so in these columns it is impossible. Doubtless some practical and illustrated papers on the art will be supplied when the Editor can find room for them.—H. L. B.

New Buckle.—F. H. A. (*Ajmere, India*).—The notice of your buckle duly appeared in No. 49 of WORK.

Firewood Manufacturing.—ANXIOUS.—There is an excellent machine for bundling firewood, which has already been noticed in WORK—the Excelsior bundler, Glover & Co., Potterdale, Leeds; but a simple contrivance of rope and lever is often used, and while the lever is strained over the bundle the string is tied by hand. The machine tiers, I believe, use wire. This is not quite the place to fix the workman's wages, but it ought to depend on the sort of appliances provided by the employer.—B. A. B.

Chucks.—T. D. (*Keighley*).—The chucks used on the self-fitting joiner's braces are composed of the jaws, and the male and female screws which contain them. New jaws can be had to fit joiner's braces at any good tool shop for 1s., and the complete chuck is made in varied sizes and prices, and I have bought an excellent one at Melhuish's, Fetter Lane (who advertise in WORK), for a small sum. I expect you will have to get it in the form of a universal tool handle. Circular saws of the same firm, or of dealers in metal goods and tools for jewellers, as the size given is very small.—B. A. B.

Trade Usages.—INQUIRER.—I know of no book that will give you any information on the above. There was a good old custom of allowing the men a certain amount of time during the morning for lunch. I have made inquiries amongst men who have been in the trade a long time, but, as far as I can make out, the usages generally took the shape of "horse play;" for instance, if an apprentice left his saw standing in an unfinished saw cut, and it was noticed, he would most likely find the handle covered with dirty oil, paint, glue, or any other substance that the practical joker might find handy. Of course I have from time to time heard of a good many old-fashioned usages, but as I could not vouch for their veracity, I do not feel justified in quoting them. But if I hear of anything that I think might interest you I will let you know forthwith.—E. D.

Composition for Panels.—WAITING.—Your first note was duly answered in "Shop," shortly after your second note was received. I do not think your first question corresponded with the one now under notice. In reply to the latter I do not know of any substance you are likely to succeed in "moulding upon paper or cardboard in imitation of lincrusta," unless it be gesso, of which I cannot personally speak. The articles which appeared in Vol. I. on this kind of work will doubtless give you all the information thereon you require. You are not likely to succeed with what you mention. I think you are occupying yourself with anything but a commendable notion, and will find you may spend much time and trouble, and get nothing worth preserving. Surely there is a better direction for your personal tastes and energies than in

making or attempting poor imitations of a *machine*-made article.—F. P.

Violin Rib Bending. — CATGUT. — The only useful instruction which I can give you through "Shop" is that you must clean up the rib strips, and afterwards bend them to the required shape over hot irons; the details of the process will be described in the proper place.—B.

Lamp Burner.—READER FROM THE START.—In view of the present controversy I should be sorry to say definitely which is the best lamp burner, but I presume you only require a burner to fit a lamp fount you already have. In that case I shall have no hesitation in recommending Hinks' No. 1 patent safety duplex burner, which, in my opinion, far surpasses those of any other make, that can be fixed to an ordinary fount. It has a bar fitted across the bottom, to put a suction wick in, which facilitates the oil being drawn up to the two wicks that are lit; the extinguisher is also very good. The price, I believe, is 6s. 6d. or 7s.—T W.

Developing Dry Plates.—C. W. (*North Tawton*).—(1) Keep the plate well covered with developing solution, and moving it about during the time it is in contact with the film. (2) Yes; after the development is well advanced, not before—the less the better; wash the developer off before holding it up to the light, or marks of irregular development may be caused. (3) It is a good developer, but with some plates carbonate of soda is better than ammonia. Do not hurry the development, give plenty of time, and expose to the light as little as possible during the operation.—D.

Umbrella Sign.—W. J. B. (*Bermondsey, S.E.*).—If you wish for an enlarged drawing of the small umbrella engraving you send, you must get a draughtsman to make it for you, as such things are not sold, there being no possible use for them.—H. L. B.

Sign-Writing Book.—J. R. B. (*London, S.E.*). AN ADMIRER OF "WORK," and A. R. (*Saltaire*).—"The Art and Craft of Sign Writing," price one guinea, *The Decorative Art Journal* Publishing Co., 15, St. Ann Street, Manchester. The publishers notify that there are but very few copies of the work left, which cannot be reprinted.—H. L. B.

Mounting Drawings.—G. B. (*Accrington*).—Your inquiry is somewhat disjointed: first, you inquire about picture *framing*, then your query resolves itself into how to mount *pictures*. I suppose you mean drawings, lithographs, etc.—in fact, productions whose base is paper; it is as well to inform you that in the trade we understand *pictures* to mean paintings on canvas, *drawings* to be (as I before said) anything sketched on paper. Now to mount your paper drawing, first lay down with drawing pins on a bench or board a piece of 6-sheet common mounting board, which you can obtain at any stationer's; then take your drawing, and with a clean sponge damp the back—I say damp, I mean do not drench it; the effect will be that in a few minutes the paper will expand; you then paste (still at the back of drawing) about ¾ in. all round (not all over), then lay it down on the mounting board, just carefully pressing with a silk handkerchief all round the edges; the next thing to do is just allow it to dry very gradually; do not hurry it; you will then find it strain as tight as a drum-head. To make a more finished effect, you can now cut an opening in an 8-sheet white board, just sufficient to show the drawing; the edges of the opening should be cut on the bevel; this you should glue with thin glue; place over your drawing, and put in a press or under a weight till quite dry.—F. B.

Copper Analysis.—F. N. (*Smethwick*).—Native copper—that is, pure copper—is found in veins disseminated in granite in Cornwall and North Wales; but the most abundant English ore of copper is copper pyrites or yellow copper ore, which is a double sulphide containing copper, iron, and sulphur, and is generally associated with arsenical iron pyrites, tin-stone, quartz, fluor-spar, and clay. A purer variety of pyrites is peacock ore, or variegated copper ore, which is found at St. Austell and Killarney. Another abundant ore is grey copper ore, which is a compound of the sulphides of copper and iron with those of antimony and arsenic; but it often contains lead, zinc, and sufficient silver to render the extraction of the latter a matter of great importance. Another important Cornish ore is copper glance, a chemical compound of copper and sulphur, which is generally free from other metals. Red copper ore differs from the preceding ores in being free from sulphur, consisting of copper and oxygen; and green malachite, which is, however, not abundant in England, is a basic carbonate of copper. These are all English ores, but we also import copper sand, a mixture of metallic copper and quartz; and indigo copper, so named from its dark blue colour, from Chili; and also blue malachite from Australia. The following table will show you the proportion of copper in the above:—

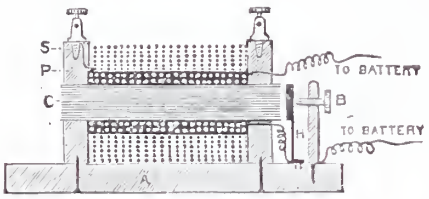
Ore.	*Composition.*	*Copper in 100 parts of pure ore.*
Red copper ore	copper, oxygen ...	... 89
Copper glance	copper, sulphur ...	... 80
Indigo copper	copper, sulphur ...	... 97
Copper pyrites	copper, iron, sulphur	32 to 35
Peacock ore	copper, iron, sulphur	... 56
Grey copper ore	copper, iron, sulphur, antimony, arsenic	25 to 40
Green malachite	copper, oxygen, carbonic acid, water	... 58
Blue malachite	copper, oxygen, carbonic acid, water	... 56

F. B. C.

Induction Coils.—W. D. (*Belfast*).—"Intensity Coils: How Made and Used," by Dyer, is published by Perken, Son & Rayment, 99, Hatton Garden, London, and is sold by all booksellers and opticians at 1s. Order it from a bookseller. It is a thin book, only weighing 4 oz., so could be sent by post for 1d. extra.—G. E. B.

Model Dynamo. — AN INQUIRER. — Most certainly there must be a definite proportion between the various parts of a model dynamo. The weight of iron in the field magnets should be from seven to eight times the weight of that in the armature. The wire on the field magnet cores of a shunt wound machine must be longer and finer than that on the armature: the resistance of the first being in the proportion of 400 to 1 of the latter. In a series wound machine, the resistance of the wire on the field magnets should be two-thirds that on the armature. Small machines must be worked rapidly to get any useful effect. Get Mr. Bottone's little book on "The Dynamo: How Made and Used." It is a good book for learners such as yourself.—G. E. B.

Galvanic Coil. — IKY MO.—Make the core of your coil out of a bundle of fine iron binding wire soaked in paraffin wax. This goes inside a paper tube forming the body of the bobbin. On this, wind two layers of No. 18 silk covered copper wire to form the primary wire. Wrap a fold of silk ribbon round this, and then fill up the bobbin with No. 36 silk covered copper wire wound on evenly as a reel of cotton is wound. Attach one end of the primary wire to the foot of brake spring, as shown in sketch. The other end



Galvanic Coil.

of this wire goes direct to the battery. A wire from the battery goes to the foot of the brake pillar, as shown. The two ends of the secondary wire are attached to the feet of binding screws fixed in the bobbin ends. The secondary wire is not fastened to the primary. Your coil when thus wound will not be a very powerful one, but should give smart shocks. Get Dyer's book on Coils (price 1s.) if you cannot await my articles on this subject.—G. E. B.

Electro-Motor for Lathe. — R. N. (*Grays*).—Space cannot be spared in "Shop" for detailed instructions and necessary illustrations showing how to make an electro-motor. To make an electro-motor capable of driving your 3½-in centre lathe, I should advise you to get a set of castings of the "Simplex" pattern, to the following dimensions:—core, 4½ in. by 8 in.; armature of cogged and laminated plates, 6 in. in diameter and 2in. in length. The core should be wound with 20 lbs. of No. 20 double cotton-covered copper wire, and the armature with 4 lbs. No. 16 double cotton-covered copper wire.—G. E. B.

Electro-Magnet. — G. W. (*Folkestone*).—It is not necessary to get a larger magnet to pull 1 oz. at a distance of ½ in. The bell magnet of a 2½ in. bell will do the work if you put on enough battery power. It is weak because your battery power is weak. Increase the number of cells in series, and then you will probably get the power that you require. If your cells are small, and the magnet is not improved by adding to their number, unwind the wire on the magnets and wind on a wire one or two gauges finer, so as to get more turns of wire on the bobbins. To get the full power out of a piece of iron, it should be wound with wire to within three times its diameter. Then the magnetic power developed will be equal to the ampères of current sent through the coil multiplied by the number of convolutions of wire wound on the core. 5,000 ampères will fully magnetise 1 cubic inch of iron, and this should then hold up 120 lbs.—G. E. B.

Book on Scales and Weights. — F. A. C. (*Appledore*).—Get "Oldberg's Manual of Weights, Measures, etc.," 9s., Trübner & Co., Ludgate Hill, London.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. G. M. (*Bow, E.*); J. W. H. (*Bradford*); W. J. L. (*Deptford*); W. M. (*London, W.*); UT PROSIUM; J. S. (*North Shields*); HANDY; A DELUDED INVENTOR; J. L. (*Peckham*); J. L. D. (*Ballytrophy*); D. B. (*Glasgow*); T. C. (*Aberdeen*; W. H. H. (*Huddersfield*); P. W. (*Ashton-under-Lyne*); W. J. M. (*Hampstead*); MIEUX QUE QA; J. W. (*Middleton*); J. W. (*Stoke-on-Trent*); H. E. (*Clapham*); NED (*Tynemouth*); PRACTICAL; W. D. V. (*Abingdon*); W. W. P. (*Glasgow*); A. E. W. (*Birmingham*); H. W. (*Caton*); F. C. J. (*Masboro*); T. F. (*Wellington-on-Tyne*); MONUMENT; T. E. C. (*Liverpool*); SQUARE CENTRE; I. J. W. (*Merthyr Tydvil*); H. M. (*West Ham*); T. R. B. (*Newcastle-on-Tyne*); J. F. (*Glasgow*); W. H. E. (*Kensal Green*); A. P. (*Frome*); W. B. (*Preston*); J. H. (*Leeds*); C. E. W. (*Birkenhead*); W. J. T. (*Swansea*); W. H. (*Bristol*); J. K. (*Islington*); W. H. H. (*Chancery Lane*); R. A. (*Islington*); J. W. (*Middletown*); W. M. B. (*Reading*); F. S. (*Northumberland*); G. T. (*Plymouth*); G. E. S. (*Berkeley*); AMATEUR; F. T. R. (*Cardiff*); W. H. C. (*Tipton*); G. B. W. (*Hammersmith.*)

"WORK" EXHIBITION
(1890-91).

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in page 290 (No. 70) of this Magazine:—

For Design for Medal.

FIRST PRIZE	Two Guineas.
SECOND PRIZE	One Guinea.
THIRD PRIZE	Half-a-Guinea.

For Design for Certificate.

FIRST PRIZE	Two Guineas.
SECOND PRIZE	One Guinea.
THIRD PRIZE	Half-a-Guinea.

If any Competitors wish to submit a Model in Clay, Plaster, Wax, etc., as a Design for Medal instead of a Drawing, they are at liberty to do so.

Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

Prize Competition. Medal (or Certificate, as the case may be.)

A Motto must be affixed to each Drawing, and the name and address of the sender enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted to three competent judges, who will select those that are considered most worthy of prizes.

The Prize Drawings will become the property of Messrs. CASSELL & COMPANY, Limited, who will return all Designs made by unsuccessful competitors to their respective owners carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced in WORK in due course.

For further particulars, all intending competitors should apply to the Secretary, "WORK" Exhibition, CASSELL & COMPANY, Limited, as above.

Trade Note.

THE second competition for Carving and Art Wood Work, held by the Worshipful Company of Carpenters in their hall in London Wall, has just taken place, and it is satisfactory to learn that in the number of exhibits, but more particularly in the quality of the work shown, there was a marked improvement on that of last year. Money prizes to the amount of nearly £60 were awarded besides Medals, and the Company have every reason to hope that with these Competitions and the School of Wood Carving they have established at Chapel Street, Bedford Row, a fresh impetus will be given to the Art of Wood Carving in this country. The next competition will be held in June, 1891, and the syllabus of same will be duly given to readers of WORK.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£ s. d.
One Page - - - - - - - - -	12 0 0
Half Page - - - - - - - - -	6 10 0
Quarter Page - - - - - - -	3 12 6
Eighth of a Page - - - - - - -	1 17 6
One-Sixteenth of a Page - - - - - - -	1 0 0
In Column, per inch - - - - - - -	0 10 0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

Fretwork, Carving and Repoussé Work.—Catalogue of all requisites, 700 illustrations, 6d. each — HARGER BROS., Settle, Yorks. [13 R

The New Demon Water Motor, now ready. Supply pipe only ½ in. bore. One man power, 8s. 6d.; ¼ horse, 13s. 6d.; ½ horse, 18s. List, 1d. Castings supplied.—P PITMAN & Co., Aubrey Road, Withington, Manchester.

AMATEUR PHOTOGRAPHY.—J. H. SKINNER & CO., *Manufacturers, East Dereham, Norfolk.*

J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description, from the cheapest to the most expensive. The process is simplicity itself. Full instructions supplied with each set.

CHEAP SETS FOR BEGINNERS.

3/6 The Eclipse Camera Set. 3/6
Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6
Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6
Including Polished Mahogany Camera, with Folding Tailboard, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at 20 per cent. to 50 per cent. discount to clear. Send post card for Sale List.

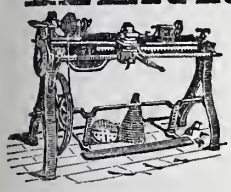
New and Enlarged Edition. CLOTH, 3s. 6d.

COLOUR. A Scientific and Technical

Manual treating of the Optical Principles, Artistic Laws, and Technical Details governing the use of Colours in Various Arts. By A. H. CHURCH, Professor of Chemistry in the Royal Academy of Arts, London. With *Six Coloured Plates.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets, containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

Monthly, ***4d.***

Cassell's Time Tables.

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Post Free on Application.

CASSELL'S Classified Catalogue.

FOURTH EDITION. *Price* 7s. 6d.

Practical Electricity: A

Laboratory and Lecture Course, for First Year Students of Electrical Engineering, based on the Practical Definitions of the Electrical Units. By Prof. W. E. AYRTON, F.R.S., Assoc. Mem. Inst. C.E. With *Numerous Illustrations.*

Cassell & Company, Limited. Ludgate Hill, London.

NEW AND ENLARGED EDITION, price *1s.*; or in cloth, *1s. 6d.*

Photography for Amateurs. A

Non-Technical Manual for the Use of All. By T. C. HEPWORTH. *With Illustrations.*

Cassell & Company, Limited, Ludgate Hill, London; and all Booksellers.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). ***An Archimedian Drill,*** with brass handle and Three Bits, will be ***SENT GRATIS*** with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, ***EAST DEREHAM, NORFOLK.***

Kindly mention this paper when ordering.

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,
TOOL MAKERS,
DUBLIN.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6d. OR FOR 7 STAMPS.
BIRMINGHAM. [33

London Warehouse: 124, NEWGATE STREET.

Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic WEAKNESS speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,
President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS
Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be Healthy and Strong permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,
52, OXFORD ST., LONDON, W.
(Corner of Rathbone Place).
All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

NEW SERIAL ISSUE. In Monthly Parts, price 7d.

British Battles on Land and Sea.

WITH ABOUT

800 ILLUSTRATIONS.

Part 1 ready August 26, 1890, including, as a PRESENTATION PLATE, *a large Tinted Engraving of*
"THE BATTLE OF TEL-EL-KEBIR."

"As good a boy's book as we could wish to give to the best boy we know is 'British Battles on Land and Sea.' We feel sorely tempted to lay down our pen and read the book through, from the very first page to the last. That the boy who once gets it into his hands will do so we feel very certain."—TIMES.

Prospectuses at all Booksellers', or post free from
CASSELL & COMPANY, LIMITED, LUDGATE HILL, LONDON.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE
"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 75.] SATURDAY, AUGUST 23, 1890. [PRICE ONE PENNY.

A PLAIN CABINET BOOKCASE.

BY DAVID ADAMSON.

GENERAL CHARACTER AND STYLE OF BOOKCASE — DIMENSIONS.

TURNING over in my mind which of various articles of furniture will be most suitable for description without being able to arrive at any decision, and giving expression to my thoughts, a voice from one who is near and dear to me suggests that "our" bookcase would be a good subject. As the question with me had almost resolved itself into a tie between the bookcase and something else, it requires only a hint to turn the scale in favour of the former. The other will be described in due course.

I do not know that anything need be said about the delights of a well-filled bookcase, for in these days of cheap literature, those who have any taste for reading know the pleasure which is derivable from a bookcase—or, rather, from its contents. It may, however, be suggested that even a bookcase can be put to other uses than its nominal one, for the lower cupboard, having wooden panels in the doors, may be made available as an enclosed sideboard, the upper portion, with glass doors, being reserved for books. The cabinet bookcase is, indeed, contrived "a double debt to pay," if desired: a thing for use rather than for ornament alone. The contents are the decorations, but they must not be spoiled in appearance by an ugly setting.

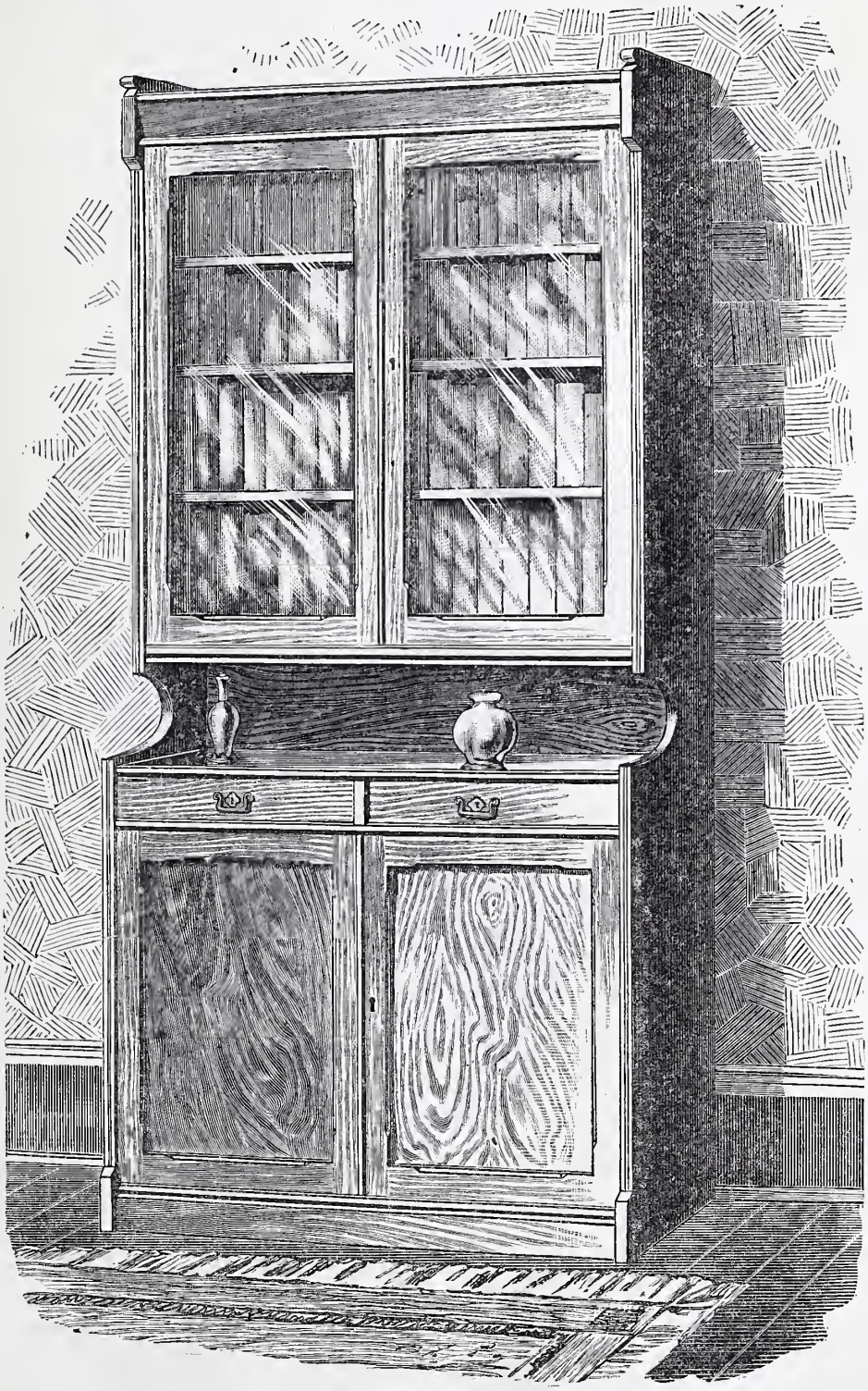
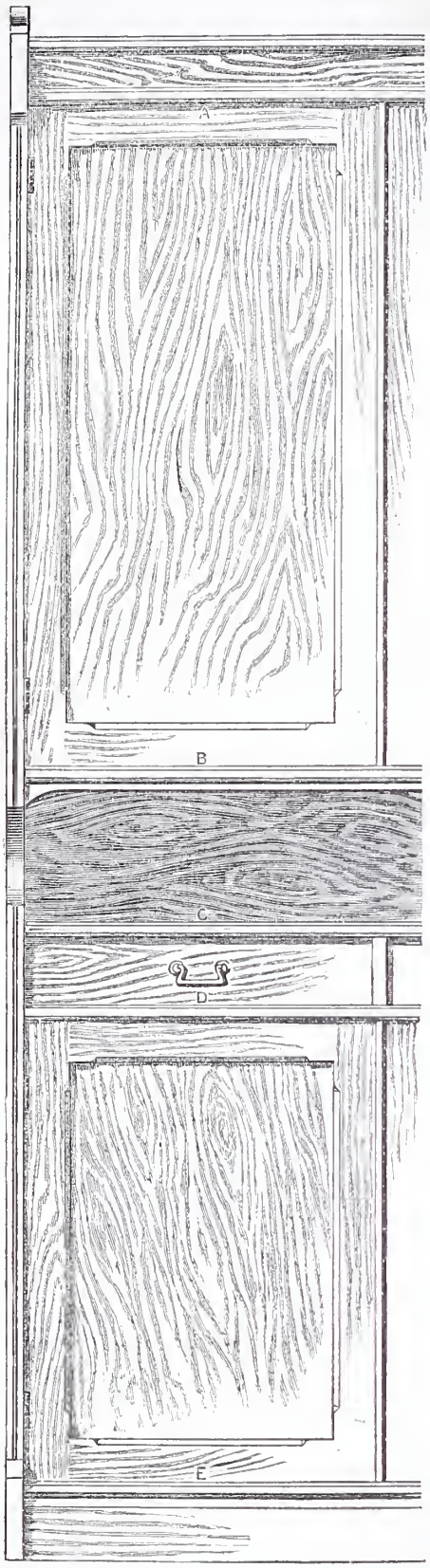


Fig. 1.—Perspective View of Bookcase.

Of course, in the drawing the bookcase looks so plain as to be almost bordering on ugliness; but then, in the drawing we have not the marvellous ever-changing play of reflected light which, in itself, forms an important feature in any piece of polished woodwork. I do not now speak about figure or variety of texture in the wood, for as it happens, in this particular bookcase it is ebonised or blackened, so that the surface is uniform. The play of light to which reference has been made is, therefore, an important feature—though may-be an accidental one—in the decorative effect of any plain piece of furniture. The same remark applies to any woodwork painted in self-colour without graining. I am tempted to enlarge on this a little, as I am convinced that comparatively few people have given the subject the attention it deserves. Of course, to treat it in these pages — devoted, as they are, to purely practical work—from a scientific point of view, would be somewhat out of place, and perhaps it is scarcely necessary to do more than allude to it. We may be unconscious of the effect—or, let me say, of why the effect — is produced on us when we view a piece of plain furniture. It may have looked nothing in the drawing, absolutely nothing but an orderly

arrangement of straight lines; yet, when the thing is made no one seems to think it so very plain, after all. Why? Simply because the texture—if I may so call it—of the smooth flat surfaces is not monotonous. As we ourselves alter our position, so does the quality of the colour vary. But perhaps some may say, If the thing is black, it always looks black; and, without contradicting them, I would merely suggest that they should make a practical trial with such a thing as an ebony round ruler. True, it is black, but a long line shows white, or it may be only grey if the polish is dull and the light the same; still, whatever it is, it is lighter in appearance than the part which is in the shade or away from the light. You don't see it: you don't see the light, I mean. But surely you see the shine in one part? Yes. Well, that is the reflected light, which I claim plays such an important part in all plain furniture. Call it shine or reflection—it does not matter which—the fact is the same. Even if we would, we cannot—even in such artificial things as articles of furniture—annul the beauties which Nature lavishes on us, though we may ignore them through mental blindness—or, worse, through wilfully refusing to see them. Instead of acknowledging that the chief charm about a plain undecorated wooden contrivance is due to the natural effect of light, we are, perhaps, rather too apt to attribute it to the artistic skill of the designer. I sometimes think we strive rather too much after effect in our furniture, and so, by our efforts, defeat the ends in view. However, this is merely a suggestion, which, though it is quite consistent with the fact that plain furniture is not often considered ugly—indeed, more often is considered æsthetic (I use the word in its true sense)—may not meet with universal approval; but I trust enough has been said to show that the bookcase in question is agreeable to look at. Of course, tastes vary, and it is not to be expected that it will please all; but remembering that the furniture described is, as the title states, easily made and cheaply produced, no great scope is available for mere decoration. This must give way to utility and soundness, for, whatever else is sacrificed, these two qualities should not be. It is owing to neglect of this fundamental principle that we see so much bad work. There is too much attention paid to mere ornament, and too little to honest construction. Of course, ornamentation is all very well in its way, but the cost of production is increased thereby, so that, when decorative details are a *sine quâ non*, something must be sacrificed. Unfortunately, this something is too often structural. In the bookcase under consideration nothing whatever has been thrown away on decoration. It is simply a useful piece of furniture, which its very homeliness invests with an attraction not always found in more pretentious work.



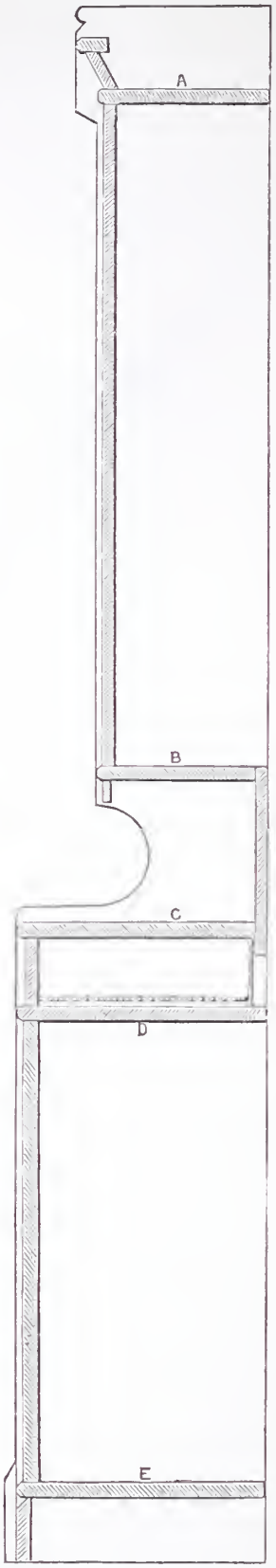


Fig. 2.—Front Elevation (letters show corresponding parts. Scale 1 in. = 1 ft.).
Fig. 3.—End Elevation.

By Fig. 1, which represents the bookcase pictorially or in perspective, it will be seen that the ends are flush from top to bottom; there is no cornice at the top, nor plinth at the bottom, projecting from them. The reason for which is, that the bookcase was originally made to fit into a recess, and cornice or plinth would have prevented its ends fitting close to the wall at the sides. As much space as possible was wanted in the bookcase—or, in other words, it was wanted as large as it could be. To have made a cornice in the usual way would have rendered it necessary to reduce the width of the carcase, or body, of the case some three to four inches. By adopting the straight ends, this additional space is gained, and, moreover, a piece of furniture made so can be closely fitted within the space intended for it. A bookcase made in the ordinary way with cornice might be placed within a recess, but can scarcely be said to fit. But perhaps it may be thought that such a formation at the top would be unsightly if the bookcase is to be placed against a flat wall instead of in a recess. If so, I can only say that the appearance is merely a matter of opinion, and that, personally, I see no reason why a bookcase or similar piece of furniture—such as a wardrobe—should have, of necessity, a moulded cornice on the ends. Those who think they would like to have a cornice will have no difficulty in forming one according to the method described for the overmantel shown in Vol. I., page 25. If, by the way, the two things are to be in the same room, it will be just as well to keep to the same general features in any cornice that may be adopted.

In the meantime, as it is the earnest endeavour that this series of furniture should be as widely useful and suggestive as possible, let it be supposed that the bookcase is to be made as described. If any worker of average intelligence should then be unable to modify details according to his special liking or the necessity of individual cases, it will, probably, be owing to his not having given sufficient attention to the subject.

As Fig. 1 gives a general idea of the bookcase, Figs. 2 and 3 will be at once recognised as the front and end elevations, which are almost self-explanatory. In order to economise space, only a little more than one-half of the former is given—just sufficient to include the division between the two drawers. The other half, of course, is identical, the division between the drawers, or, the same thing, the edge of the doors, being the central line. As these diagrams are drawn to inch scale—*i.e.*, each inch in them represents 1 ft. of actual measurement with a pair of compasses and a rule—it will be easy to see that the dimensions over all are as follows:—Height, 8 ft. 4 in.; width, 4 ft.; depth from back to front on upper part, 11 in.; depth from back to front on lower part, 1 ft. 4 in. To the top of the drawers the measurement is 3 ft. 5 in., the open space above them being 9 in. high. A bookcase made to these sizes will be found a very useful one, space permitting; but before going any further, a few general remarks, for the benefit of those who want to depart from them, will not be amiss. As every one must be aware, bookcases are made in almost any size, but one to the design given could hardly be made either much larger or smaller without modifying the details very considerably. It would not do, for example, to make the bookcase as shown 6 ft. wide, for the simple reason that two doors in such a width would be not only inconvenient, but unsightly. It would be altogether better to have three, but as it is beyond the present purpose to describe a 6-ft. bookcase, nothing need be said about the arrangement.

Perhaps it may be as well to explain, for the benefit of all amateurs, that the size of a bookcase is ordinarily understood, technically, to refer to its width only, other dimensions being either understood, or, if exceptional, expressed in figures separately. Thus when we speak of a 3 ft., 3 ft. 6 in., 4 ft., or any other sized bookcase, none but those unacquainted with furniture would understand that the measurement referred to anything but width across front. But reverting to sizes for which our design is suitable, let it be said that 5 ft. is the utmost. Even this will be fully large for it, and, unless for particular reasons, 4 ft. 6 in. will be better for the limit. For smaller sizes than 4 ft., we are not bound by the same considerations, though it will need very little perception to see that if made much less one drawer will be better than two. Roughly speaking, I should advise only one drawer for a bookcase, not more than or anything under 3 ft. As it is in 4 ft. size, it may have only one drawer without this being very unwieldy. Perhaps this will be as appropriate a place as any to suggest that, if desired, the drawers may be omitted altogether, the lower part then being a plain cupboard only. If made without drawers, the top of the cupboard may with advantage be a little lower than the height named for it. For a very small bookcase, *i.e.*, one not exceeding 2 ft. 6 in., one door instead of two to each portion would be an improvement, but such a narrow case is so seldom wanted that this may almost be left out of consideration.

With regard to height, it need only be said that 7 ft. 6 in. to 8 ft. 6 in. may be regarded as suitable, and that the measurement to the top of the drawers is rather more than usual, owing to large cupboard accommodation having been required.

The depth from back to front of the top portion will, of course, be determined by the size of the books to be placed in it, and remembering that almost $1\frac{1}{2}$ in. will have to be deducted from the available space for these—or, as it may otherwise be stated, that the width of the shelves will be $1\frac{1}{2}$ in. less than the depth of the end—these may seem too small for large books. The shelves will be $9\frac{1}{2}$ in. wide, and this will take a good-sized book: for instance, WORK.

Have I forgotten the back of the bookcase, as no allowance has been made for it when giving the width of the shelves? No; for the simple reason that there is no back. The wall against which the case rests serves for this, so a back as part of the bookcase itself is not part of the specification. But some may object to a bookcase without a back, and, if so, they will surely find no difficulty in putting one on without directions how to manage it. I may, however, remind those who think the bookcase will look incomplete unless the back is enclosed that when the books are in nothing can be seen there. The open space between the upper and lower cupboards may seem an innovation to some readers who have been accustomed to see bookcases as they are usually made, with the upper portion immediately above the lower. Though not so commonly met with, bookcases with recess, as in our model, occupy a regular place in furniture, and, even were it not so, there is no good reason why this arrangement should not be adopted. Everybody knows that the lower cupboard of a bookcase is usually deeper from back to front than the upper, so that there is a narrow space in front of this on which anything may be placed. As, however, the glass or upper doors swing within an inch at most of this shelf or top, they cannot be opened unless it is cleared. Of course, those who regard their books merely as ornaments, and seldom take them down, will not regard this as an objection; but people who are in the habit of constantly using their bookcase do not care to be always removing and replacing the odds and ends which lie on the projecting top. Perhaps it may be said, Why have such things on it at all? and it must freely be conceded that without them the objection, slight as it may be, cannot be urged. The ledge, however, forms such an apparently suitable place for a few nicknacks—specimen glasses holding a flower or two, or such-like things, with which one cannot very well find fault—that it is generally encumbered. By raising the glass doors to a good height, and leaving a space between their lower rails and the top of the cabinet, or lower cupboard, we can get to the books without disturbing anything on it. The wide open shelf, however, is convenient for many purposes, both useful and ornamental, so that nothing more need be said in its favour. On the other hand, it might be, and sometimes is, objected to on the score of the enclosed space for books being curtailed. That it does reduce the accommodation behind the doors cannot be denied, and it must just be for the maker—or, rather, for the users—of the bookcase to decide which form he, or she, will find the most useful. Both are good, and I do not wish to at all imply that one is in any way better than the other. Each has advantages of its own, as I have endeavoured to point out for the consideration of those who may find the suggestions helpful, and having said this, we may proceed to the construction of the bookcase, taking it first as it stands, and then giving whatever suggestions may seem necessary for alternative details.

BRICKLAYERS' WORK.

BY MUNIO.

ARCHES.

AN arch may be defined as a curved beam composed of wedge-shaped materials, the joints of which are so constructed, that by their mutual pressure the weight is distributed throughout the whole of them. It is, therefore, important in designing an arch that its form, and the materials of which it is composed, should be carefully calculated in respect to the weight which is to come upon it.

The lowest point in an arch is called the springing, and the highest the crown; the under-side is called the soffit, and the centre brick at the top the key; the supports from which the arch springs are called the abutments; and when a number of arches are in a range, the pillars supporting the centre arches are called piers; sometimes the arch bricks are called voussoirs, the lower part of the bricks the intrados, and the upper part the extrados. Arches are built of various forms; those used in brick-work are generally semi-circular, segmental, camber, Gothic, elliptic, and elliptic Gothic. The semi-circular arch is half a circle; the segmental a portion of a circle less than half; the camber is very slightly curved on the underside; the Gothic is struck from two centres; the elliptic is half an oval; and the elliptic Gothic is struck from four centres.

Arches executed in brick-work are plain arches, cut arches, and rubbed and gauged arches.

PLAIN ARCHES.

Plain arches are those in which the bricks are not cut or moulded to the radius of the arch. Arches of large span, bridges, vaultings, &c., are executed in this manner. These arches are built in half-brick courses which are not bonded together, the number of courses being proportioned to the load the arch is to sustain. The centres for these arches should always be set on double wedges, so that they can be slacked as soon as the arch is keyed and backed up, in order that the joints may settle before the centre is finally removed; the brick-work should be made of uniform thickness, for it is evident that if one course has thicker joints than another, there will be unequal settlement, and the arch will be thrown out of form. After the centres are removed, the joints in the soffit are raked out and pointed.

The arches of bridges, and other work exposed to the weather, generally have a covering of asphalt spread over the crown of the arch, to prevent water soaking through and washing the mortar out of the joints.

When culverts or barrel arches are built in embankments, or where earth is to be tipped on them, the arch should be backed up solid to the level of the crown, and a good depth of earth should be barrowed on the top and at each side, as, if the embankment is tipped directly on them, the arch will be crushed out of shape or broken in.

Arches for fire-proof floors are turned in half-brick courses between iron girders, then backed up level with the crown, and the floor laid upon them, as shown in Fig. 33. These floors are also constructed in one solid mass with Portland cement concrete, iron rods being fixed across them at intervals to tie the whole together.

Trimmer arches are also turned in half-brick courses, a springer is nailed to the trimmer joist, and the arch is turned from this to the chimney breast, backed up level, and the hearth laid upon it; this method is

much less liable to fires than laying the hearths in wooden boxes: the joists should be strutted and bolted together, to prevent the arch forcing the trimmer joist away from the breast.

Cut Arches.

Cut arches are those in which the arch bricks are cut to a mould made to the radius of the arch by means of the brick hammer and chisels; they can therefore be set with much thinner joints than plain arches, generally about $\frac{3}{16}$ in.; the bricks are sometimes cut before being burnt, and when burnt, are pared, to remove any inequalities caused by burning; they are also called axed arches.

Rubbed and Gauged Arches.

Rubbed and gauged arches are those in which the bricks are first cut and then rubbed till they are perfectly true with the mould; the face is first rubbed true on the rubbing-stone, then one bed rubbed square from this; the brick is then set on the bedding stone, and the mould marked on the two faces; the lines are then notched in with the saw, and the brick cut to the lines; the remaining beds and soffit are then rubbed true, and tried on the bedding stone. The arches are set with very fine joints with washed putty, the joints generally being about $\frac{1}{16}$ in. thick. The bricks for this work are specially made, and are called cutters and rubbers.

Drawing Arch Moulds.

In getting out the moulds for arches a large drawing-board or table is required, large square, straight-edge, and set square, beam compasses and ordinary compasses; a lath, with a pencil fixed at one end and a bradawl for centre, may be substituted for the beam compasses.

Semi-circular Arch.

Draw the springing line A B (Fig. 34) and find the centre, C, then with the radius C A draw the semicircle A G B; set off the depth of the arch A E, and with the radius C E draw the outer semicircle E D F; draw C D at right angles to A B, and mark half the width of the key on each side of D, then divide the remainder of the outer curve into equal spaces, the same size as the key, and draw lines between the two curves, from these points radiating to the centre C. A mould cut to one of these spaces will form the mould for the arch bricks. If the outer curve does not divide equally from the key, it must be reduced a little, so as to take an extra brick in; one half only of the arch need be drawn, both sides being alike. These remarks will apply to all other forms of arches. Sometimes a circular window is inserted in a gable; the moulds for this are obtained in the same manner, except that four keys are set out: one at each side of the springing, and one at the top and bottom, and the remaining spaces divided as before. In cutting the mould the thickness of joint must be allowed for.

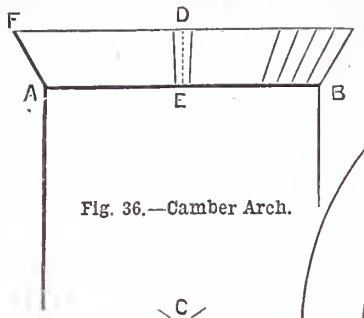


Fig. 36.—Camber Arch.

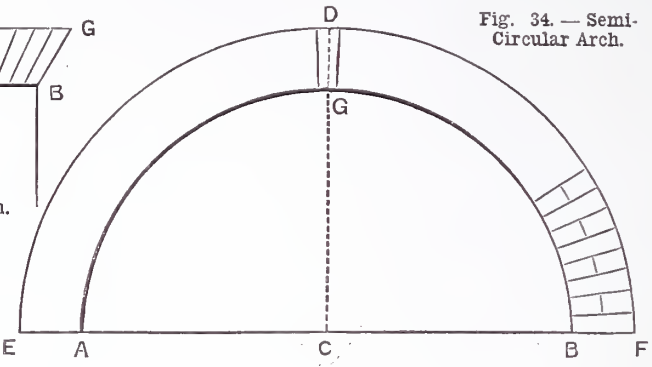


Fig. 34. — Semi-Circular Arch.

Fig. 33.—Fire-Proof Floor.

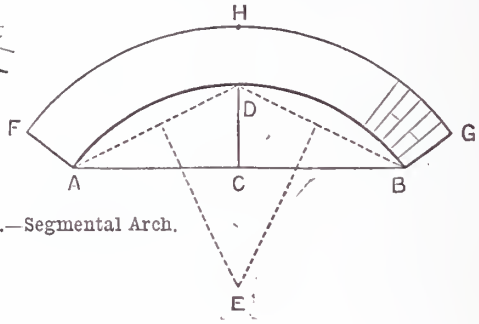


Fig. 35.—Segmental Arch.

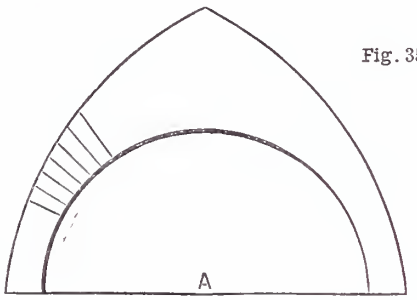


Fig. 40.—Semi-Circular Arch with Gothic Head.

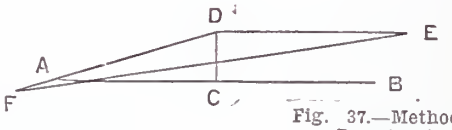


Fig. 37.—Method of Drawing Camber Curve.

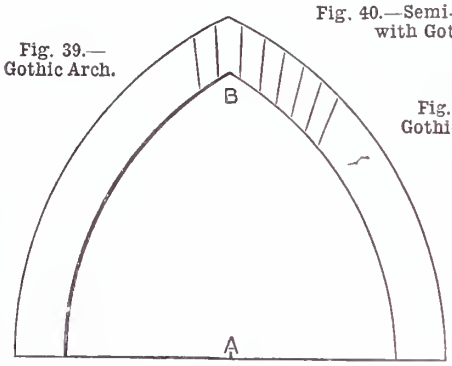


Fig. 39.—Gothic Arch.

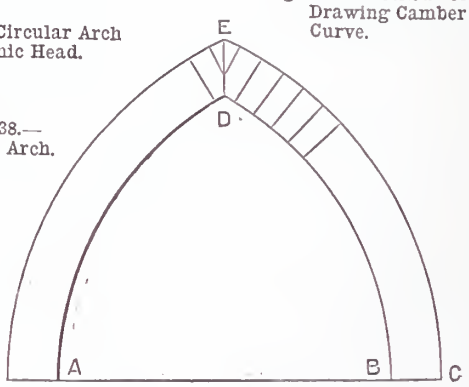


Fig. 38.—Gothic Arch.

Segmental Arch.

Draw the springing line A B (as shown in Fig. 35) and at the centre C draw C D perpendicular to A B, making C D equal to the rise of the arch; join D A and D B, and on their centres draw perpendiculars cutting each other in E; from E, with the radius E D, draw the curve A D B; draw A F and B G radiating to E—which are the springing lines or skew-backs. Make A F equal to the depth of the arch, and from the point E with the radius E F draw the outer curve F H G. Set off the key on each side of H D, and divide the remainder of the curve into equal spaces, the size of the key, as before described.

Camber Arch.

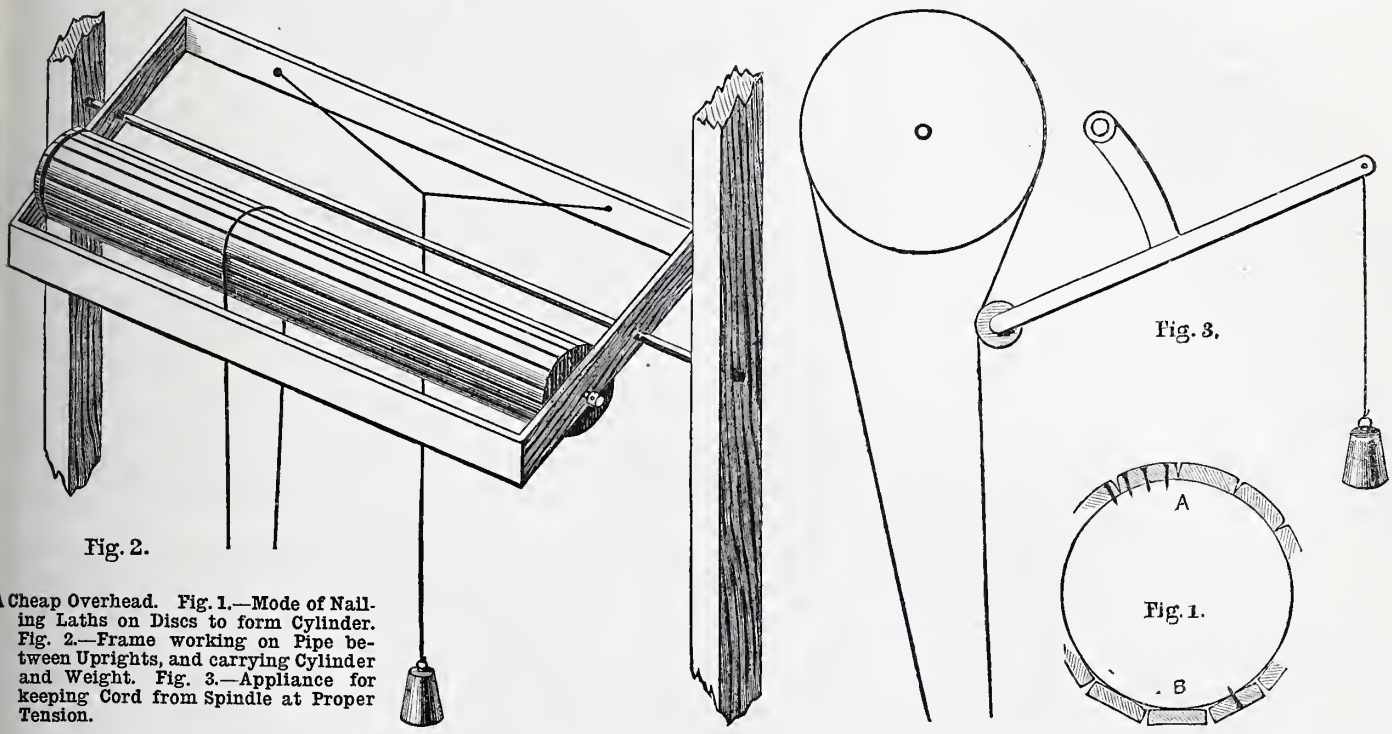
Mark the width of the opening A B (Fig. 36), and with the radius A B, and the centres A and B, draw arcs intersecting each other in C; draw A F and B G radiating from C, which will form the line of skew-back; set off the height of the arch, and draw the top line F G, then with the camber slip draw the soffit line A E B; if the camber slip is not at hand the curve may be drawn in the following manner, as described by Mr. Nicholson in his work on arches; draw the springing line A B (Fig. 37), and mark C D equal to the rise of the arch; draw D E parallel to C B, making D E longer than C B, draw D A F equal to D E, and join F E; cut a mould to the triangle F D E. Fix a bradawl at A, D and B: lay the sides D F and D E against the bradawls at A and D, and with a pencil point fixed at D, trace half the curve from D to A; move the mould against A and B, and trace the other half of the curve; this method may be used for any curve of long radius. Having drawn the curve, set off D E (Fig. 36) perpendicular to the springing line, and mark half the key on each side, and draw lines radiating to C, cut a mould to these lines, making it 3 in. longer at top and bottom, and mark the soffit line on the mould; lay the mould against the line of key already drawn at one side, keeping the mark against the soffit line, and mark the next joint; move the mould to this joint and mark the next and so on till the whole are marked, keeping the soffit mark on the mould in each case against the soffit line on the drawing board: if the last brick does not fill out to the skew-back the mould may be lowered a little for the last two or three bricks, or the key may be made a little thinner, so as to fill out with an extra brick. It will perhaps be advisable before marking the joints to try the mould right through, so that if it does not fill out the lines will not need rubbing out. The bricks are cut to the mould, keeping the soffit mark to the longest corner of the brick, and marking the soffit line and top line on the bricks by means of a bevel, set to the marks on the drawing board. Half the arch only need be drawn, and allowance must be made for the joints.

Gothic Arch.

Set off the width of opening A B (Fig. 38), and with the radius A B, and A as centre, draw the arc B D, and with the same radius

and B as centre, draw A D; set off the depth of the arch B C, and with the radius A C, and the same centres, draw the two outer curves. Draw D E perpendicular to A B, and set off on each side half the thickness of key, and divide the remainder of the outer arc into equal spaces the size of the key, and from these points draw lines between the two arcs radiating to the centre A; one of these divisions will be the mould. Sometimes the whole of the joints are drawn to the centre A (Fig. 39), but when so drawn the arch is not so strong; the key at B is called a bird's-mouthed key.

Sometimes a semicircular arch is finished with a Gothic head outside (Fig. 40). In this case the soffit or semicircle is divided equally, and the joints drawn to radiate to the centre A, the key being set off in the centre.



A Cheap Overhead. Fig. 1.—Mode of Nailing Laths on Discs to form Cylinder. Fig. 2.—Frame working on Pipe between Uprights, and carrying Cylinder and Weight. Fig. 3.—Appliance for keeping Cord from Spindle at Proper Tension.

A CHEAP OVERHEAD.

BY H. A. MILES.

No amateur's lathe can be termed complete unless it is fitted with overhead motion, and though the addition of this apparatus usually adds a few pounds to the initial cost, it does not by any means follow that the humble amateur unable to afford this outlay is necessarily to be deprived of the pleasure gained by such a valuable addition to his lathe.

The intention of the writer is to show how an efficient overhead motion may be added to any lathe at the cost of a few shillings at the outside.

Overhead motion, however, is of but little use unless the lathe has a slide rest and a division plate. True, a hand tool is sometimes employed, but it can only be used for boring or cutting rosettes, and is unsatisfactory even for the simplest work. With a drilling spindle in the slide rest, however, the range of the tool is vastly increased. Fluted work, such as is seen in table legs, rosettes, and perforations, are but a few of the ways in which plain turned work may be enriched by this means.

For the construction of this apparatus the only material required is enumerated below.

Two pieces of quartering not less than 2 in. by $2\frac{1}{2}$ in., and of sufficient height to reach from the floor to at least 3 ft. 6 in. above the lathe bed.

A piece of $1\frac{1}{2}$ in. by 2 in. stuff, about 5 in. longer than the lathe bed.

A few feet of $\frac{3}{4}$ in. stuff, in strips about $2\frac{1}{2}$ in. wide.

A length of $\frac{1}{2}$ in. iron gas-pipe (internal measurement).

A few odd pieces of some hard wood, about 5 in. square and 1 in. and $1\frac{1}{2}$ in. thick, four iron brackets, and half a dozen old Venetian blind laths.

The above will cost but a trifle if it has to be purchased new, but many readers would have little difficulty in obtaining the larger portion at the price of carrying it home.

The material to hand, we will begin by erecting the two uprights, one on each side of the tool-board, and about 3 in. behind the lathe bed; these should be firmly screwed to the tool-board, and bound to the iron standards near the floor by strong wire or hoop iron. A cross-piece must now be fixed a few inches from the top; this may be screwed on or fitted tightly between the uprights, and fixed with brackets. The best way, however, if the maker is a carpenter, is to mortice them together before fixing up.

Now cut a piece of gas-pipe of sufficient length to pass through holes bored in the uprights about 2 in. below the cross-piece. This is the pipe on which the overhead frame swivels.

The length of the pulley will have to be governed by the capacity of the lathe: thus a 3 ft. bed would take about 2 ft. between centres, and this would be found quite sufficient for all purposes.

Cut a piece of pipe the full distance between centres, and bore holes through the centres of the pieces of hard wood, which must be roughly fashioned to a circle, and then rammed on the pipe, one an inch or so from either end and intermediate pieces about every 6 or 7 in. If these fit loosely a cut nail may be driven in between the disc and the pipe, which will key them up tight.

Put a carrier on one end of the pipe and turn up all the discs between centres, making a V-groove on one of the end discs to receive the cord from the driving wheel.

The frame on which to build up the cylinder is now ready for the laths; these must be cut into strips about 1 in. wide, and nailed on to the discs, as shown in section in Fig. 1. On the two outside discs three nails should be used to each strip (gimp pins are best), so as to bend the strips as nearly as possible to a curve (as shown at A, Fig. 1); but on the others put only one nail in the centre (as in B, Fig. 1), and it will be found that the projecting edges of the joints will offer a better hold for the driving cord than a smooth round surface would.

Now take some of the $2\frac{1}{2}$ in. by $\frac{3}{4}$ in. stuff, and make a frame about 18 in. deep, and wide enough to take the pulley cylinder when swung on two steel-pointed screws driven through the sides of the frame; a glance at Fig. 2 will show how this is made. The corners are strengthened by iron brackets. Half-way on each side bore a hole through which you can easily pass the iron pipe you put through the uprights, and half-way between this and the front put the steel-pointed screws on which the cylinder revolves.

The cord from the driving wheel is kept tight by means of a weight, W, suspended from the hind part of the frame.

The cord from the spindle in the slide rest to the overhead is kept at the proper tension by the appliance shown in Fig. 3.

This is merely a piece of wood with a pulley at one end which presses against the cord, and a weight at the other connected half-way to a perpendicular piece which hinges on the iron bar (a piece of tin plate bent over the bar and nailed to the wood effects this). The apparatus is now complete, and if the weights are properly proportioned, will be found as effective as many at a much higher figure.

The weights, which may be any old castings or scraps, should be suspended at a short distance from the floor, so as to make little noise if the cord breaks.

The best material for the latter is lathe

cord, about fifty yards being sold for 2s. 6d.; this can be neatly spliced, thus preventing undue jumping over the pulleys. If a cheaper material be preferred, white linen blind cord, twelve yards for 6d., is very serviceable, and can be joined by laying two ends together and binding with wire; the edges must not be overlapped, and then bound, as it would make the spindle jump, even if it did not get off the pulley with every revolution.

I think I have made the description plain, but if any difficulty should be found I will reply to querists through medium of "Shop."

PRACTICAL DETAILS OF BOOKBINDING.

BY GILBERT CLARKSON.

TREATMENT OF EDGES — SPRINKLING, MARBLING, GILDING, ETC.

THE next operation of any importance in bookbinding is the treatment of the edges, and this admits of so much diversification, that were I to go into detail respecting the edges which I have seen in my day I could fill a volume. It will be sufficient to give a general idea of the most common styles, dwelling more particularly on the two most important, viz., gilding and marbling. In colouring the edges equally over as for red edges, the book must be knocked up even at the head and laid on the edge of the press or table, the left hand holding it tightly to prevent the colour running in. The colour should be applied with a small sponge passed evenly towards the back one way, and the fore-edge the other, to prevent the colour forming in a mass at the back or fore-edge. The tail of the book is treated in the same manner as the head. For the fore-edge the boards will have to be thrown back and a cutting board held firmly above. The colour is more liable to run in at the fore-edge, therefore a little more care will be necessary. If a number of volumes are to have the same edge, they can be done by simply placing them one above the other. Sometimes binders put their books in the lying press when colouring them as a precaution against the colour running in. But I do not think this necessary.

For sprinkled edges the books may be tied up, or simply placed the one above the other. The best method of applying the sprinkle is to use a large brush similar to a painter's, dipped in the colour and knocked against the press-pin until the sprinkle becomes fine. The edge is then sprinkled by beating lightly at first, and stronger as the brush gradually loses its charge of colour, being careful that the spots are as fine as possible. I have seen binders sprinkle with a riddle and boot brush, holding the riddle over the book, rubbing the brush vigorously backwards and forwards, causing the sprinkle to pass through the riddle upon the edge below. Whether they thought this method a clever one, was always a *riddle* to me. My own opinion is, that it is a very stupid method, entailing a great amount of unnecessary labour. Another plan, but one I cannot recommend, is this: — A small brush like a sixpenny gum brush, dipped in colour, is held tightly between the finger and thumb of the left hand near to the end of the hair. The forefinger of the right hand strikes the projecting hair with a movement similar to that employed by a boy when playing a Jew's harp. The brush does not hold much colour owing to the manner in which it is held in the fingers, and the workman is obliged to keep dip, dip, dipping it in the pot every few spots he makes, and in consequence, loses a great deal of time.

One, two, three, or any number of colours may be used to the same edge, and many combinations have a pleasing effect. A great deal depends upon the taste of the workman.

Fig. 23.—Marbling Comb.

Fancy sprinkles are not much used now, so it is not worth while describing them.

A good substitute for marbling, and one which looks much better than sprinkling, is mottling. This is done with an open-holed sponge filled with colour and daubed lightly over the edge, leaving the natural marks of the sponge. The edge may be coloured all over first, or it may be mottled on the white edge alone. Red and black makes a good combination. But this style of edge is not very suitable for letterpress work, it looks its best on heavy account books. It is certainly much more beautiful than some of the outrageous Dutch marbles one sees upon this class of work.

I will now give the amateur a tip for *marbling* his edges. The amateur is not always content with substitutes, and he may not be in a position to get the necessary rig out to do the real thing, and as this comes so near the real thing, to anyone not in the secret it will pass as current coin.

Have ready a few strips of good marble paper—a little larger each way than the edges to be marbled. Screw the book tightly in the press. Dip a broad camel-hair brush into commercial hydrochloric acid (spirit of salt) and pass it quickly over the edge of the book, lay on a strip of marble paper, on the top of which place a sheet of white paper, tap the edge over gently, but firmly, with a binder's hammer. Lift off the papers, and the marble will be found to have been transferred to the edge. This operation requires a little expertness, as the acid will soon dry into the book.

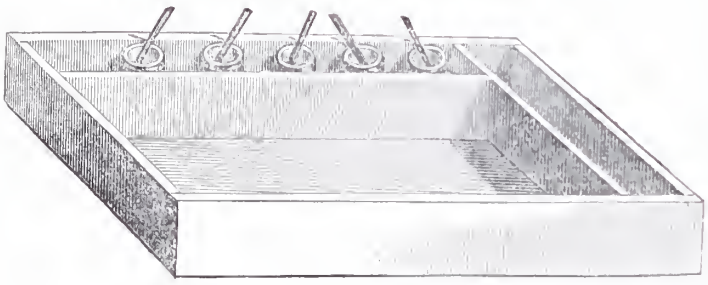


Fig. 24.—Marbling Trough.

Another ready means of marbling comes to my mind. Take a small portion of any vegetable colour, and grind it on a slab or in a mortar until it becomes very fine. Mix a little of this colour with spirits of wine, and having a vessel large enough to admit the fore-edge of the book filled with clear water, take up some of the colour on a knife, and allow it to flow gradually on the surface of the water. The spirits of wine will cause it to spread in a variety of forms. The edge of the book may be dipped in, and the result will be a nice clean edge with very little cost.

In most large towns marbling is done outside the binding-shop. Those firms which manufacture and supply marbled and enamelled papers generally keep men for the purpose of marbling edges, and binders are in the habit of sending their books to them. This is a capital arrangement, for it is not always possible for a master binder to keep a man specially for this purpose. Every binder is not a marbler. But I think that no binder, if he has the ghost of a chance to learn to marble, should allow it to pass without taking advantage of it, and for this reason I will try to be as explicit as possible in describing the process. Every detail must be carefully carried out, for if any part be faulty it will be impossible to make a good marble.

The following articles will be needed:— A shallow wooden trough (Fig. 24), a little round stick, a scraper, combs of various widths (Fig. 23), separate cups and small brushes for each colour, and other preparations, a small marble slab and muller for grinding a little colour in an emergency. The slab will be little needed, for colours can be had ready ground in air-tight jars. These, besides being cheaper, will be found to give much more satisfaction than hand-ground colours.

The size should be made with the best gum tragacanth dissolved in soft water. The usual way of making it is to put a few handfuls into a large deep vessel, such as a pail, and allow it to steep overnight. It should then be well beaten up until the whole of the gum is dissolved. A bundle of light canes tied at one end is kept for this purpose. It must be strained through a very fine sieve and should be as thick as buttermilk.

Oxgall and spirits of wine will be required to mix with the colours to cause them to spread upon the surface of the size, and to make them assume the desired pattern.

All being ready, the size is poured into the trough, and any air bubbles or froth carefully scraped off with the wooden scraper into the receptacle at the end of the trough partitioned off for this purpose.

The colours which are intended to be thrown first on the size are mixed with a little gall and water. The top colours must have more gall and a drop or two of spirits of wine mixed with them to cause them to spread and throw the other colours into veins. Should they not spread sufficiently, more gall and spirits must be added, and if on the contrary, more colour.

Suppose, for example, it is intended to make a "blue shell" marble. Take some red colour on the brush set apart for that particular colour, and tap it gently on the forefinger of the left hand, allowing the surface of the size to become almost covered, and with the yellow brush repeat the operation. Now take the little round stick, and draw it through the colour from side to side of the trough, this will make the colour take the form of lines. Take the blue brush, which in this case is the top colour, and sprinkle it over the trough as the others, this will force the other colours into veins, making a large blue shell-like spot, finish off with a fine sprinkle of gall and water, this will make a white spot on the edge.

Marbling is commenced by knocking the book up even at the head, and holding it tightly with both hands near the edge which is dipped into the size. It should be immediately withdrawn, and any size adhering should be shaken or blown off to prevent it running into the book. The tail is dipped in the same manner. The boards must be thrown back and the fore-edge flattened before it can be dipped, and immediately replaced after dipping. The refuse colour is scraped off the trough before fresh colour is thrown on.

Nonpareil is a very common marble. To produce this design, the colours are put on as directed above and drawn into lines with the little stick. A comb is then taken and drawn carefully across the colour from left to right.

Spanish marble is effected by giving the volume a to-and-fro movement while dipping. This causes the colours to appear light and dark at intervals along the edge.

The Dutch is the same as the Nonpareil, but the comb used is much wider.

An infinite variety of marbles might be added, but as the proceedings are almost the same as above described, the marbler will be able to execute any design he may fancy. Experience alone will make him successful. He will have many failures at first. But let him call to mind the lesson he learned while at school—

"If at first you don't succeed,
Try, try, again."

and summon perseverance to his aid. Failures are but the stepping-stones to success.

Gilding is the next operation to which I would refer. It may be described in a very few words which, when read over, may seem to convey the idea that gilding is a simple matter. Be assured, dear reader, it is by no means so. It is simple enough "when you know the way," to use a vulgarism. It is getting to know the way is the whole trouble. How very interesting it is to watch an experienced gilder at work! Many an hour I have stood. The gold leaf which to the tyro seems to be the most unmanageable thing in the world, is very obedient to his every movement, one would almost fancy it was conscious of the fact that he was earning his bread through its agency. The edges are scraped, black-leaded, and the size applied, the gold leaf laid on and covered with a hot plate to assist the drying with a dexterity which is simply surprising. And, although the whole thing is performed in this sleight-of-hand manner, when the final burnishing is accomplished there is neither patch, crack, lap over, or shaky bit, observable in all the edges. Many a thousand Family Bibles have passed through my hands, and although all this work was paid for by the piece, I am glad to say that I never had occasion to return a single book.

The fore-edge of the book is the first to be gilt. It is screwed up as tight as possible in the lying press, of course it must have been previously flattened between boards placed even with the edge. It must be scraped perfectly smooth with a steel scraper, and a wet sponge, with a little bole, and black lead rubbed over it, brushed dry immediately, and burnished with the agate. The bole gives a deeper appearance to the gilding, and cracks will not be so readily observed as in the case of a white edge.

The gold is next blown out on the cushion, and cut to the required size and lifted on a piece of account-book or note-paper with an even edge. To make the gold adhere to the paper, rub it over the hair of the head and press it gently on the top of the gold.

The size (which should be one part white of an egg to three parts water) must be applied evenly with a large flat camel-hair brush and the gold immediately laid on.

After the edge is dry, it should be rubbed down before burnishing, and any defects remedied.

The rubbing down is performed by placing a piece of account-book paper on the edge, holding one side of it with the fingers of the left hand, and burnishing the edge lightly, moving the paper up and down to see how the work is progressing. After this has been successfully accomplished, rub the edge with the heel of the hand, or with a piece of waxy leather kept for this purpose, and burnish the edge until it is perfectly clear and uniform all over. The head and tail of the book are gilded in like manner and with similar precaution.

Gilding, although a very high class method of treating book edges, can be and is, greatly improved upon. There is, for instance, gilding upon red edges, which goes by the term "red under gold," seen to advantage upon those fine pocket Bibles already alluded to in these articles. Then there is what is termed "tooled edges," and when gold of different shades is used in the tooling a very rich effect is produced. There is also gilding upon marble edges, which, although but rarely seen now, was one time considered the "ne plus ultra" of edge treatment.

BRASS: ITS ANALYSIS.

BY "CHEMICUS."

Brass, practically, is an alloy of copper with zinc, and sometimes small quantities of tin. Occasionally, however, the metals lead and iron are present, the former either as a constituent or an impurity, and the latter always as an impurity.

Before proceeding with the description of the analysis of the alloy, which is based upon the supposition that the afore-named metals, and they only, are present, we would make a few remarks on the ignition of the precipitates. As generally performed, the filter-paper containing the precipitate is dried in the water oven, the dried precipitate detached from the filter-paper, the latter ignited separately, the ash added to the precipitate, and the whole then ignited. In general practice the following method may be substituted:—Fold the wet filter-paper containing the precipitate in the form of a cone, and place in a tared porcelain crucible, so that the base rests on the bottom, while the apex is uppermost. Ignite at as low a temperature as possible, until combustion of the paper is complete, when increase the heat to bright redness.

The above mode of ignition is, however, not possible with all the metallic precipitates, since some of them suffer decomposition upon ignition in contact with carbonaceous matter, such as the filter-paper. One instance only of this will be met with in the analysis of brass, namely, that of the lead sulphate precipitate obtained in the determination of the lead, which becomes reduced to the metallic state. The ignition of this precipitate is conducted in the following manner:—After being thoroughly washed, the filter-paper, together with its contents, is dried, the dried precipitate detached as completely as possible from the filter-paper, and placed in a suitable receptacle. The filter-paper is then rolled up into as compact a mass as possible, encircled a few times with one end of a long piece of platinum wire, ignited in the Bunsen burner, and allowed to burn itself out, being meanwhile held (by the wire) over the mouth of a tared porcelain crucible, destined hereafter to receive the bulk of the precipitate. When the last spark has died out, and not till then, the carbonaceous mass is held in the flame until combustion is complete, which being obtained, the ash is shaken out of the wire cage into the crucible, a couple of drops of nitric acid added to dissolve the reduced lead, and a little sulphuric acid added to precipitate the same as sulphate. The crucible is then gently heated until the acids are driven off, the precipitate added, and the whole ignited to redness, cooled, and subsequently weighed.

Tin.

One, two, or more grammes of the brass, as finely divided as possible, is weighed out into a large conical, covered with strong nitric acid, and digested at a gentle heat until solution is complete. When this is accomplished, to the resulting solution a somewhat large volume—say, three or four times its bulk—of dilute nitric acid—one acid to six water—is added, and the liquid heated to boiling until it is reduced by two-thirds. Twice its own volume of water is now added to the solution, the volume again considerably reduced by evaporation, the liquid diluted with a large volume of water, the whole well boiled for ten to fifteen minutes, and allowed to stand at rest until the precipitate has completely settled. By this treatment the tin is obtained as insoluble metastannic acid. After being allowed to settle, pass as much as possible of the supernatant liquid through a double Swedish filter without disturbing the precipitate, throw on the precipitate with the last portions, and thoroughly wash filter, together with contents, with water until free from acid, as determined by litmus paper. Ignite, contained in a tared porcelain crucible, the metastannic acid, at a strong red heat, whereby it is converted into stannic oxide, SnO_2, containing 78·67 per cent. of tin, and weigh as such.* If the amount of metastannic acid is at all considerable, the final ignition should be formed over the gas blowpipe.

Lead.

The filtrate remaining from the determination of the tin, which contains the remaining metals in solution, is concentrated by evaporation, cooled, and an excess of sulphuric acid added. It is then mixed with two or three times its volume of methylated spirits, and allowed to stand for some hours, until the resulting precipitate of sulphate of lead has settled to the bottom of the containing vessel. When this is accomplished, the supernatant liquid is passed through a Swedish filter, the precipitate thrown on with the last portions, and the filter, with contents, washed with acidulated water—one sulphuric acid to five water—and finally with methylated spirits to remove the acid. (On no account must the alcoholic washings be mixed with the filtrate.) The filter and contents are then ignited in the special manner described, and subsequently weighed. Lead sulphate contains 68·32 per cent. of lead.

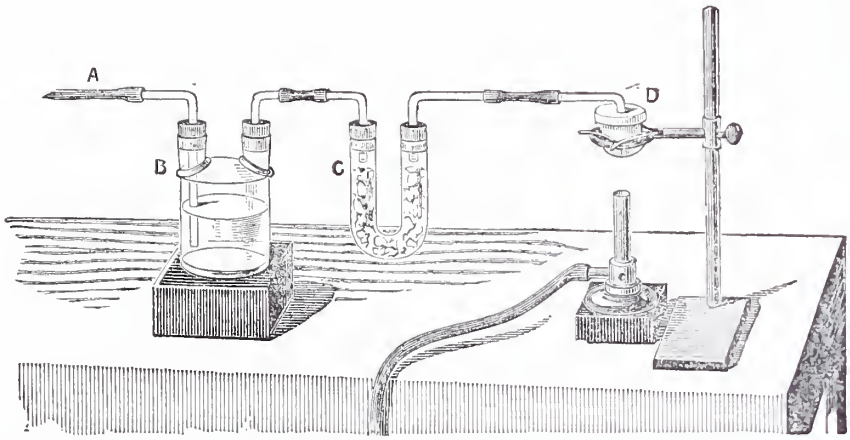
Copper.

Make up the solution† remaining after

* The weights of the filter-paper ash must be deducted from the weights of all precipitates.

† If more than one gramme has been taken for

the estimation of the lead to a volume measuring 400 cubic centimetres, and add a small quantity of sulphuric acid. (It is necessary to have a slight excess of acid present, to prevent precipitation of the zinc, as sulphide, along with the copper.) Heat the solution to boiling, and while hot, conduct a current of sulphuretted hydrogen gas through until it is thoroughly saturated, whereby the copper is precipitated as sulphide. Allow to stand for some time, collect the precipitate on a Swedish filter, and wash with water containing sulphuretted hydrogen. On account of the acidity of the solution, the whole of the copper, in all probability, will not, in the first instance, have been precipitated. The filtrate, therefore, remaining after precipitation as above is diluted, cooled, and a current of sulphuretted hydrogen gas again conducted through; the second precipitate collected, washed with the sulphuretted hydrogen water as before, and the two precipitates ignited in the following manner: Having dried the filter-papers and contents, detach, placing in a tared porcelain crucible, the precipitates of copper sulphide as completely as possible from the paper, ignite the latter separately, and add the ash to the contents of the crucible. The copper sulphide precipitate is now intimately mixed with at least twice its weight of pure powdered sulphur, and the mouth of the crucible loosely closed with a lid, through which passes a porcelain or hard glass tube, connected with a hydrogen generating apparatus. Allow the current of hydrogen to pass into the crucible for some time, until it is judged that the precipitate be thoroughly impregnated, when ignite the gas escaping at the mouth of the crucible. After proceeding thus for fifteen to twenty minutes, apply, at the first, a gentle heat to the crucible, and gradually increase to bright redness, at which temperature maintain until the flame burning at the mouth of the crucible ceases to be coloured blue (due to the presence of sulphur). When this point is obtained, remove the source of heat, extinguish the flame at the mouth of the crucible, and allow the latter, together with contents, to cool, the current of hydrogen being allowed to pass over meanwhile. Subsequently, when cold, re-weigh the crucible to determine increase due to the copper sulphide, Cu_2S, which contains 79·85 per cent. of copper.



Apparatus for Ignition of Copper Sulphide Precipitate—A, Connection with Hydrogen Generating Apparatus; B, Wolff's Bottle containing Sulphuric Acid for drying the Gas; C, Tube containing Calcium Chloride for drying the Gas; D, Tared Porcelain Crucible containing the Copper Sulphide Precipitate.

analysis, it is advisable to divide this solution into two or more equal portions, and after dilution, &c., to precipitate the copper in each in the manner above described.

IRON.

The filtrate, or, if the copper has been determined in several portions, the combined filtrates, from the above determination, is heated to boiling for some time, until the volume is considerably reduced, filtered from any free sulphur, and the iron oxidised to the ferric condition by the addition of a small quantity of strong nitric acid, and again heating to boiling. This solution* is then cooled, and after the addition of a small quantity of water containing barium carbonate in suspension, allowed to stand in a warm place for some considerable time. The resulting mixed precipitate of iron and barium carbonates is collected on a filter, washed (the filtrate and washings being preserved for the determination of the zinc), and then dissolved in the least possible quantity of hot hydrochloric acid. The resulting solution is diluted, ammonium chloride added, together with ammonia in slight excess, and heated to boiling. The precipitate is collected on a filter, re-dissolved in hydrochloric acid, and, after dilution of the resulting solution, ammonia in excess added, with heating to boiling. The iron is thus obtained as hydrated ferric oxide, free from barium carbonate. It is collected on a filter, well washed with hot water, converted by ignition, contained in a porcelain or platinum pot, at a strong red heat into ferric oxide, Fe_2O_3, and weighed as such. Ferric oxide contains 70·00 per cent. of iron.

ZINC.

To estimate this constituent to the filtrate remaining from the above determination, after concentrating, is added ammonium chloride, and a current of sulphuretted hydrogen conducted through to complete saturation, the mouth of the containing vessel closed, and allowed to stand in a warm place for some time. The resulting precipitate of zinc sulphide is subsequently collected on a filter, washed with water containing sulphuretted hydrogen, dried, removed from the filter-paper to a tared porcelain crucible, and after the addition of the paper ash, and at least twice its weight of sulphur, ignited in a current of hydrogen gas in a manner similar to the copper sulphide precipitate, and ultimately weighed as zinc sulphide, ZnS, which contains 67·01 per cent. of zinc.

* If it contains much free acid, it must be neutralised by the addition of sodium carbonate.

A MANTELPIECE WITH ITALIAN RENAISSANCE CARVINGS.

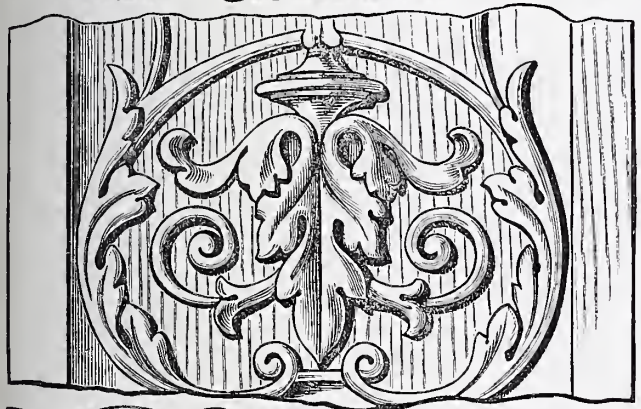
BY ALEXANDER MARTIN.

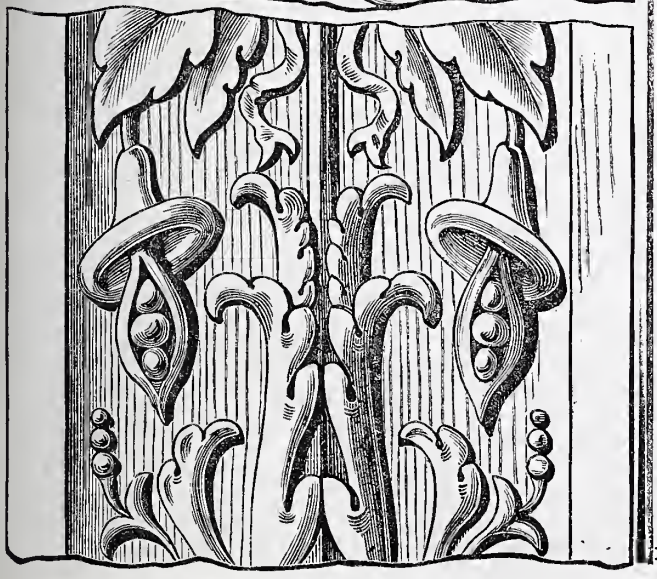
CONSTRUCTION OF MANTEL PROPER—DIMENSIONS—JAMBS—MOULDINGS—FRIEZE—MANTELSHELF.

THE corresponding pilaster should be of a different design, without being *too* much different to that shown in Figs. 2 and 3 (page 317); and this is best obtained by keeping some of the leading forms or lines similar in them both. In Fig. 4 is given three portions which may be used in place of some parts of Figs. 2 and 3. For instance, the top part of Fig. 4 takes the place of the top part of Fig. 3. The connecting scrolls being exactly alike, there need be no fear of an awkward joining. The central portion of Fig. 4 takes the place of a portion of Fig. 3 near its lower end, where the outline is the same but the detail in the centre of pilaster is quite different, and the enclosing leaf is much lighter in mass. The lower portion of Fig. 4 are set in immediately above the scrolls which rest on the vase in Fig. 2. With these three portions incorporated with the first design for pilaster, the two will then be sufficiently like, and yet unlike, one another.

With these pilasters carved, the mantel proper may now be started. The front elevation (in Fig. 1) is drawn to the scale of one inch to the foot, or one-twelfth real size. An end elevation is given, to the same scale, in Fig. 5. An enlarged plan of the jamb is shown in Fig. 6, while a section through the frieze in centre is given in Fig. 7. It is, perhaps, as well to mention here that these sections should be drawn out full size on paper or on a board, so that the exact dimensions of any piece of wood may be had when required. This, though occupying time at first, saves much time and temper in the end. In drawing out the job full size, the first thing to settle is the size of the opening for the grate. If possible, get the size of the actual grate that will be put in; but if, as is not uncommon, that cannot be determined, the next best plan is to make the opening of the mantel of such a size that will most likely suit the grate when it is placed in position. A usual opening to work to in such a case is that taken in this instance, viz., 3 ft. 4 in. wide, and 3 ft. 2 in. high. The moulding round the opening is fastened separately, so that it may be fixed to suit the grate, half an inch either further in or further out. The mantelshelf should stand about 4 ft. 3 in. from the floor; higher than this it is not advisable that it should be, and though it may be two inches lower, that is about the extent it may vary with safety.

Supposing the height mentioned (4 ft. 3 in.) be that decided upon, the jambs are formed with a frame as in Fig. 8, which will measure 4 ft. 2 in. long, reaching from the floor to under side of shelf. Each style or upright is 2½ in. broad by 1 in. thick, and the finished breadth of the frame is ten inches. These styles are of walnut, but the three rails will be quite covered up, so they may be of deal, 4 in. broad and 1 in. thick. Against this frame is placed the carved pilaster, which will be found to overlap the edges of the styles by half an inch, leaving 1¾ in. of their surface seen. The pilaster is screwed fast from behind, through the three pine rails, and is blocked up the sides of the styles as well. (See Fig. 6.) On the outer side of each jamb is now placed a piece of wood, the whole length, by 3 in. wide





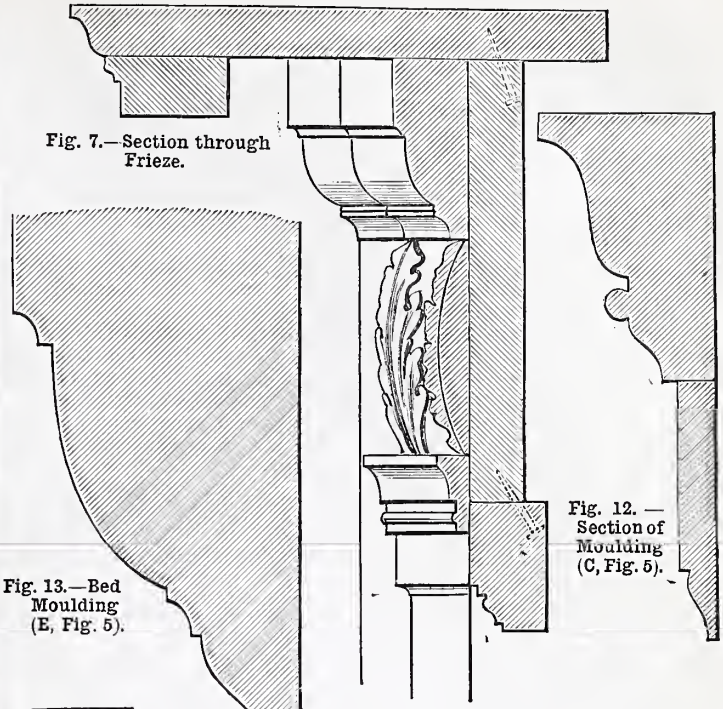


Fig. 7.—Section through Frieze.

Fig. 12.—Section of Moulding (C, Fig. 5).

Fig. 13.—Bed Moulding (E, Fig. 5).

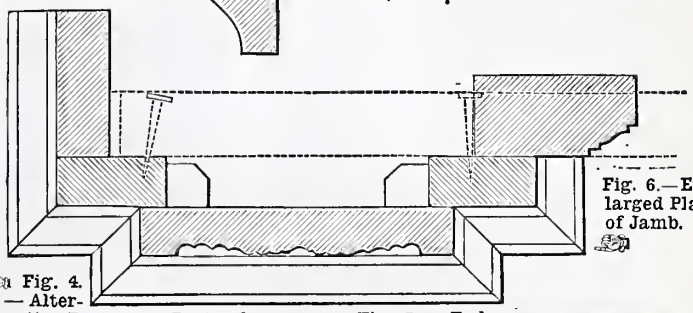


Fig. 6.—Enlarged Plan of Jamb.

Fig. 4.—Alternative Design for Parts of Figs. 2 and 3.

Fig. 5.—End Elevation.

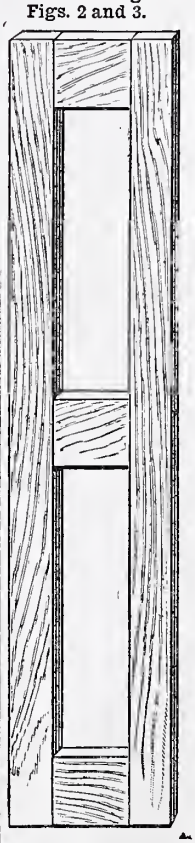


Fig. 8.—Formation of Jamb.

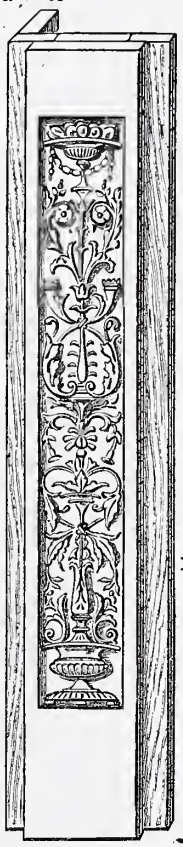


Fig. 9.—Jamb with Pilaster.

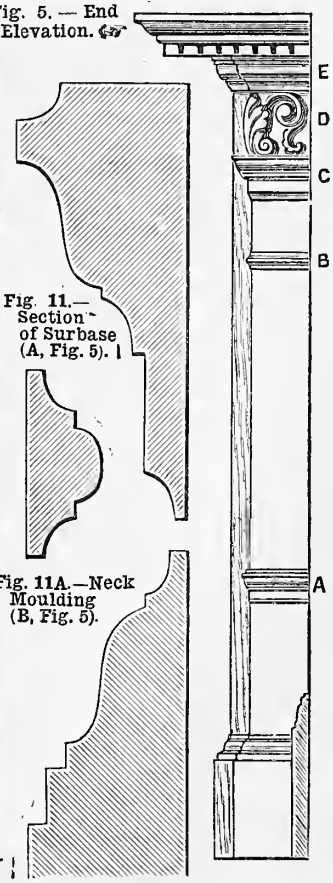


Fig. 11.—Section of Surbase (A, Fig. 5).

Fig. 11A.—Neck Moulding (B, Fig. 5).

Fig. 10.—Moulding of Base.

and 1 in. thick. This is glued and blocked fast, and the jamb now looks as sketched in Fig. 9—ready for the base and other mouldings and carvings being planted in their positions, and ready also for the deal rail behind carved frieze, which connects the two jambs together. The base is 7 in. high to top edge of moulding, and is $\frac{7}{8}$-in. thick, moulded as in Fig. 10 (drawn full size), and is mitred round pilaster and jamb, butting against the wall at the one side, and the moulding (to be afterwards fixed) round grate. It will be noticed that the piece on front of carved pilaster is carved; therefore, after fitting the base round, get this piece carved before gluing fast. The detail of this carving will afterwards be given. The next moulding is the surbase marked A. (See Fig. 5). This is given in full-sized section in Fig. 11. It is mitred round the jamb, stopping square (or "butting," as it is called) against the wall at one side and the grate moulding at other side, exactly as the base did; but it also butts against the side of pilaster, instead of mitring round it like the base. (See Fig. 1.) The pilaster is 1 in. thick, and as this moulding has less than that of projection, it will stop nicely against its edge. Passing upwards, the neck moulding (B, Fig. 5) is fitted exactly as A was; it is given full size in section in Fig. 11A. The next moulding, C, shown full size in section in Fig. 12, is fitted in its position in the same way. After marking the position of mouldings B and C, the little flutes (shown in Fig. 1) should be worked, after which the mouldings may be made fast—excepting the inner parts of C. These inner parts of C must be mitred to the moulding carried along the frieze, and as the other mouldings above this are also mitred along frieze, the deal rail before mentioned should now be fastened in position. This rail is entirely covered with carving and mouldings planted on its face; hence it need not be of walnut. It measures $9\frac{1}{2}$ in. by 1 in. thick, and is long enough to extend behind the framing of jamb, so that it may be screwed to both styles of framing. (See dotted lines in Fig. 6.) If any blocking connecting the outer gable with this frame is in the way of this rail, it should be removed where the rail interferes; it may, of course, be put in again on the top of the rail. A rough spar, about 3 in. by 1 in., should be fastened at bottom of jambs in the same way as this top rail is, to keep everything square until the job is finished. As, of course, this is merely a temporary contrivance, it should only be screwed, so that it may be readily removed when the mantel is being fixed up in its place. It will also have to come off before that; but of that more anon.

The bed-moulding, E (Fig. 5), is next mitred round all the breaks of pilaster and along the frieze; a section of the members of this moulding is given full size in Fig. 13. This moulding is $4\frac{1}{8}$ in. wide, and the members shown are worked on its lower side. The portion of moulding on front of carved pilaster is carved also, the detail of which will afterwards be given. After being fitted, and before being fastened, this carving should be done, as it will be more easily handled than when fastened in its place.

The moulding C (Fig. 5) was left unfastened to allow of its being mitred along the frieze. This is only partly carried along the frieze (the upper part of Fig. 12); the lower part stops against the grate-moulding yet to be put on. In Fig. 7 this is clearly indicated, where also is shown the moulding projecting below the bottom edge of the deal frieze-rail. When this moulding is properly fitted and fixed, the convex frieze (D, Fig. 5) is prepared. It is of wood 1 in. thick, and of sufficient breadth to fit accurately between mouldings C and E. It is convex, as shown in Fig. 7; but as in such Fig. it is shown in section, as if carved, it may be well to state that, when preparing it for the carver, it should be of section as in Fig. 14, which, to save space, is drawn only half full size. The thickest portion is the full inch, and the edges are only $\frac{5}{8}$ in. thick. The dotted line in Fig. 14 shows where the ground of the carved work will be.

In fitting this frieze, the centre piece should butt right between the framing of jambs. This part of the frieze must then be carved—or, at least, have the ground set down at each end before the adjoining parts of frieze can be fitted; for they are "scribed"

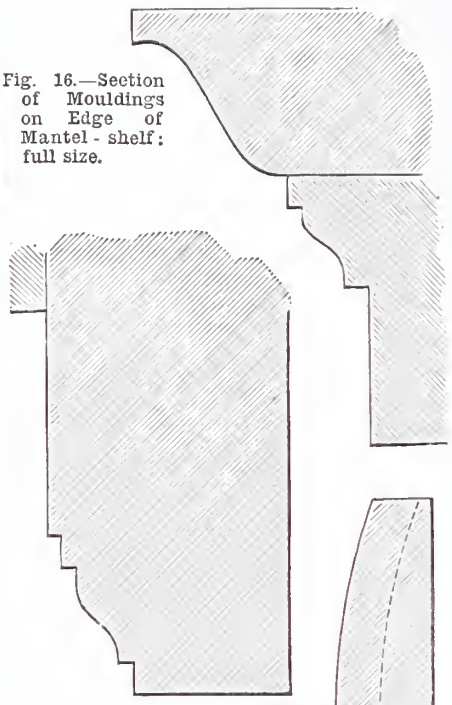


Fig. 16.—Section of Mouldings on Edge of Mantel-shelf: full size.

Fig. 15.—Moulding round Grate: full size.

Fig. 14.—Section of Wood for Frieze before Carving: half full size.

against it—that is, fitted to butt on its curved ground. This frieze is then mitred round jambs, and, when fitted, the different parts are carved and then fastened in their positions. The moulding round grate, shown in Figs. 6 and 7, is given full size in Fig. 15; it extends behind framing sufficiently to be screwed firmly to it, and it is pocket-holed, to be screwed to frieze-rail (see Fig. 7). In order to get this moulding put on, the temporary rail at foot must be removed, and afterwards fastened on behind this grate-moulding, until the mantel is fitted up in its place. This prevents any unnecessary strain being put upon the fastenings of the frieze-rail while the mantel is being handled—in polishing, etc.

The mantelshelf is the only thing required to complete the cabinet-making part of the job. The shelf itself is 11 in. broad and 1 in. thick, and has a clamped moulding $2\frac{1}{2}$ in. by $1\frac{3}{8}$ in. along its front and ends. A full-sized section of mouldings on edge is given in Fig. 16, the dividing line showing the joint of the clamp. The ogee may be worked on the end wood at end of shelf, but the clamp-piece should be mitred for the sake of the carved dentils. The shelf is secured by half a dozen screws from underneath. (See Fig. 6).

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

60.—MACPHERSON'S FOOCHOW ENAMEL.

Ever since the appearance of Aspinall's Enamel, which is reputed to have set certain enthusiastic home decorators among women "aspinalling all the day," many proprietors of paint and colour-works have been striving to the very utmost to produce something, that if it did not altogether rob Mr. Aspinall of his laurels, should, at all events, prove a competitor for public favour which should run his speciality hard, and render it a difficult matter for him to hold his own and still to keep ahead. The most successful in the competition appear to have been Messrs. Donald Macpherson & Co., of London, Manchester, and Brussels, Oil, Paint, Colour, and Varnish Manufacturers and White Lead Grinders, who have brought into the market a fluid colouring substance, apparently half paint and half varnish, which has the merit of drying very rapidly, as I can testify by experiment, hardening sufficiently in five minutes to prevent anything that touches it from being soiled by the contact, as would be the case with ordinary wet paint; and this rapidity of drying and hardening, apart from its other merits, renders this "Foochow Enamel," as it is called, a most desirable decorative medium for household use. The tints are numerous, there being no less than seventy-eight on the list of tints and sixty on the show-card sent out with specimens of the colours. "It can be used on any dry surface," to use the words of the manufacturers, "on any dry surface, greasy or otherwise, whether it be metal, wood, plaster, rubber, leather, paper, or *papier mâché*, producing a surface as smooth and as glassy as a mirror. Wainscots and cornices can be made in a few minutes to resemble mahogany, and floors to look like old oak, its rapid drying properties rendering it invaluable in this respect, as floors treated with it in the afternoon can be walked on at night without injury to the enamel." For fancy decorative work it is unique, for the plain tints may be combined with gold, silver, fire, green bronze and red bronze, colours which impart lustrous metallic effects of great beauty, contrasting pleasingly with the ordinary tints. The metallic colours are made up in bottles at 6d. and 1s., sent post free for 9d. and 1s. 3d. The ordinary colours are sent out in tins with cover that can be easily removed and replaced. The enamel must not be brushed into the material like ordinary oil colour, but must be *floated on* with a full brush and left to smooth itself, when it will dry quickly with a hard and lustrous surface. When used as a floor stain one coat is sufficient, but for painted work two or three coats are necessary, each being allowed to dry before the next coat is put on. If it is desired that the enamel should dry with an egg-shell gloss, a small quantity of any kind of oil may be added; but to produce a dead flat tint, a little methylated spirit should be used instead of oil. There is no offensive smell with the enamel, so the most delicate may use it.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Mitre Cramp.—H. B. writes, in reply to Codgeto, see page 275, Vol. I.:—"Sorry to have unknowingly copied Kildonan's principle of mitre cramp, not having seen it until you drew my attention. The block, A, must be a right-angle bisected by the saw-cut E^1 E. The size is unimportant. Mine is 8 in. from E^1 to G, and 5½ in. from E_1 to E. The sketches on page 111 are not drawn to scale but in the perspective view."

Mandrel for Lathes.—A. W. (*Cromarty*) writes:—"At page 159, J. T. refers to the cost of mandrels by Britannia Company, Colchester, a company who make excellent work and charge very high prices. Let him try H. B. Massey, Spalding, where he will get as good work at a very different figure."

II.—Questions Answered by Editor and Staff.

Attendance on Dynamos.—J. S. (*Newcastle*).—The general attention required is similar to that needed by all high speed machines. Keep all bearings and wearing parts clean and properly oiled. See to it that the driving belt is wide enough to take a good grip on the pulley, and thus maintain a good speed without undue tightness. Near one end of the armature spindle you will find a boss of brass in two or more segments, on which press lightly two strips of brass or of copper. This boss is named a commutator, and the strips pressing on it are named the brushes. These are the wearing parts of the machine. The brushes must be adjusted to the proper angle, and this is found by practice to be in that position when there is a good flow of current from the machine and very little sparking under the brushes. Sparking wears away brushes and commutator very fast. The wear of the brushes will demand frequent adjustment to keep them bearing on the best part of the commutator. When the brushes cut grooves in the commutator, it is necessary to true this part up, and sometimes put in a new one. You will learn something about the care of dynamos in Mr. Bottone's book, "The Dynamo: How Made and Used," and Mr. Croft's book on "How to Make a Dynamo."—G. E. B.

Marquetry Machine.—W. H. W. (*Leyton*).—There is no machine specially known as a "marquetry cutter," but probably you refer to some fret cutting machine for which its maker claims features rendering it useful for marquetry. I may, however, tell you that the finest marquetry work is done by hand: *i.e.*, with a frame very like that used for ordinary fretwork, but much lighter. The veneers, while being cut, are held in the jaws of a combined seat and vice, called a "donkey." If you wish to try a machine for cutting marquetry you cannot do better than try the Britannia Co's. No. 8 fret saw.—D. A.

Mattress and Bedding Books.—R. B. B. (*Edinburgh*).—There is no book specially devoted to this subject, which even in ephemeral literature has been strangely neglected.—D. D.

Bookcase.—Constant Reader.—An illustrated article describing the construction of such a piece of furniture as you describe appears in this number of Work—D. D.

Clock Materials.—For these go to Mr. Barton, watch material dealer, etc., 31, Williamson Street, Liverpool.—J. S.

Glass Blowing Apparatus.—W. W. (*Whitehaven*).—You will find Messrs. Townson & Mercer, of 89, Bishopsgate Street Within, E.C., one of the best firms you can write to for what you want; you will get a complete set, and they are extremely courteous, and willing to give every information; I can strongly recommend them. If any reader is in want of any chemical or scientific apparatus, they cannot do better than consult the above firm; their catalogue is one of the most complete I have ever seen; it is a handsome book, bound in red cloth, fit for any library, and extends to 400 pp., and nearly 3,000 articles are priced, besides complete sets of apparatus; price of catalogue, 3s.—W. E. D., Jun.

Fret Dealer.—W. H. (*Bury*).—I do not know of any one who makes a speciality of this class of work in Manchester, but many tool dealers supply all that is necessary in the way of designs, saws, etc. You cannot do better than get Skinner's or Harger's Catalogue.—D. A.

Polishing Lenses.—Beta.—I am sorry to disappoint you, but you must give me more particulars. You should think of the Editor as if he were a doctor when you write for his advice. Tell him everything, and then, if he can get help for you he will do so. What lenses are you making? What size and focal length? What are they for? What glass are you using? Are the "wavy lines" in the polish or in the field of view? What are you using to polish the glass? This is the kind of information that you or any other optical querist should give. Without it—well, the very information I might send to the printer would be useless to you.—E. A. F.

Acid on Gold.—Jeweller.—The stuff you are asking about is boracic acid. It can be bought at most chemists and druggists in twopennyworths. It is a powder which you mix with water to a cream-like consistency, and apply with a camel-hair pencil just as you apply your borax for soldering. This is the way I use it: first borax the work, apply the pallions of solder and dry it; then, in the second place, paint the acid all over the work, and run the solder in run. My reason for this is to keep the borax perfectly free from any and every material which could by any chance prevent the solder flushing. Then in all such jobs it is best, I think, to endeavour to do them at one heating, and to let them get quite cold afterwards, before cleaning in sulphuric acid pickle.—H. S. G.

Bookcase and Cupboard.—Constant Reader.—A bookcase is given with this number that will, I think, meet your requirements. If the dimensions are not precisely in accord with your own, you will find no difficulty in modifying the size to suit your own wants.

Safety Bicycle.—J. W. H. S. S. (*Sheffield*).—Instructions to make a safety bicycle could not be given in a "Shop" reply. I think a former correspondent made a similar request, when I signified my readiness to contribute a series of papers on the subject, and I still await the Editor's time and opportunity to make use of such a series.—A. S. P.

Voixophone.—T. N. (*Halifax*).—The only "musical instrument" (if it can be dignified by that term) with which I am acquainted answering to the above name is one of the "Za Zah" or "Kazoo" tribe, and which you can make by procuring a piece of stout bamboo reed about 1 in. in diameter, and about 10 or 12 in. long. At a distance of 1½ in. from each end on opposite side of this tube make a hole of ½ in. in diameter, and then with gold-beaters' skin cover each end by tying, not gluing, it on, and the instrument (of torture) is complete. To play it, cover one of the holes with the lips and sing (or howl) into it, and the musical sounds emanating from it will bear a strong resemblance to those produced by the time-honoured paper and comb. If this is not the kind of instrument you mean, please explain more fully, and I will try my best to help you.—R. F.

Musical Box Comb.—J. O. (*Huddersfield*).—You will be able to obtain a new comb for your musical box by sending to Messrs. Paillard & Co., 62, Holborn Viaduct, London. It will be necessary to send the whole box, as they will require it for fitting. Send it carriage paid, and ask for an estimate of the cost, as it may be more than you are inclined to pay. From the size you give, it will cost not far short of a couple of pounds, and I have found that as a rule these sort of jobs do not recompense one for the outlay. If you send the box, see that the spring is quite down, and, at the same time, that the click or trigger which stops the movement at the end of the tune is in position in its slot. Cut a wedge of cork, and fix it tightly between the face of the drum containing the spring and the left end of the barrel. This will prevent any shifting of the barrel and consequent damage to pins, etc. If you decide upon having a new comb, it will probably take six or eight weeks to get it done, as the work will have to be sent to Switzerland. You may, however, depend upon its being thoroughly well done.—R. F.

Pocket Lamp.—J. H. (*Manchester*).—If you or others have a pocket lamp that you think would suit W. G. H. (*St. Germans*), you should advertise it in the cheap "Sale and Exchange" column of Work, which space has been specially allotted for advertisements of the kind.

German Silver Cuttings.—A. L.—This answer is bound to be unsatisfactory, no information being given as to quantity, nor yet the place where it is desired to dispose of it. Such "scrap" as this is usually returned to the dealer that sold it. He generally allows a good price, for he knows the quality, of which there are several. If that is not possible, then you should take or send a sample to some respectable firm, and ask them for an offer for it. Do not omit to give the weight as near as you can of the "quantity" you possess. If you do not know of any such dealer, you will find the addresses of jewellers' material shops and of dealers in metal by dozens in the Directory. Send one or two of them a reply post-card, asking if they are open to buy your "quantity." This is the best I can do for you with so little information to go upon.—H. S. G.

Draughtsmanship.—T. D. G. (*Highgate*).—I suppose from your letter that you mean that you have to make plans of existing buildings in which it is intended to put machinery; that you find a difficulty, and that you ask how to set about it. You should commence by rudimentary geometrical drawing, which you can learn from any school-book on the subject (which you may easily pick up for sixpence or less, on any secondhand bookstall). When you can draw any angle, any proportion of parallelogram, right or oblique, either full size or to scale, careful measurement only is necessary. Thus take for instance a room (inside dimensions); measure one side, commencing always with the side in which the principal door is. Draw a line roughly in your note book and mark in feet and inches its exact length, A B, thus—

A [door] 19 ft. 6 in. B

| 3 in. × 2 ft. 9 in. 25 ft. 3 in. |

then the distance from corner A to door opening, then the opening of door, then the distance to B from door on that side, then, as a check, add 3 ft., 2ft. 9 in., 19 ft. 6 in. together, which must be the full length, 25 ft. 3 in.; if you have made any mistake you will thus find it out. Now proceed with the other walls in the same way, drawing lines to indicate their position. Never mind the exact proportions in your sketch, the figures are the main point, the sketch only shows to which wall the figures belong. When you have gone all round giving all window and door openings, all projections, chimney breasts, etc., check the squareness of the room by measuring carefully both diagonals, *i.e.*, from opposite corners, both ways, marking them on your sketch in feet and inches, and even an odd quarter of an inch. Do the other rooms in the same manner, taking care to get their relative positions from the same party wall, and ascertain that it is straight, marking the thickness of each wall (which you can easily get at) the door and window openings). It is usual to mark heights on plan with a circle round them. If any beams run across to support floors above, show them in your note book in dotted lines, and put their dimensions and distances apart (and also from the party wall from which you are measuring) in blue pencil or red pencil, as also skylights, ventilators, or other interruptions that occur in ceiling. This being done, if you cannot yourself make a correct plan, anyone else who can draw plans can construct them from your measurements without having to go and take them. Meantime, by all means, if you have the leisure, attend any technical drawing classes, such as the one you mention, or those of the Polytechnic. If you explain exactly what you want to become proficient in, you will readily ascertain what course to take.—J. W. H.

Jet Black Ink.—A Constant Reader, P. B. L. (*Padiham*), does not say whether for writing or printing, or for window tickets. My guess may be wrong, if so, please write again; meanwhile, if you want to make ordinary writing ink dry black and glossy you have only to add lump sugar finely powdered until (experiment alone can decide) the sugar, being dissolved, produces the effect. Gum arabic crushed with the sugar in a mortar enhances the effect, and will not crack if you use enough sugar to prevent it. It would be of no use my giving a formula, inasmuch as it must vary according to the make of the writing ink. Red, violet, green, and other writing inks are rendered very bright and glossy in the same way. Use a hard sized smooth paper or Bristol board that will not soak up the ink. Printing inks are thrown up glossy by adding japan gold size and best copal varnish, in equal proportions, to the ink; but the copies should be laid out for an hour, not super-imposed or they are apt to stick together.—J. W. H.

Gold Printing Composition.—E. C. M. (*Ipswich*).—1. I never heard of such a composition. Gold (*i.e.*, real gold) printing is done by printing with hot brass blocks on sized paper, silk, satin, etc., with leaves of gold leaf between, when the pressure is put on. Imitation gold leaf (Dutch metal) may also be used in the same way. What the public often take for gold printing (from stone, or wood, or type) is done with bronze powder, which is made in all shades from deep copper colour, to rich gold, pale gold, green gold, even to silver white, which is dusted on to the paper immediately after the sheet is printed in an ink composed of japan gold size, mixed with a pigment, yellows and even reds being used under the bronze according to the desired shade, or richness of colour. Steel blue, emerald green, and other similar unprintable dust colours are used in this manner, and when the gold size is dry the colour is permanently fixed. 2. In a similar manner, by adding a very little japan gold size to the ordinary black ink in which letter headings are printed (either litho or letter-press), and dusting them over with a mixture of equal parts of powdered gallic acid and proto-sulphate of iron. Such printed heading will copy in the usual way in the press on the damped leaf of the ordinary copying book.—J. W. H.

Inks for Block Printing on Calico.—H. G. (*Liverpool*) asks us a number of almost breathless queries. 1. For a list of tools for soleing and heeling boots, and where to get them, and whether in "Shop" any instruction will be given. In Work, Nos. 39 and 44, page 622 and page 702, if H. G. had perused them, he would have seen the subject treated of by H. G. (*Bishopsgate*) and Nitram in reply to J. R. He can get the tools from any Liverpool curriers, and they will tell him what he requires. 2. Best inks to use for printing on calico: Calico printing is one of the most intricate and complicated processes ever brought to perfection. Block printing has long been superseded by machine printing from engraved copper rollers, and the colours used consist of chemical combinations afterwards re-acted upon by dyes and other re-agents which convert each printing into far different

colours to the dull greys originally laid on, which are fast, that is, will resist frequent washing. In the old block printing on calico, which was done by hand, the blocks were always inked precisely as indiarubber stamps are now inked on a pad; but, as previously stated, in inks bearing not the slightest resemblance to the intention of the design, being afterwards chemically changed to fast and brilliant colours. If H. S. applied by letter for a visiting order to Hoyle's Print Works, Mayfield, Manchester, he might (possibly) see two or three very old men, the last of the race of calico block printers, at work, and their chemist (who, in common with the chemists employed by all large calico printers, receive salaries varying from £800 to £1,500 per annum) might possibly give him a wrinkle or two. I can, however, tell him this much, that printing on calico is to be considered rather as dyeing than printing. Size is of no use at all. Calico before printing is subjected to some mordant such as alum (double sulphate of alumina and potash), which fixes the dye or pigment afterwards used. 3. How to set to work painting magic lantern slides: First, can H. G. draw and paint? if not, do not attempt it; if he can make designs in water-colour on paper, make careful tracings, and then, pricking through these designs with a needle, pounce with venetian red on to the glass (which has previously been coated with a very thin coat of venice turpentine just as it is "tacky"). As soon as the surface is dry, paint, exactly like the water-colour designs, your subject (using oil colours in tubes) with the transparent colours only. By lifting the glass and looking through it you can see its effect as you proceed, or better still, fix it against an upper window and paint against the light. Again, you can make a transparent positive, photographically from a negative, varnish it with spirit varnish, and add the colouring by hand. I have, this time, endeavoured to answer all your queries, "not vaguely;" but another time I trust you will observe our rule that each query should be written on a separate slip of paper, so that it may be referred to our experts in each range of subject.—J. W. H.

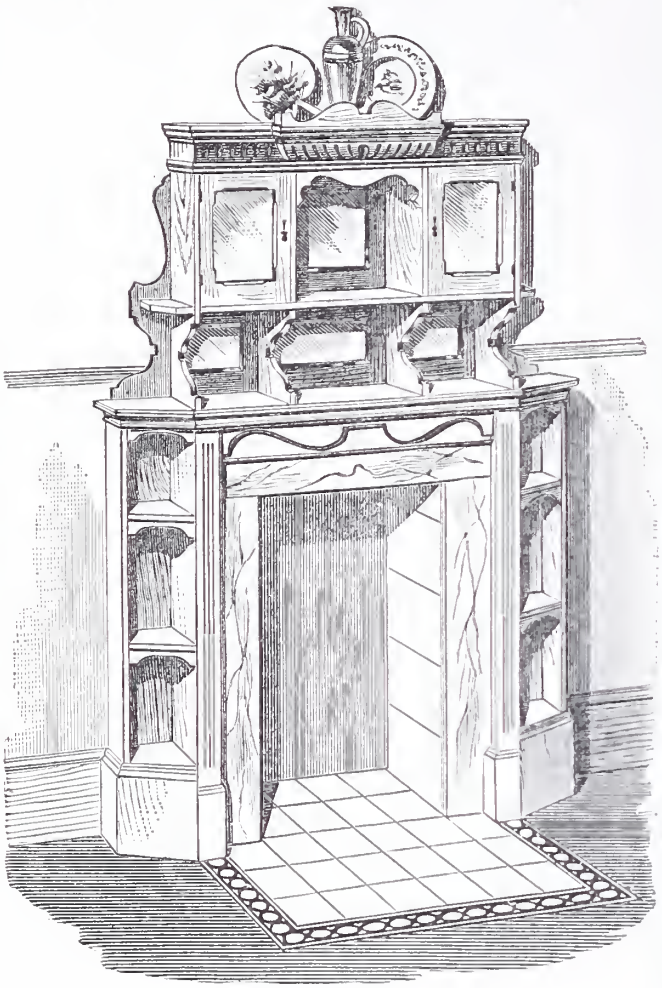
Civil Service Draughtsmen.—LLEWELLYN.—All competitive appointments to the Civil Service of Her Majesty are conferred wholly and solely on those candidates who pass a rigid examination in the various subjects required by the Home Office. Space precludes my giving a list of these, especially as LLEWELLYN does not state with any precision what class of draughtsman he wishes to become—mechanical, engineering, surveying, architectural, or geographical. Write direct for forms and particulars to the Home Office, Whitehall, S.W.—J. W. H.

Concreting Yard.—T. F. F. (*Bowes Park*).—The best materials for concreting floors are crushed bricks, limestone, granite, slag from iron furnaces, or similar hard material. If you use gravel, after it has been down some time, the upper surface becomes rough; owing to the pebbles being round and smooth, the cement does not adhere well to it; if you could crush it and make the pebbles sharp and angular, you might use it. The foundation should be rammed solid and covered with a layer of not less than 3 in. thick of broken stones, to pass through a 2 in. ring, the top of which should be 2 in. below the finished surface. The yard should be divided by strips of wood laid on edge, into spaces about 6 ft. square; if laid in larger sizes than this it is almost sure to crack, and if the foundation is not prepared as above it will most likely crack. To lay the concrete, prepare a hard level piece of ground, or lay a floor of boards on which to mix it; also have a box without top or bottom; fill this three or four times with the crushed material, and once with cements; mix the whole together thoroughly with pick and shovel, then wet it, and turn over twice till all is thoroughly mixed; it must not be made too wet; then lay in each alternate space, and beat it well with a beater till level with the strips, and when stiff, which will be in about twenty-four hours, rub off smooth with a plasterer's trowel, then take up the strips of wood and lay the remaining squares, and finish in the same manner; either three or four to one of cement may be used, but the latter takes longer in setting; it should be laid with a fall to a trap to carry off the water; a channel can be formed in it if required by pressing a piece of round wood into the concrete while soft, and smoothing off with a trowel.—J. T.

Civil Engineering.—T. B. (*Swanley*).—You cannot learn civil engineering by studying at home; but, in addition to other things, diligent home study is necessary that you may get a thorough knowledge of the principles upon which practice rests. To lay the foundation you should go for about three years into the workshops of some busy firm, there to learn the use of tools and become acquainted with the nature of materials. You should next be articled to a civil engineer having actual works in progress, to acquire knowledge as to the designing and execution of work. During this time you should study in the evenings to advance your theoretical knowledge *pari passu* with your practical progress. You should then try and get employment for two or three years with a contractor to get hold of the "dodges" of the trade. What you can earn will depend upon your ability and perseverance in a great measure, but chiefly upon what capital or influence you can command.—F. C.

Pinion and Rack.—R. G. R. (*Blair Athole*).—You can get small pinions and racks at Grimshaw & Baxter's, 33, and 35, Goswell Road, London, E.C.—F. C.

Mantel.—W. W. (*Glasgow*).—You have omitted to state the size of the gas stove you propose using, and whether the flue pipe comes out at the back, side, or top, or where you intend to carry it. I have inserted a sketch of a fancy mantel as desired, which could be easily adapted to suit any form of stove. If the general design pleases you, I will give you a few hints as to making same on receipt of further particulars or alterations that you may deem necessary.—E. D.



Fancy Mantelpiece.

Hardening Tools.—MACHINIST.—For your purpose make the tool red hot and quench the edge in salt water, then quickly brighten and let the heat descend to the edge until it shows a straw yellow colour, then quench the whole in the salt water. If the tools are not large enough to hold sufficient heat for the tempering (lowering the temper, as it is called) quench them completely and then lay on a piece of red hot iron till the required colour comes. The lighter the colour the harder will be the tool, so if your edge turns you must re-harden and lower to a lighter yellow; but should the edge gap you must re-harden and lower to a deeper yellow. By trial you will soon find the right colour for the kind of material you are working.—F. C.

Bee Hives.—E. H. (*Bath*).—Those who wish to profit by my papers on "Hives" etc., should understand a good deal about the practical part of bee keeping as opposed to appliance making. I will touch on the theoretical part of our craft as little as possible, and simply confine myself to the mechanical. An excellent book for beginners is "British Bee Keepers' Guide Book," by T. W. Cowan, published by Houlston & Sons, Paternoster Square, London, at 1s. 6d. A somewhat more pretentious book is written by Frank Cheshire, and published by Gill, 170, Strand, in two parts, the scientific and practical, at 7s. 6d. and 8s. 6d. each respectively. If a person wishes to be economical, he might send 2d. to Mr. S. J. Baldwin, Bromley, Kent, for his catalogue, which contains enough information to fire the ardour of most novices, and make them wish for more. The ¼-in. space at the ends of the frames is to permit the bees to pass between them and the hive side. There is a somewhat greater space at the bottoms of the frames to allow of the bees running freely on the floor. There is ½ in. between the surface of the combs, and between the edges of the top bars of the frames which gives room to work and allows of access to the super. I trust E. H. will be very successful in his bee keeping. I know that to me the pursuit is full of interest, and impresses upon me most forcibly the wisdom of the Creator.—APIS.

Lathe Matters.—A B C D (*Tooting*).—(1) Patent metal is an alloy containing ten parts of tin, one of copper, and one of antimony, but the proportions vary slightly in different specimens. It can be bought for about 1s. a pound from any large tool merchant, and A B C D had better get it this way rather than attempt to make it. (2) A straight piece of iron with a screw at both ends and two nuts, might mean almost anything. It could be made to act as a mandrel if everything was the proper shape. The great point to aim at is to have the wear capable of being taken up, which can only be managed with a cone or split bushes. (3) The speed ratio of a wood turner's lathe ought to be eight to one, therefore the pulley will be ⅛ of the diameter of the driving wheel, in your case 1½ in., which will be very small. You can expect to turn only light work in such a lathe. I will be glad to help you at all times, and quite agree with your good opinion of WORK, which only echoes my own.—SELF HELPER.

Gas Engine for Lathe and Dynamo.—H. H.—As your lathe is only 3½ in. centres, you do not require any motor; but if you want one for the fun of the thing, the simplest way to connect the two is to have a pulley on crank shaft of lathe, and let the strap run from gas engine on to that; leave treadle as it is so that you can use it if you wish to retard or accelerate the motion, or to drive backwards, the belt being thrown off the while. Of course the proper way would be to drive the lathe by a shaft above, with striking gear and crossed belt, for stop, start, reverse; but this involves a good deal of expense. You are sure to have hitches and trouble with the gas engine, and will not have such complete control as with the foot on treadle. I think you could get a second-hand Bisschof engine from Crossley's, Manchester, of 1 man power for £7. Cuttress & Co., Leeds, are good makers of dynamos, etc.—F. A. M.

Price of Lathe, etc.—S. F. W. (*Edinburgh*).—(1) You will find the answer to your first question in the second number of WORK, pp. 18 and 19. (2) I do not know anyone in Edinburgh who would test a lathe for you. Any really competent turner should be able to do it; a foreman of turners from some engineer's for a metal turning lathe; as to the necessity of having it tested, that depends on whom you buy it from. (3) A 6-in. centre lathe need not be too heavy for an amateur to use, it would depend entirely on the construction, chiefly on the size of the mandrel necks and the way it is speeded.—F. A. M.

Trade.—W. H. (*Rainhill*).—There is nothing at present in WORK that is exactly in your line of business, and we can hardly advise you to take the course you indicate. That is always a grave step, which should only be taken under exceptional circumstances. We should advise you to stick to the vice, and if need be, get into another shop where by arrangement you could be occupied also at lathe work. Perseverance—pegging away in your present groove will probably ensure you a better income than making a change.—J.

Holes in Mahogany.—G. P. (*Islington, N.*).—If you cannot saw the holes in ½ in. mahogany accurately enough for your purpose with a fretsaw, you might, perhaps, do so with a stouter saw, a keyhole or pad saw, or you might get a circle cutter, which is a tool fitting in the joiner's brace, having a strong point which forms the centre; this has passing through it a steel bar which carries a cutting knife like that of a cutting gauge, only stronger. The bar is fixed at any desired point by means of a small thumb-screw, and the cutting knife is also fixed in a similar manner. I have drawn mine and another form of a similar tool. G. P. will find it is not the easiest of all tools to use; it must be held so that the knife touches the wood equally when the centre has made itself a hole, which will not be if the tool is held aslant. As to silicine glass painting, see No. 40 of WORK, front page.—B. A. B.

Bicycle Oil.—CYCLE SUPPLY CO.—I am not much acquainted with the make-up of lubricating

ils. For cycles I use bleached sperm oil: six of perm to one of paraffin. A lot of information bout lubricating oils will be got in Spon's "Recipes," pp. 334, 373, 374.—A. S. P.

Patent Penknife.—PENKNIFE.—We have examined the sketch you sent us, and it seems to be ingeniously contrived, and will, no doubt, answer the purpose you intend it for. We don't quite understand the object of the two wing or side pieces which open, nor do you give us any explanation of what they are intended for. Is it to give a better hold for the hand when they are opened out?—G. E.

Expansion Engine.—EXPANSION.—To answer this correspondent would involve *designing* a triple expansion engine and boiler and propeller. I should refer him to A. E. Seaton's "Manual of Marine Engineering;" all particulars are given in that, and when he has studied it for a month or so he will be able to essay the design he contemplates.—F. C.

Cooking Stoves.—J. P.—Having had considerable experience in the use and also in the fitting up and fixing of the class of stoves you inquire about for cooking, I can speak with some degree of confidence as to their merits, but it would be a difficult matter (almost as difficult as to pick out the best make bicycle) to say which is the best, there are so many; some excel in one point, some in another. The points to be considered in choosing a stove of this class (self-contained) are briefly as follows:—It should possess a good-sized oven, and the oven should not only be a good size as regards the width of it and the depth from back to front, but should be a fair height. It should also possess a boiler, either wrought-iron or copper. The top or hot plate should be capable of accommodating at least three good-sized saucepans. The fire should not be too small, and should, if possible, present sufficient surface to the front to allow of toasting or grilling. The arrangement of flues and dampers should be simple and easy to get at. I could name a dozen makers whose stoves fulfil most, if not all, of these conditions, but two or three will suffice, and a perusal of their lists, which they send free, will give J. P. fuller information. They are Messrs. Dobbie & Forbes, Larbert, N.B., Grove & Sons, Leamington, and Brown & Green, Luton, Bedfordshire, and Finsbury Pavement, London. I am constantly fixing these ranges, and never have a complaint, except occasionally through the foolishness or carelessness of a servant who has been used to the old-fashioned and wasteful kitcheners, and "don't like them new-fangled things." The stoves made by Dobbie & Forbes are the "Larbert," "Hanley," and "Livingstone." The "Livingstone" is my choice; it is a good-looking range, fulfilling all the requirements I have mentioned, and no better working range could be wished for. The "Larbert" is somewhat similar in principle, but cheaper. Groves' ranges are more in appearance like the ordinary kitchen range: they have a large oven, but a small boiler, and are moderate in price. Brown & Green's stoves are called the "Gem." They are a very plain-looking range in the smaller sizes, but will cook splendidly, and the small consumption of fuel is something astonishing. With regard to parlour stoves, I recommend an "Abbotsford," or one of similar class—viz., slow combustion: that is, with no grating in the bottom. And with regard to washing machines, I do not know the "Torpedo," but should think from the name it was one of those zinc affairs to stick in the copper. If you have gas available, try Fletcher's "Quick" washer; it is about the best thing I know of, and the most economical. Hope these hints may prove useful.—R. A.

Fern Case.—RUPERT HOW.—Fern cases have not yet been treated upon in the pages of WORK, but an article on a "Wardian" case is in the hands of the Editor awaiting space, and further designs will appear when possible.—C. M. W.

Aquarium Leak.—AQUA.—You can stop the leak in your aquarium by coating the joints with copal varnish, thickened to a creamy consistency. Let each coat be quite dry before putting on another. This, of course, is assuming the aquarium is otherwise sound. If it is badly made and improperly glazed, no composition will do it any good. If you do not succeed, write again, giving full particulars as to construction.—C. M. W.

Volumes of WORK.—S. J. (*Stockport*).—The price of Vol. I. of WORK, already published, is 7s. 6d. bound. Succeeding volumes will be the same price. You and all who do not do so should write separate questions on separate sheets of paper. One man does not answer such divergent questions as yours on Blast Pressure, Price of WORK, and Gold Wedding-Ring Making. Every subject is answered by a distinct authority thereupon.—C.

Modelling.—GAMMA (*Nairn, N.B.*) must not allow his clay to "dry and crack up." When he is not working his model must be wrapped in wet cloths, and if left for any length of time, waterproof should be put over all. To prevent cloths from rubbing a delicate model, wooden skewers should be stuck into it. If the model dries while he is working on it, he should sprinkle water over it—blowing the water in a cloud of spray from the mouth is the best way. When finished, the model should at once be cast. With regard to modelling wax, let him read our recent reply to LOVER OF WORK. Any large dealers, such as the Stereoscopic Company, Regent Street, London, will be sure to have abundance of photos of sculpture. Why should he not communicate with such a house, and learn their terms?—M. M.

Strain on Rings.—G. L. (*Liverpool*).—A radial strain acting on a ring towards its centre causes a circumferential crushing strain equal to the pressure per inch of circumference multiplied by radius in inches. Boiler rings usually fail by distortion because the resistance of the material is not absolutely uniform. So long as the pressure is radial the same formula will apply to arched girders, but if the loads on the girder are vertical the case is different, and moments of bending stress are set up which are calculated in the same way as for a straight girder.—F. C.

Bicycle Repairs.—LONG CRANK.—1. Handle bars may be bent hot or cold. With makers who have rolling machines the process is easy. In the absence of rolls they, if the bends are slight, may be heated and bent over the horn of an anvil; this process ovals the bend somewhat, but careful hammering will put that right. They may also be bent cold by filling the part with lead, and applying the pressure of a screw. In the absence of the proper rolls, I use a screw cramp with which I bend tubes either hot or cold, quick bends being always heated. The instrument in question will be understood from the annexed sketch. A is a straight bar with a screw passing through the centre, said screw being turned by the cross T handle, B. C C are two arms hooked on to the bar, A, and carrying at their ends cast-iron blocks, which turn on the through pins, D D. The point of the screw is armed with a similar block only it is curved on the face. The tube, E E, is placed in the cramp as shown, the three blocks having deep hollows into which the tube fits, each size of tube requiring a separate set of blocks. It

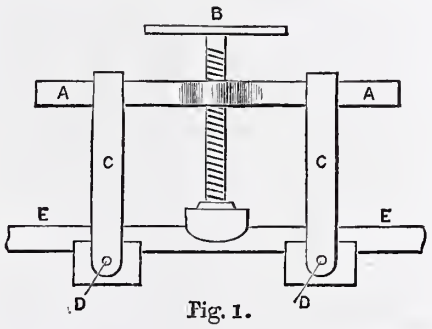


Fig. 1.

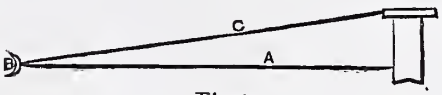


Fig. 2.

Screw Cramp.

will be readily seen that pressure upon the screw will very easily bend the tube. The arms, C C, are movable along the bar, and for quick bends they are placed nearer to the centre screw. 2. The gauge of tube for semi-racing bar is 18 B. W. I., for ordinary roadster, 16 B. W. I. 3. Hubs are divided with a division plate on the lathe or the drilling machine. To divide and drill a hub on the lathe without the division plate you have got to find the places for the number of spokes with small dividers, then centre punch the marks, taking care to have the marks on one flange, midway between those on the other. In drilling, the hub is held against a wooden pad, and led to the drill with the sliding headstock. This pad is a thick block of wood with a deep hole fitting the sliding mandril nose and bevelled to the extent required, for the angle of the spokes. The block is long enough to pass down between the shears of the lathe, and has the narrow end uppermost. To find the proper bevel of this block draw the line *a*, Fig. 2, through the centre of the hub; draw the section of rim at *b*; from *b* draw line c to flange of hub. The centre line and the spoke line represent the two faces of the pad and give the correct angle for boring.—A. S. P.

Cheap Clocks.—G. V. (*London, S.W.*).—Try the British United Clock Co., 34, Farringdon Road, London, that is the London office, their works being at Birmingham. Also for foreign try J. J. Stockall, 6, and 8, Clerkenwell Road, London. From these you can get all you require. I should think one is maker, the other importer.—A. B. C.

Painting Bicycle.—BICYCLE.—Clean off all rust and smooth down rough places with emery cloth or glass paper, then give a coat of best black japan, to be had of most oil and colour merchants. It will be all the better if you can heat the parts at a fire and apply the japan while the parts are hot, with a soft camel hair brush. If it is not properly covered, or some parts appear brown through one coat, give it another. This will dry in about an hour and will wash well.—A. S. B.

Condenser for Coil.—INDUCTION (*Tewkesbury*).—You appear to have prepared the paper all right. Are you quite sure it is free from flaws? A mere pin-hole will spoil the effect. The sheets of tinfoil are also of the right size, and are rightly arranged. You do not give the size of your coil, or I could have told you how many sheets of tinfoil to use. From the size of the sheets I suppose it to be a small coil, and, in this case, from twenty-five to thirty sheets will be sufficient. The whole, when built up, must be tightly pressed together, and the respective slips on each side should be all lightly soldered together to each conductor. The wires from these will go, one to the foot of break spring, and the other to foot of contact pillar. The condenser is placed under the coil, in the stand of the instrument. I hope to deal with the subject more fully in my articles on "Coils."—G. E. B.

Electric Belt.—W. M. (*De Beauvoir Town*).—The most correct method of connecting the discs is considered to be as follows:—Arrange the discs in two parallel rows with c and z alternate in both rows, and also in their relation to each other. Connect the two rows together, the c of one to the z of next, and so on, leaving a zinc plate free at one end and a copper plate at the other. I don't see how the effects claimed can be produced, and am not personally acquainted with any person who has been really benefited by these appliances. The only relief experienced by my acquaintances has been felt in the pocket.—G. E. B.

Inlaying, Imitation of.—J. B. (*Londonderry*).—I believe there is some such process as you suggest, which was patented some time ago, but I do not know that it has ever been more than a partial success. I am not acquainted with the details of manipulation, so am unable to tell you how to overcome the difficulties which you think likely to occur. If you want imitation inlays, paint them, and then you will run no risk of infringing any patent. Stencilling may be an assistance up to a certain point, but you will not be able to manage fine work by this means. If you think your idea of a process for imitating inlays has any advantage over others, the best advice I can give you is to experiment on your own account. Were I to do so, and find out or perfect some new and commercially useful method, I am afraid the temptation to patent it, instead of publishing it *pro bono publico*, would be too strong for my philanthropy to overcome.—D. A.

Silvering Glasses.—R. H. (*Accrington*).—See what has been said in recent numbers of WORK on this subject. If you had read "Shop" carefully you would not have had occasion to put your question. No one on the staff, from the Editor downwards, objects to answer reasonable questions, but valuable space cannot be wasted by repeating instructions which have been given only a week or two before. The process is not suitable for amateurs, who cannot possibly do the work either so well or so cheaply as they can get it done for them. Read the answer to W. K.—D. D.

Walnut Stain, etc.—A. B. (*Bradford*).—It is not absolutely necessary to use ammonia in the walnut stain, but it is better to do so. You do not require much of it, only sufficient to make the vandyke brown into a paste. The smell will soon evaporate, and I can hardly see how it can be objectionable if you let the stain stand for a few days before using it. If you like you may substitute caustic soda or potash for the ammonia, but against them also objections may be urged. It is, however, a matter of opinion, and you will find good workers using both materials. The chemicals required to dissolve bichromate of potash are hydrogen and oxygen, of which a combination forms the liquid sometimes known as *aqua pura*, but more commonly called water.—D. D.

Soldering Tinware, etc.—AMATEUR.—If you have only just commenced to take in WORK it is, I think, hardly fair to it to criticise it unfavourably on reading a number or two. It also accounts for your not having seen the articles on "Soldering" which have already appeared in Nos. 19 and 23, where you will find some information which I think even you will not say is "too much advanced," as it is put in a form that any one with ordinary faculties can comprehend. Further information and instruction in the various branches of tin, zinc, iron, etc., will appear as time and space will permit.—R. A.

Venetian Blinds.—RACHET BRACE.—This subject cannot be explained in "Shop" as it would occupy the whole of it. I will with pleasure write an article on the subject, of which I have had practical experience. RACHET BRACE asks for addresses of those who supply materials; to do this would be difficult without incurring a charge of unfairness, and impossible unless he tells us where he resides. Please to give some idea of your appliances and capabilities. If every querist would give fuller particulars it would be better.—B. A. B.

Self-feeding Fountain.—C. E. T. (*Liverpool*).—Your want of a fountain to feed itself is a very common one; but it is, nevertheless, unattainable without a cistern, or some other form of supply. An ordinary hydro-pneumatic fountain could be successfully applied to the design you mention; but the full particulars and instructions could scarcely appear in the limited space of "Shop." An article on this kind of fountain appeared in WORK, No. 69. This will probably suit you.—C. M. W.

Aquarium.—S. R. G. (*Liverpool*).—1. If you cannot get the dish you require as a dish, buy a cheap flower stand, say about 1s. 6d., and use the lower part; if you do not succeed in this, you can order through a gasfitter or ironmonger, what is known as a glass consumer for hall lamp, with a hole in centre; these are made in sizes from about 7 in. to 12 in., and are quite plain, and would suit

the purpose admirably; cost about 1½d. per inch diameter. 2. Enamel paint will not injure the fish when quite dry.—C. M. W.

Litho Printing, etc.—REGULAR SUBSCRIBER (*Leeds*) does not comply with any of our rules. He asks three questions on one sheet; he does not give his name and address (not for publication, but for the information of our Editor); whilst his queries are not in any sense particular, but general, as "How the method of lithographic printing is executed?" In reply to this I can only refer him to "Richmond's Grammar of Lithography" (Wyman's Technical Series), 5s., of any bookseller, or direct, 65, Chancery Lane, E.C., as my space is utterly inadequate to give even an outline of the process. 2. Recipes for all sorts of transfer ink, transfer paper, etc. etc., will be found and are thoroughly reliable. 3. Show cards are glazed in various ways. The glassy brilliant finish of some is done with gelatine in ovens construeted for the purpose. Another method is to size the card or paper with isinglass dissolved in water (or sometimes in methylated spirit), and then after two coats at least, when perfectly dry, varnish with pale copal, mastic, or paper varnish very thinly laid on. Paper varnish consists of a gum or gums dissolved in spirit, and dries with a good bright lustre in a few minutes. Still another mode is to pass the cards or sheets of paper after printing through a calender, *i.e.*, hot rollers, several times under great pressure, which gives smoothness and gloss, slightly inferior to the others, but at a cheaper rate. I have mentioned these processes in their order of brilliancy.—J. W. H.

Banjo Making.—W. H. R.—The metal for banjo hoop is brazed, mounted in the lathe, and the edges are spun over a steel wire. You might manage to turn over the edges to your own satisfaction without a lathe. The inside of hoop must have a wooden lining to get the best results. An ordinary wooden banjo hoop will do. If you want to tune your banjo to concert pitch, the best length of fingerboard for a 12-in. hoop will be 18 in. long, not longer, and the strings used must not be too thick. Professionals generally have their banjos made with a 20-in. handle, but tuned a note lower, therefore when playing with piano accompaniment the piano part has to be written a tone lower to harmonise with banjo. See reply to J. K., how to put on vellum. Nickel plating would cost about 2s. or 2s. 6d. for hoop and band. Screws and brackets can be had from the various music shops; the best are only to be purchased from banjo makers of note, who use only the best. The best way for you to do would be to write to two or three makers asking for prices; living in London you will no doubt know the addresses of several. Do not purchase cheap brackets or your banjo will be a complete failure.—J. G. W.

Artist's Easel. — ELEPH. — A full description with working drawings of a studio easel as required by you would occupy three or four columns of WORK, and I shall be prepared at some future time to supply the requisite information should our Editor so desire; but for the present I should advise you to write Messrs. Winsor & Newton (Limited), of 37, Rathbone Place, London, or Messrs. G. Rowney & Co., of Percy Street, Tottenham Court Road, London, for their illustrated catalogue of easels; or in your own city, Edinburgh, go to Messrs. Doig & McKachnie's, the Art Galleries, 90, George Street, and frankly ask either of those gentlemen, who are most kind and courteous, to show you one, which I am sure they will do.—F. B.

Small Billiard Table. — INQUIRER. — The best article for a small billiard table bed is slate. It should be about ½ in. thick for a 4 ft. by 2 ft. table. The cost would be about 12s. The cushions should be stuffed with india-rubber, and the india-rubber will cost about 6s.; you will buy a 4 ft. billiard table cheaper than you can make one, and have it perfect, for 70s. complete.—G. E.

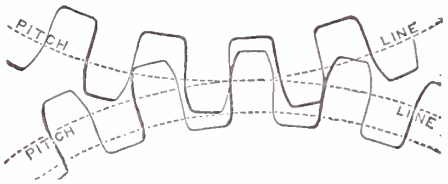
Brazing Bandsaws.—A. C. (*Old Ford, E.*).—The jaws of the tongs used for running the spelter, that is the bright hot tongs, should be from 1½ in. to 1¾ in. wide and about ⅜ in. thick; the reason for having these tongs so heavy or thick is to hold the heat, and when once heated, if you have several saws to braze, and have a good fire, by placing the tongs in the fire as soon as slipped off the saw, it will be ready to put on the next saw by the time you get it in position for brazing. The second tongs need not be so heavy, but about the same width; these tongs are used to close the joint and to prevent the spelter running out, and to a certain extent temper the saw where it is joined, for you must understand that the saw may be made hard or soft as the second tongs are cold or hot. By using a rest, as described in Vol. I., No. 36, page 571, of WORK, or some such device, no wire will be required. While you are messing about the wire the braze may be made. If you refer to instructions given in back numbers, and work accordingly, you need not fear making a good braze in your saws.—A. R.

Blast Pressure.—S. J. (*Compstall*).—To measure the pressure you should attach to the blastpipe a gauge. Many of these are on the market. If you wish to make one yourself, a syphon tube form would be the best to adopt. In regard to delay in replying to you, you, as a constant reader of WORK, must observe that our most strenuous efforts will not be sufficient to answer every correspondent as quickly as we wish.—F. C.

Human Body. — FRENCH POLISHER. — Get through your bookseller "Human Physiology," published by Cassell & Co., London, E.C., price 7s. 6d.

Bicycle Matters. — CYCLIST. — (1) About the best black enamel for bicycle short of stoving is the "Club" special hard-drying enamel, sold by the Silico Enamel Co., 97, Hampstead Road, London, N.W. (2) There is no good thing for retouching bare plated parts; plate over again is about the only satisfactory way. Unsightly parts may be made to look better by careful polishing with emery cloth, then coat with Silico transparent colourless enamel. (3) For rubber soles use Brown Brothers (late Snell & Brow's) rubber cement for mending rubber cuts. The two surfaces must be thoroughly cleaned; then coat both all over with the cement and leave them aside (separate) for, say, two hours; then stick evenly together and press. They won't come off.—A. S. P.

Mechanical Drawing. — AN ADMIRER OF "WORK" (*Otley*). — The cheapest works on this subject are those in Weale's Technical Series—a list of which can be seen at almost all booksellers'. You will be readily able to select those you most want, and as you progress and discover your own deficiency of information you can order others more advanced. Computation of speeds is quite simple. Given the speed of any main shaft, say 120 to 150 revolutions per minute, you can put a drum upon it, say, 2 ft. 6 in.; then to obtain slower speed make the pulley of the machine larger than the drum; to gain speed it must be smaller; the proportions are ascertained by the rule of three, but in nine out of ten cases can be done mentally. Thus, for instance, main shaft, 150 revolutions, machine, 300 revolutions, drum, 3 ft., it follows that the pulley must be half that, so that it may go round twice to every revolution of the drum, *i.e.*, 18 in. Again, tooth wheels, spur wheels on shaft, 100 revolutions, 4 ft. in diameter, speed required, 400 revolutions; no matter what pitch or number of teeth (which depends entirely upon the h. p. to be transmitted), the diameter of the pinion must be one fourth, so as to compel it to revolve four times to the spur wheel once, *i.e.*, 1 ft. diameter. Of course by diameter of a toothed wheel it is always understood to be measured to the pitch line—*i.e.*, a line which (theoretically, though not practically) is the mean between the top or periphery of the teeth, and the bottom, and which, when in full gear with the pinion, is identical in both wheels, thus—



Pitch Line of Tooth Wheels.

You might obtain a wheel list, which is well worth study. Having made a special study of printing machinery, and patented many improvements therein, I shall take a special pleasure in explaining to this correspondent in "Shop" any of the many difficulties which he is certain to encounter in the career he has chosen if he will write to our Editor, asking the advice of J. W. H.

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Nitric Acid Guard.—R. A. (*Salisbury*) writes in reply to ACID (see page 262):—"Let ACID line a wooden tray thickly with gutta-percha: this will resist strong nitric acid; or your existing bad tray might be lined with it, but I always thought that lead would stand. Have you got solder anywhere? if so, this would eat away. The joints (if any) should be what plumbers call 'burnt' together. Autogenous soldering is the proper term."—R. A.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—P. C. B. (*London*); H. W. (*Surrey*); L. & L. (*Cambridge Heath*); C. G. (*Camden Road*); F. P. (*Hoxton*); F. M. (*Maldon*); F. S. (*Kidderminster*); C. M. (*Perth*); A. F. R. (*Birmingham*); J. B. B. (*Sutton*); F. H. (*London, N.W.*); A. J. K. (*Sheerness-on-Sea*); H. C. (*Islington, N.*); I. J. (*Shipley*); W. H. M. (*Glasgow*); J. A. P. (*Preston*); O. L. (*Birstall*); F. F. (*Govanhill*); A WEEKLY SUBSCRIBER; W. R. S. (*Stratford*); G. R. (*Dorchester*); R. W. M. (*Kildare*); J. B. (*Burton-on-Trent*); C. C. (*London, W.C.*); CARNGORM; E. G. (*Forest Gate*); A. J. T. (*Islington*); G. R. R. (*West Calder*); W. H. M. (*Glasgow*); A. H. W. (*Bath*); J. J. C. (*Staffs.*); AN AMATEUR; P. H. Z. (*Hammersmith*); R. T. (*Blackburn*); W. B. (*Huddersfield*); A PLAYER; J. D. (*Birmingham*); O. B. (*Preston*); A. A. (*Richmond*); J. M. B. (*London, S.W.*); G. S. (*Stockton-on-Tees*); H. P. (*Maidstone*); COOPER; M. & C. (*Grimsby*); H. R. H. (*Forest Gate*); CHURCH MANUFACTURING CO.; R. K. (*Burnley*); NERO; J. B. (*Pontefract*); MONA; W. T. S. (*Burnley*); LATHE SPEED; B. X. E. (*London*); H. W. (*St. Albans*); GATESHEAD; OX GALL; F. L. (*London, N.*); F. R. (*Ashford*); J. W. (*Middleton*); M. A. E. S. (*Bristol*); MUSICUS; W. R. P. (*London, N.W.*); T. L. P. (*Liverpool*); R. W.; J. S. (*London, N.*); J. K. (*Mile End*); S. H. H. (*Brighton*); T. L. P. (*Liverpool*); F. S. M. (*United States, America*); A. W. (*Edinburgh*); A. P. (*London, E.*); J. S. (*Norwich*); W. B. (*Preston*); L. & L. (*London, E.*); H. A. H. (*Manitoba*); F. J. (*North Finchley*); R. G. & Co. (*London, N.*); H. P. (*Didsbury*); H. W. (*Wallington*); W. F. (*Mile End*); J. S. (*Monmouth*); J. C. (*Seacombe*); AMATEUR VIOLINIST; C. F. F. (*Islington*); S. R. (*Ireland*); A. Ch. B. (*Norwich*); R. J. A. (*Seacombe*).

"WORK" EXHIBITION.

(1890-91).

For Classification, Prize List, etc., see WORK No. 70.

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in page 290 (No. 70) of this Magazine:—

For Design for Medal.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

For Design for Certificate.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

If any Competitors wish to submit a Model in Clay, Plaster, Wax, etc., as a Design for Medal instead of a Drawing, they are at liberty to do so.

Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

Prize Competition.
Medal (or Certificate, as the case may be.)

A Motto must be affixed to each Drawing, and the name and address of the sender enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted to three competent judges, who will select those that are considered most worthy of prizes.

The Prize Drawings will become the property of Messrs. CASSELL & COMPANY, Limited, who will return all Designs made by unsuccessful competitors to their respective owners carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced in WORK in due course.

For further particulars, all intending competitors should apply to the Secretary, "WORK" Exhibition, CASSELL & COMPANY, Limited, as above.

Trade Notes.

THE following is given as the railway mileage at the beginning of 1889:—Europe, 133,900; America, 190,000; Asia, 17,800; Africa, 5,200; Australia, 10,500; total, 357,400, as compared with 293,000 in 1884. Of the increase of 64,000 miles during the four years, 40,000 is in America and 30,000 in the United States alone; 11,000 miles were opened in 1885, 17,000 in 1886, 23,000 in 1887, and 13,000 in 1888.

THE Armourers' and Braziers' Company will hold, at their hall, in the City of London, in May, 1891, a second exhibition of art brass work of original design, the work of British subjects, manufactured since 1st January, 1889. Prizes and certificates will be given to designers, craftsmen, apprentices, students, and amateurs respectively. Particulars may be obtained by forwarding an addressed envelope to the undersigned. Marshall Pontifex, Clerk, Armourers' Hall, 81, Coleman Street, E.C.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

Fretwork, Carving and Repoussé Work.—Catalogue of all requisites, 700 illustrations, 6d. each.—HARGER BROS., Settle, Yorks. [13 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [14 R

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

DELICIOUS

TEMPERANCE DRINKS.

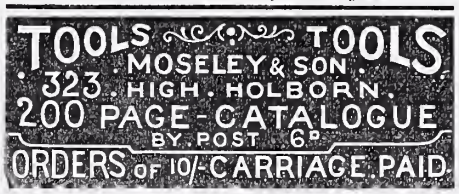
Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.



ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

NOW READY. Price *5s.*

Strange Doings in Strange Places

Complete Sensational Stories by FRANK BARRETT, MAXWELL GRAY, JOHN BERWICK HARWOOD, Q (Author of "Dead Man's Rock," etc.), R. E. FRANCILLON, G. MANVILLE FENN, F. W. ROBINSON, FITZGERALD MOLLOY, CHARLES GIBBON, FLORENCE WARDEN, RICHARD DOWLING, THEO. GIFT, Mrs. EDWARD KENNARD, M. BETHAM EDWARDS, J. K. LEYS, HENRY FRITH, MAY CROMMELIN, and Major ARTHUR GRIFFITHS.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

How to Beguile the Tedium of a Railway Journey.

"*These Official Guides afford a very simple and effective way of depriving a railway journey of its tedium. They are well arranged, full of interesting information about the places passed, with a profusion of pictures and useful large-scale maps and diagrams.*"—THE TIMES.

JUST READY, price **1s.**; cloth, **2s.**

The Official Illustrated Guide

TO THE

Great Western Railway.

With Maps, Plans, and Illustrations on nearly every page.

UNIFORM WITH THE ABOVE.

London & North Western Railway. *Enlarged.*
Midland Railway. *Revised.*
Great Northern Railway.
London, Brighton & South Coast Railway.
London & South Western Railway.
South Eastern Railway.

*** Ask for the Official Illustrated Railway Guides published by CASSELL & COMPANY.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers.*

For Young People in Town and Country, or at the Sea-side.

JUST PUBLISHED. Boards, **3s. 6d.**; cloth gilt, gilt edges, **5s.**

"Little Folks" Midsummer Volume,

containing **432 Pages of Letterpress,** with ILLUSTRATIONS ON NEARLY EVERY PAGE, Two Pictures in several Colours, and Four Plates in Colour, and comprising a treasury of bright and attractive reading for Children of all ages.

"There is reading enough to keep a big boarding-school quiet for six weeks."—SPORTSMAN.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NOW READY, price **1s.**; post free, **1s. 2d.**

The New "Little Folks" Painting Book.

Containing nearly

350 Outline Illustrations

Suitable for Colouring.

*** In connection with this Work a large number of PRIZES in BOOKS and SILVER and BRONZE MEDALS are offered, full particulars of which appear in the **July Part** of **"Little Folks" Magazine,** now ready, price ***6d.***

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

AMATEUR PHOTOGRAPHY.—J. H. SKINNER & CO., *W Department, East Dereham, Norfolk.*

J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description.

CHEAP SETS FOR BEGINNERS.

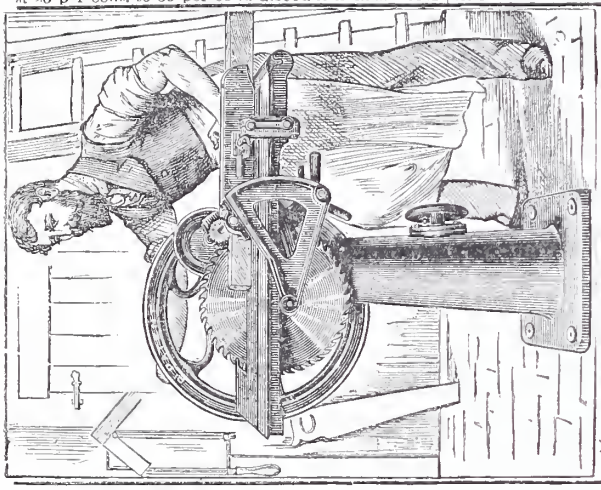
3/6 The Eclipse Camera Set. 3/6
Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6
Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6
Including Polished Mahogany Camera, with Folding Tail-board, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at 20 per cent. to 50 per cent. discount to clear. Send post card for Sale List



"THE LEYTON"
New Patent Circular Saw Bench for Hand Power.
Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.
LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

DISEASE EXTERMINATED from the System, and Muscular, or Organic WEAKNESS every form of Nervous, speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,
President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS
Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,
52, OXFORD ST., LONDON, W.
(Corner of Rathbone Place).
All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

On the First of Every Month, *4d.*

Cassell's Time Tables

AND

Through-Route Glance-Guide.

A SUBSCRIBER *writes*:—"I always buy 'CASSELL'S TIME TABLES,' and although I travel almost every day have never yet found any mistake in it, and I consider it more useful and at the same time more simple than any other book of the kind."

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*
Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

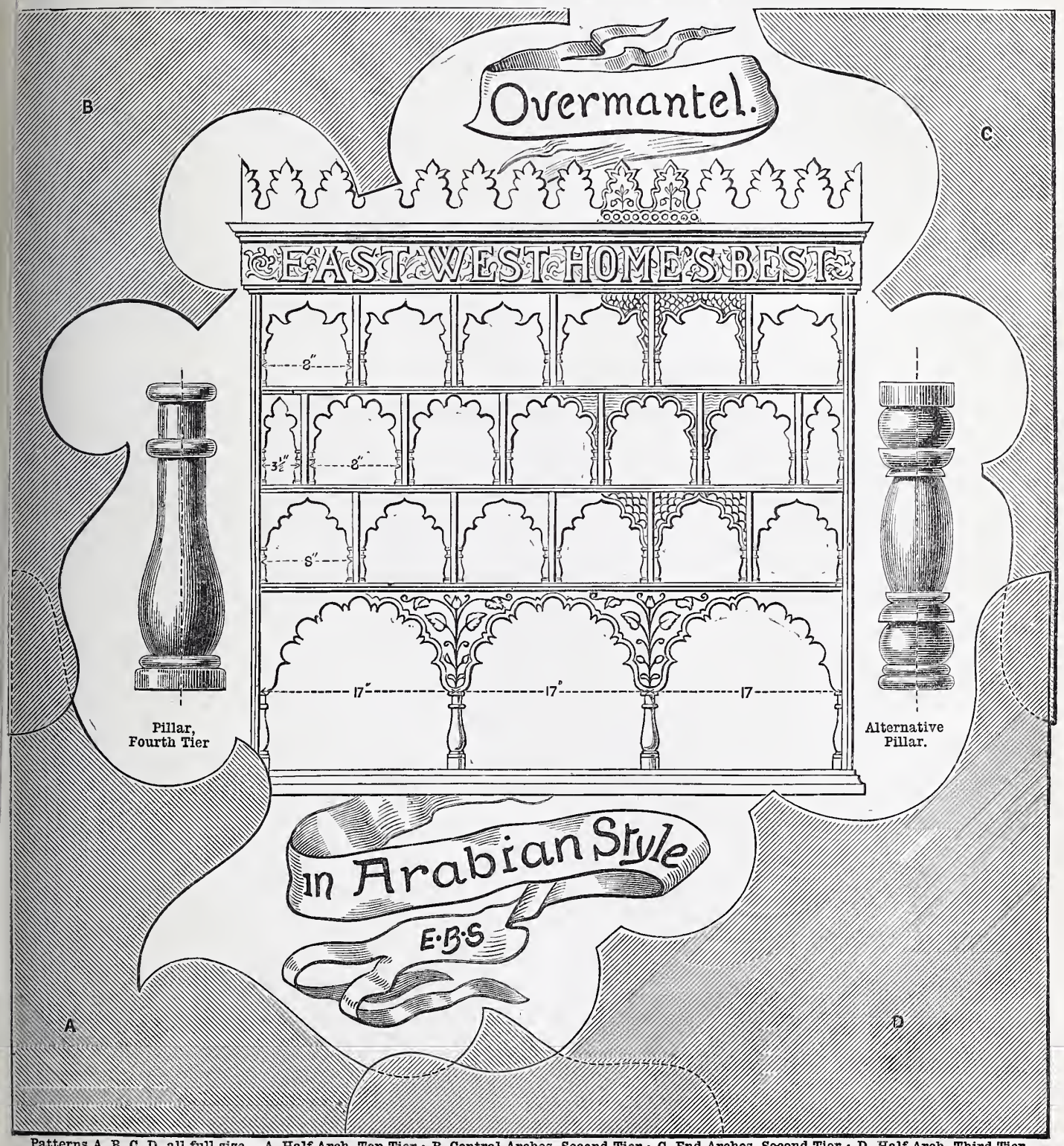
WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 76.] SATURDAY, AUGUST 30, 1890. [PRICE ONE PENNY.



Patterns A, B, C, D, all full size. A, Half Arch, Top Tier; B, Central Arches, Second Tier; C, End Arches, Second Tier; D, Half Arch, Third Tier.

AN OVERMANTEL IN THE ARABIAN STYLE.

BY E. BONNEY STEYNE.

THE motive whence this overmantel is derived will be found in a number of the *Furniture Gazette* for June, 1888, containing a drawing of a cabinet said to be now in the possession of a gentleman at Bayswater. But although for the sake of preserving the symmetry of the genuine Arabic work the proportions of the shelves have been faithfully followed, both details and size have been freely adapted to befit it for its new purpose.

Most people are beginning to grow weary of the hackneyed type of overmantel—the style illustrated *ad nauseam* in art-furnishing hand-books and catalogues—with its prim little mirrors and trim little spindles, its rigidly accurate symmetry, and unsympathetic concord with its environment.

The original cabinet is described as decorated with gold in colours, and the many objects of Saracenic and Moorish art at South Kensington Museum show the style of such ornament, and show also how unlikely it is that any northern craftsman could catch the spirit of that southern extravagance with its prodigal use of gold and colour. The decoration lavished upon a square yard of Arabian work is enormous, and the apparent roughness of its detail a huge factor in its pleasant effect. When English workmen learn that the neatness of finish is not art, but dead mechanism; and when their employers and the public recognise that the personality of the craftsman, the very flaws of his handiwork, excel in their human interest all geometrical exactness, then, and not until then, may we look for living art in our country. Fancy a tangled country hedge or a landscape executed with the same precision: nay, take an exhibition rose-tree grown with an absence of all grace, and made artificial in its wooden regularity, and then see if Nature's great law of individual expression be not one of her most widespread and unalterable.

In place of a somewhat elaborate cornice and railing I have suggested a frieze worked in fretwork—a painted decoration with a motto that if trite is certainly apt for its position.

The carcase is made so simply that words may be saved in describing it. The arched pieces are intended to be cut out of thin wood (several layers at a time) by an ordinary fret saw, with an applied decoration of paint, or made of plain polished wood with fret-cut ornaments. The halved pillars at either side of the arches are of turned wood to the pattern given.

The difficulty in giving full-sized working drawings of the parts that specially need them must be pleaded in excuse for the rather involved page of sketches. I only wish it had been possible to have included full-sized studies of possible decoration, but the attempt had to be abandoned, as black and white is unequal to convey an effect of colours in a space so crowded.

Neither was it feasible to give working patterns for the cornice nor for the lower arches and their turned pillars, which, it will be noted, are in the round, not halved and applied to each side of a partition, as in these upper storeys.

The arch openings for the first or top tier, the second with its narrower ends, and the third are all indicated. The size is governed by the thickness of the shelving, the average opening being 8 in. wide and 7 in. high.

If painted, naturalistic presentation of flowers or birds must be avoided. In the Arabic, above all styles, conventional ornament is alone fit. To employ Japanese mottoes, for example, would be a hideous anachronism. Mediæval detail would be far less so, and Indian, although it differs from Persian and from true Arabic, is yet near enough to be possible.

In these days of illustrated papers, when fine-art volumes like Messrs. Liberty's catalogues and the advertisements of our papers bring representations of genuine Oriental Art to every home, the whereabouts of designs for painted pattern to embellish this should not be hard to discover.

If any one attempts to carry this out, and yet sticks fast for want of instructions, let him write to "Shop," and in due time he shall have all the information he desires that it is in my power to impart.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

INTRODUCTION—ELECTRIC LAMPS—HOW THE LIGHT IS OBTAINED—COST OF ELECTRIC LIGHTING.

Introduction.—The subject of electric lighting is one of great interest to every householder throughout the civilised world. Old methods of lighting the houses in which we live have all some uncomfortable or inconvenient drawback to make us all desire some better method of illuminating our homes when the long dark nights of winter creep in upon us. Rushlight candles, with their dim uncertain light and guttering propensities, have had to give way to the cotton-wicked tallow candle of larger dimensions; and its flaring, yellow, smoking flame has had to yield its position in the household to the whiter light of the cleaner-burning composite candle. But the light from this has been found inadequate to the wants of even humble country cottagers when evening work has had to be done in the home, or it has been sought to beguile the long evening hours of winter with reading, drawing, and similar intellectual pastimes. Hence, paraffin and other oil lamps have superseded the use of composite candles as a light for the family table, because the volume of white light from one lamp is much greater, and more agreeable to the eye, than an equal volume from several candles; and also, because one such light entails less labour in its maintenance. Some of the best oil lamps give out a splendid light, and are free from noxious fumes arising from vaporisation of the oil and combustion of the vapour; but common lamps in unskilled hands are dreadful nuisances, making their presence felt in a most unpleasant manner. Dwellers in towns and cities are able to choose between lighting their homes by means of oil lamps or by coal-gas, but the use of gas in a house as a means of lighting has its inconveniences, among the most prominent being the bad effect of the products of its combustion on the bindings of books, the frames of pictures, the upholstery of the furniture, and the decorations of the room generally in which gas is burnt. Electric lighting by means of incandescent lamps is entirely free from all these faults (although it has others peculiarly its own, which we shall notice in their place), for the light is pure, white, soft, and agreeable to the eye, and cannot by any means vitiate the atmosphere of a room; whilst, at the same time, it does not sensibly raise its temperature. We may therefore safely say that the desire of the people for a pure artificial light has been fairly met in the invention of electric lighting by means of incandescent lamps: that is, those small lamps enclosed in glass globes in sizes varying from a pigeon's up to a goose's egg, and some of them having the ovoid contour of an egg. Electric lighting by means of arc lamps is quite another branch of the subject, and this is not so entirely free from objection as that of incandescent lighting.

The lighting arrangements of public exhibitions, and the special exhibitions of electric lighting appliances during the last ten years, have done much to educate people's minds with a desire for this form of illumination. It is quite natural to suppose that the sight of a building, and rooms in that building, lit up by means of a number of small lamps fed by current from a machine of moderate dimensions, should suggest that a few lamps (sufficient to light the rooms of a cottage) could be fed from a machine of corresponding small dimensions. This suggestion has led many persons to attempt electric lighting on a small scale by means of model dynamos (constructed by themselves), and also by means of primary electric batteries. The demand for these model machines has led to quite a respectable trade in iron castings suitable to the required field magnets, brass castings for the bearings, and iron punchings for the armature of small dynamos. It has also led to the invention of special forms of primary batteries, and improvements of some old forms, on which we may have something to say as we proceed.

The result of all those amateur experiments in electric lighting has been satisfactory to the experimenters in proportion to their expectations. Where a man has taken up the work of trying to make a dynamo and light up a lamp, solely as a hobby to fill up spare time, improve his education, and let his friends see that he can get a light by this means, the result has been to him most satisfactory. The same may be said of the results obtained by those who have constructed dynamos and batteries for a given purpose: as, for instance, to light up a lamp sufficiently powerful to illuminate the interior of some small instrument, to furnish a small temporary night-light, to throw light on an object under the microscope, or to furnish a light for a photographic dark room. All these, having moderate expectations, and setting about the work in a proper manner, have generally succeeded to their own satisfaction. The men who have not been satisfied are those who have been led by interested advertisers or by their own imagination to expect too much from a model machine. In the following pages I hope to clearly show what may be reasonably expected from a model electric light plant, and how to set to work to realise those expectations.

Electric Lamps.—Before we go further into the subject, it will be well to inquire into the nature of an electric light, and to examine the lamp by which it is produced. The lamp itself differs in every particular from the oil lamps and gas lamps we have been accustomed to use. Some of the more prominent points of difference are here enumerated. An incandescent electric lamp has no wick as in an oil lamp, nor perforated burner as in a gas lamp. It has no reservoir for oil, nor pipe for gas, nor any substitute for these parts, since the light it gives out is not produced by the combustion of any oil, or gas, or liquid of any kind in the lamp. The light-giving part does not

consume away at all, neither does it require any air—in fact, the smallest admission of air to the globe would cause at once a total destruction of the light-giver. As there is no combustion, there are no products of combustion, and the light will burn as well under water or in a sealed chamber (such as an air-tight glass case) as in the open air. As there is no flame to flicker, it may be used in an open space with impunity, however the stormy winds may blow.

The manufacture of incandescent electric lamps is a special trade, carried on by skilled workmen, with tools and appliances suitable to the work in hand. The lamps cannot be successfully made by an amateur in his own workshop, unless he is provided with all the costly tools and appliances employed in their manufacture. It will be well, however, to know how these lamps are made. On examining an incandescent electric lamp, it will be seen that it is composed of a sealed glass globe, enclosing a loop of thin wire with its two ends fused into the neck of the bulb. The thin wire inside the lamp is made of carbon, and is variously prepared by the several makers of lamps. The form of the loop, the size of the carbon wire, and the length employed in the lamp, also varies in lamps of differing makers. For instance, the carbon in a Swan lamp is of cotton, first made into a kind of parchment, and then converted into carbon by strongly heating the parchmentised filaments in an air-tight retort. The filament in an Edison lamp is made of carbonised bamboo. That in the Lane-Fox lamp is prepared from broom fibre. Others have used carbonised cardboard, platinum wires coated with carbon, and tubes of carbon. The Edison carbon is bent to the form of a horseshoe, and the makers of some other lamps have adopted the horseshoe or arch form in their lamps. Some of the Swan lamps have a spiral turn of half an inch in diameter put in the arch, thus giving an additional loop. The carbon in the Maxim lamp is bent into the form of an M or a gridiron. The small lamps generally used in model electric lights have only the arch form of carbon, varying in size with the resistance of the lamp or its candle power. The carbon filament is firmly clipped in the ends of two platinum wires, and these are fused in the neck of the globe, leaving two looped ends outside for convenience in connecting to the conducting wires from the battery or dynamo.

The glass globe or bulb of the lamp is blown from a piece of clear glass tube, the carbon loop is inserted in the bulb, and its conducting wires fused into the neck on the bottom of the bulb. On the other side, or at the top, is left a piece of the tube from which the bulb was blown. This tube is attached to a pipe leading to the exhaust chamber of a Sprengel air pump. The pump is set to work, and all the air is pumped out of the lamp bulb, thereby producing therein a perfect vacuum. When this has been satisfactorily obtained, a blowpipe flame is made to play on the connecting glass tube close to the bulb; this melts the glass, and (as the bulb is being drawn off) perfectly seals the exhausted lamp. This, briefly, is an outline of the methods adopted in the manufacture of the lamps employed in model electric lighting.

How the Light is obtained.—The question may now be asked—how can the carbon filament in an exhausted bulb be made to give out light? An answer to this question takes us into the mysterious domain of electricity. I say "mysterious," because to the many its workings are a mystery, although to the well-informed student they may be perfectly clear. To clearly understand what happens in an incandescent electric lamp when its carbon filament is heated to a glowing white temperature, we must dismiss from our minds all preconceived notions respecting the necessity of the combustion of a substance to render it incandescent. When iron and carbon are made white hot in air, they abstract oxygen from the air, and this combines with either of those elements to form new compound substances. In the first case the white hot iron combines with oxygen to form a black dust entirely different from metallic iron. In the second case the white hot carbon unites with two atoms of oxygen to form a gas named carbon dioxide, which passes away in a state imperceptible to our sense of sight. But the white hot condition in both substances—the iron and the carbon—did not in itself ensure the combustion of those substances. This condition was brought about in both by the particles of which they were composed being made to vibrate in a very rapid manner by means of energy imparted to them from the burning fuel in which they were placed. Therefore, if now we can produce in these substances the same vibratory motion whilst they are protected from the action of oxygen, they will attain a glowing white, or (in other words) an incandescent condition, without being consumed thereby. This actually happens when a strong current of electricity is sent through a filament of carbon sealed in a glass bulb exhausted of air. The current of electricity itself, being only a form of rapid motion in the particles of its conductors, causes a sufficiently vibratory motion in the carbon to make it white hot; but as there is no oxygen present in the bulb to combine with the white hot carbon, it is not consumed by the heat.

It will be well here to note that the carbon gets white hot only when motion of a sufficiently rapid character is imparted to it. This can only be attained by the employment of enough energy to produce this condition: that is to say, unless we send through the carbon filament enough electric energy to produce the necessary rate of vibration, we shall not succeed in raising it to a white heat. This fact should be remembered when we are planning the dynamo or battery to be used in lighting a given number of lamps, and rules for this purpose will be given further on.

Cost of Electric Lighting.—The expenditure of energy necessary to raise a filament of carbon to a glowing white heat in a vacuum, must depend upon its capabilities of conduction and absorption. Take, for instance, an ordinary electric lamp requiring one-and-a-half ampères of current to render its carbon filament incandescent. This will represent its capabilities of absorption: that is to say, it will continue to absorb the energy of the electric current until the volume of this reaches 1·5 ampères. A less volume will not raise it to the required incandescent condition, whilst a larger volume will strain its capabilities of absorption and endanger its existence, because it will be liable to rupture from excess of strain upon its particles. But the above figures alone will not, in themselves, represent the expenditure of energy necessary to light up such a lamp; for we must also take into consideration the capabilities of conduction in the carbon filament. If the carbon bridge or loop is a short and thick one, it will conduct the required volume of current freely, and thus offer a low resistance to its passage. If the loop is a long and thin one, it will offer a greater resistance to the passage of the current, and require a correspondingly higher rate of energy to overcome that resistance. Whatever length or size of carbon wire there may be in the lamp, we must employ a sufficiently large volume of current to render it incandescent throughout, and we must employ enough pushing force to send that quantity of current through the lamp. The cost of producing the amount of energy necessary to light up a lamp, or a number of lamps, must be governed to a large extent by the above considerations.

Some idea of the required energy may be obtained by noting the light obtained from one-horse-power. This power may be generated in a steam-engine, in a gas-engine, in a horse, in a number of men, or by a fall of water, or by a falling weight, or by a current of air, or by the consumption of zinc in a galvanic battery. However generated, or however derived, it is a horse-power of energy: that is, energy sufficient to lift 33,000 lbs. one foot high in one minute. It may be applied to a dynamo-electric machine constructed to generate a current of electricity, or it may be used direct from a battery. In either way, its results are the same, and it is represented by 746 watts of electric current. Now, the theoretical quantity of light obtainable from one H.-P. through incandescent lamps is put down as 300 candles, but the actual and practical outcome, with some of the best lamps, falls far short of the theoretical data. Mr. Sprague, in his latest edition of his book on "Electricity: its Theory, Sources, and Applications," puts down 200 candles as the light obtainable per H.-P. through incandescent lamps. But the Edison-Swan United Electric Light Company only claim an efficiency of 3·5 watts per candle-power for their lamps. Now, as we get 746 watts of electric current per indicated H.-P. of energy, and fully 10 per cent. of this is absorbed by the resistances in the machine and conducting wires, it follows that we can only get 671 watts of current for the lamps per I.-H.-P., and this, divided by 3·5, the number of watts consumed per candle-power, only gives us an efficiency of 191 candles per I.-H.-P. This may be accepted as the efficiency of incandescent electric lighting by small installations. If we can lay down a large installation, demanding several thousand C.-P., and can use large incandescent lamps, such as the large Maxim lamps, the efficiency of the lamps will be much higher.

An answer to the question of cost is, therefore, simplified by knowing how much light can be got from one H.-P. of energy. If we can now arrive at the cost per H.-P. to generate the required energy, and add to it the cost of lamps, holders, and conducting wires, we can get a fair idea of the cost of an installation. In calculating the cost per H.-P., some persons only start from the motor itself, and reckon the cost of maintaining the energy from the motor, such as the cost of so much coal or gas consumed per hour: this is fallacious. The cost of everything must be put down, and must include all that goes to produce the light: the prime cost of the motor, the cost of labour in putting it down, the cost of all fittings and appliances, the prime cost of the dynamo and all pertaining to this, as well as the cost of lamps, conducting wires, and fittings. This ascertained, a certain percentage should be allowed for capital sunk in the undertaking, and a rate

of depreciation fixed to cover probable cost of renewals at all future time. When this has been added to the cost of fuel and attendance, we may get at the actual cost of the light per C.-P. hour.

It has been generally conceded that water-power is the least costly method of generating electricity when this power is obtained from a fall of water in a natural stream. Next to this we may take the power of steam, and the cost of this will vary as the cost of coal in certain districts. The cost of power for a gas-engine, according to Mr. Sprague, may be taken as being 75 per cent. higher than that for a steam-engine, minus the cost of attendance, which is, of course, much less in a gas-engine. The cost of man-power may be put down as 8d. per hour, and in this time he will develop at the most only one-sixth of a H.-P. The cost of battery-power as compared with steam may be easily seen by the following quotation from Mr. Sprague's remarks on the subject:—"Now, the oxidation of 1 lb. of coal gives the same energy as that of about 7 lbs. of zinc, which costs some twenty-four times as much per pound, so that the energy of the source is in one case 150 times as costly as the other, and no amount of efficiency can make the cost of energy produced comparable in cost." This part of the subject will come up again for more detailed treatment further on, when considering the actual cost of generating power by batteries to furnish current for electric lights.

A SIMPLE SILK WINDER.

BY APIS.

MANY of the readers of WORK are interested more or less in the breeding of silkworms, and many others are interested in those who are interested in that pursuit. I am one of the latter. A mania for rearing silkworms and making huge fortunes with their produce breaks out betimes in every neighbourhood. Many of my young friends were seized with the affection. They purchased eggs, the grubs appeared, and, after having eaten enormously, began to spin their golden cocoons. These, in due time, were relegated to the warm water basin, and the process of winding the silk begun.

It was during this last process that I happened to call on one of my little friends. The work appeared tedious and unpleasant. He was winding round a lady's visiting card, revolving the card between his two hands, first half a turn with the right, then the other half with the left, and so on. It took him three hours to wind one cocoon by this means.

I wished to lighten his labour, but it took me some time to design the little winder shown in the annexed engravings. I did not want to go to much trouble about it. It should be very small, capable of being fastened on to a table, and, at the same time, efficient.

The body, or pillar, which supports the entire thing, is a piece of hard wood about 8 in. long and $1\frac{1}{2}$ in. square. Near the lower end a deep recess is cut, wide enough to embrace the top of any ordinary small table—say, $1\frac{1}{2}$ in. wide. A wheel, turned from hard wood, $4\frac{1}{2}$ in. in diameter and $\frac{3}{8}$ in. thick, is secured to the opposite side with an ordinary brass wood screw, a washer being placed between wheel and body. A little ivory handle is affixed to the wheel with a long thin screw. Within half an inch of the top a hole is bored right through the body, somewhat more than $\frac{1}{8}$ in. in diameter; and brass washers are fastened with little screws to each side, having holes concentric with the hole through body, but smaller. A straight piece of wire acts as an axle above, having a little pulley at one end, and the frame on which the silk is wound at the other. This wire is about $\frac{1}{8}$ in. thick, and fits the holes in the brass washers nicely.

Between the frame and washer I have a little bit of brass tubing about $\frac{1}{4}$ in. long, and a tight fit for the wire, which is thus prevented from moving endways.

The frame is a nice piece of work, and should be carefully made. The inside cross-piece is fixed to the wire simply by being pushed in tightly. The parallel bars B, B are pivoted to the inner cross-piece, but merely fit into the recesses in the front one.

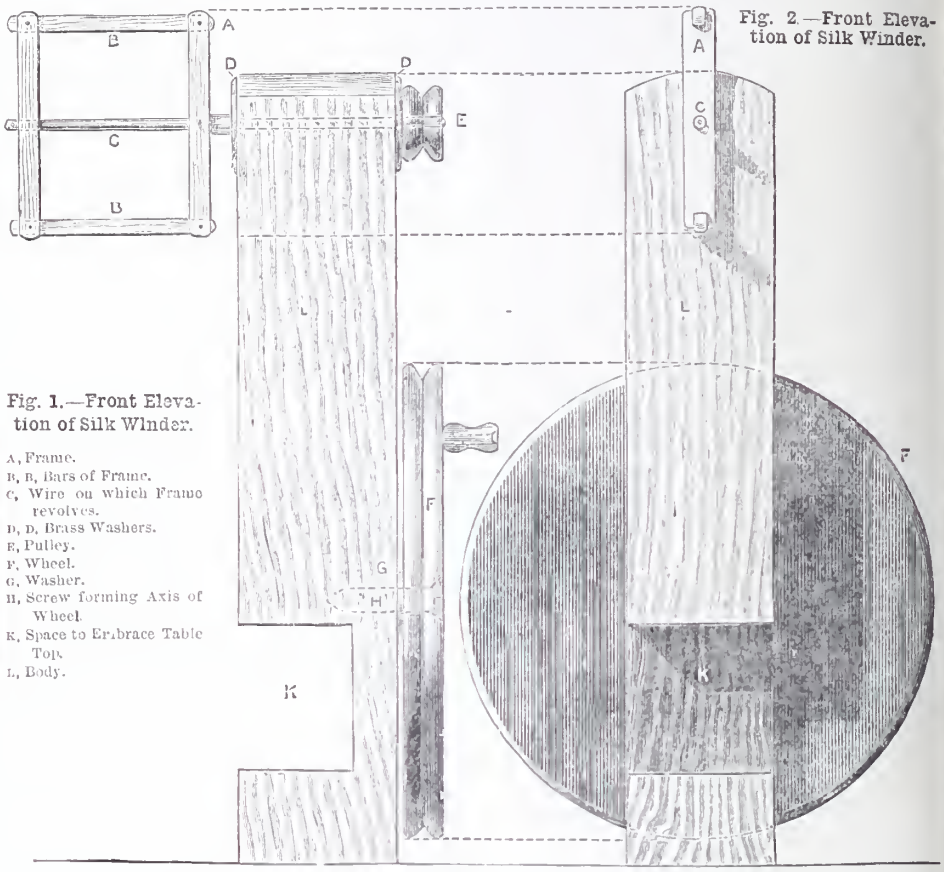


Fig. 2.—Front Elevation of Silk Winder.

Fig. 1.—Front Elevation of Silk Winder.

A, Frame.
B, B, Bars of Frame.
C, Wire on which Frame revolves.
D, D, Brass Washers.
E, Pulley.
F, Wheel.
G, Washer.
H, Screw forming Axis of Wheel.
K, Space to Embrace Table Top.
L, Body.

The object is that when the silk is wound the outer cross-piece can be slipped off, the bars B, B pressed together slightly, and the skein taken off; otherwise it would require to be cut before it could come off. I made all my frame of lancewood, which did very nicely.

The entire apparatus is fastened to a table by means of a long thin wedge put between the under surface of the table top and the lower face of the recess. This is cut to a slight angle—as seen, much exaggerated, by the dotted line in Fig. 2—to suit the slope of the wedge. A little band of silk connects the wheel and pulley, and the apparatus is an ornament to any drawing-room.

Although this will not make my *protégé's* fortune, yet I am sure it has saved him many a weary hour's winding, and has made the silkworm *furore* less short-lived than it otherwise would have been.

In conclusion, I would advise any one who thinks of going in for the interesting work of silkworm-rearing to make one of these winders. I will always be glad to help such through the pages of "Shop."

THE ART OF GRAINING.

BY A LONDON DECORATOR.

GRAINING POLLARD OAK AND KNOTTED OAK.

THE subject of my present paper marks a distinct step forward in the path of progress for the student of graining, since we shall now take in hand the imitation of a beautiful variety of oak wood, and which is obtained by the *distemper*, or "water-graining" process. So far, these lessons have dealt with the latter merely as an *accessory* to oil colour graining—as in the "over-graining" of oak. The graining of the "Pollard" variety, however, opens up a new sphere of study and practice for the learner, which will prove even more interesting than the work appertaining to imitations of the ordinary, or "maiden" oak. It is a fact fully recognised by all "imitators" of experience that facility in wiping out the "lights" of oak is acquired by some workers far more rapidly than others; whilst, on the other hand, we repeatedly find the grainers who "shine" in oil imitations often outstripped in speed and beauty of results—when it comes to distemper graining—by the same slow workers who were previously outshone. Such, certainly, has been the results of the writer's observation and experience; my purpose, however, is not merely to notice the fact herein, but to prepare the student who puts these papers to a practical use for an entirely different method of working, in which, according to his individual faculties, his previous rate of progress may be

somewhat reversed. No learner must take upon himself, from these few general remarks, to deduce an excuse for neglecting the painstaking study of and practice from real specimens of *veined* oak; for proficiency in any branch can only be acquired through the medium of correct knowledge and continuous practice.

Pollard Oak is a variety that may here with advantage be briefly considered, both with respect to its nature and appearance, and the cause of its beauty and markings. The meaning of the word "pollard" is easily discovered by reference to a simple dictionary, and, although at first glance the connection between "poll"—the head—and "pollard"—a tree lopped—with "the art of graining" may appear rather remote, their meaning gives the key-note of the explanation. Pollard, or rather "pollarded," oak belongs to the same natural class of oak as the ordinary figured variety, the striking appearance of which, however, is brought

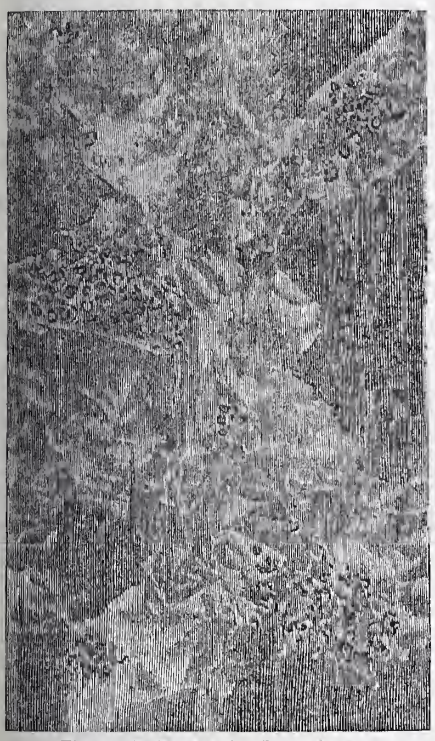


Fig. 1.—Pollard Oak: First Stage.

about by combined artificial and natural means. In most parts of the country there is a sufficiency of fuel without cutting or lopping off the branches of the trees; but when, by accident or design, an oak tree is so treated during its growth, then the trunk will display the results of this "pollarding." We are unable here to examine into the botanical cause and effect of such matters, but it must be understood that the junction of a branch with the parent trunk of the oak tree is characterised by a growth of knots and irregular twisted grain. When, therefore, these "arms" are lopped off, the knots and roots of the branch still remain connected with the heart of the tree; so that, provided the pollarding be executed at intervals of a few years, as the tree grows, the parent stem, when cut into long planks, will eventually display these clusters of knots, this gnarled and twisted grain, with intervening spaces of plainer grain, and which condition we know as Pollard Oak.

The brushes required for this imitation are a large thick mottler (Fig. 5, page 40, Vol. II.); a large sash tool, such as that advised for

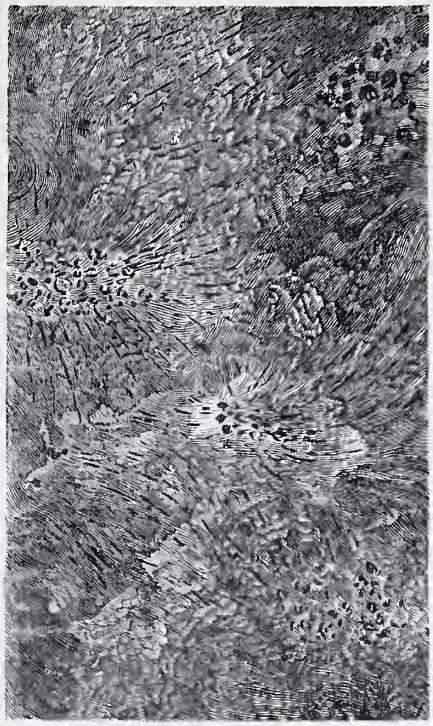


Fig. 2.—Pollard Oak: Second Stage.

overgraining ordinary oak; the "indispensable" badger (Fig. 16, page 40, Vol. II.), a piece of old open sponge, a wash-leather, a couple of round fitches, medium and small sizes (Fig. 7, page 820, Vol. I.), and, later on, the sable pencil and overgrainer, depicted as Figs. 21 and 8, respectively, upon page 40, Vol. II.

The ground colour for Pollard Oak should be a warm buff, very similar to the ground advised in the chapter on oak grounds for medium oak, but slightly richer. This is best made from white lead, Oxford ochre, a little Venetian red, and, when the imitation is required to be of a "quiet" nature, a little burnt umber will improve the

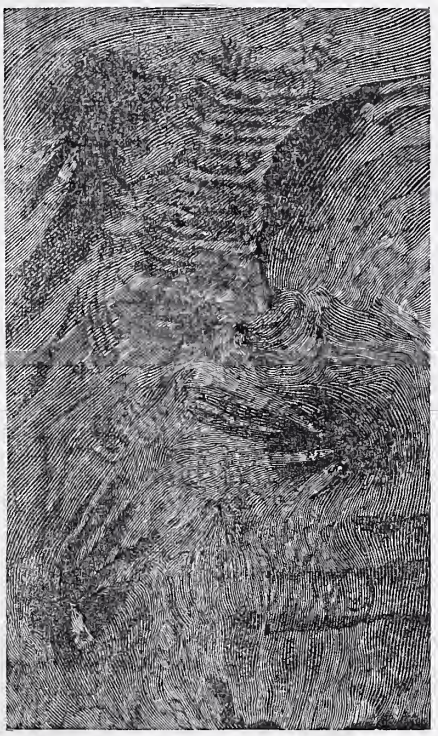


Fig. 3.—Pollard Oak: Final Stage.

colour. Occasionally we may come across directions and instructions upon this subject, which advise the ground to be made from "chrome, vermilion, and white lead." The brightness of such a combination would spoil the natural effect of any graining, however "woody" the figure may be.

The importance of working and studying from natural specimens I have repeatedly drawn attention to; and the young grainer will find a piece of real "pollard oak" one of the best investments he can make. A good specimen of this wood is somewhat difficult to obtain, and I, therefore, for the time being, will aim to make the student acquainted with the appearance and method of imitating the figure—until he is able to secure the coveted sample—by the poor, but useful, substitutes of pen and pencil. With respect to the grounding colours and the above directions for mixing, I may state that most grainers err on the side of brightness. The appearance of two real specimens

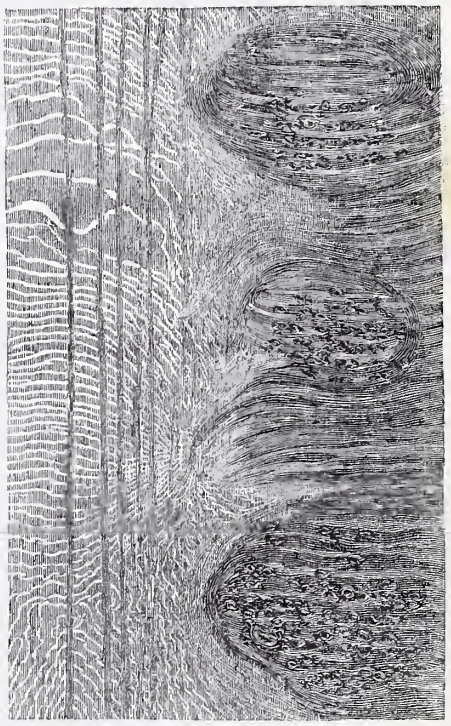


Fig. 4.—Knotted Oak in Oil.

I have in front of my table as I write may be given in support of this. Piece No. 1 has been French polished, and kept under fair conditions in my possession for many years; its colour is decidedly warm, and very rich; but even this could not be well copied without a slight dash of umber in the ground. The other sample has been merely well oiled, and in no way artificially coloured. To match this latter piece the ground would have to be that for an ordinary medium oak: viz., a slightly warm buff; the idea of graining it upon a "vermilion and chrome" tinted ground would be an absurd one.

In imitating pollard oak, there are two commendable but slightly different treatments, the working of which I will now explain. The first of these aims at reproducing the *general effect* of the wood in a broad and natural manner, and upon the ordinary buff oak ground, with complete results akin to the real uncoloured wood. The other style of imitation is worked on more, if I may so term it, *conventional* lines; the ground is made for a warm and very

rich final tone, such as the real thing would acquire from coloured polishing and age; whilst the plain and knotty features of the grain are more distinctly separated, and the detail of which is more minutely and painstakingly rendered. Both of these treatments are worth studying. That first mentioned is mostly practised in the West of England, but in the northern counties the more conventional "pollard" is chiefly favoured and practised.

The illustrations of graining Pollard Oak accompanying this description refer to the broad, and, to coin a term, "naturalistic" imitation; and as this is the most simple for the student to follow, we will give our first attention thereto. Having the tools before-mentioned conveniently to hand, and also a vessel with a little beer, some water, and a little each of Vandyke brown, blue-black, and burnt sienna (all finely ground in water), we dilute the former with beer to a fluid form, in old plates or basins, and the sienna to a thin wash in a third vessel. With the large sash tool the panel is rubbed over with the sienna wash, and then taking up a damp wash-leather, we "dab" and roll it over portions of the surface, which gives an irregular but connected "mottle." (Fig. 1.) This mottle is at once badgered and "softened" into stronger but softer masses. With a stiff round fitch dipped into the Vandyke and black, we at once put in the clusters of knots of innumerable sizes and shapes, but giving them an open appearance, and not as if put on with the finger tips. This part must now stand for a few minutes until dry, when we pass the mottler, dipped in clean cold water, over the work, and with the pencil overgrainer (Fig. 8, page 40, Vol. II.), charged with a wash of Vandyke, put in the fine grain which crosses more or less regularly the plain spaces between the knots. As we do each few lines of grain we soften each individual one to a dark edge by the aid of the badger; when all are so treated, we take our sable pencil, and with a little black we paint in the numberless fine dark veins which cross in an opposite direction the fainter cross grain, and which work from one set of knots to another set. (Fig. 2.) The work must now be varnished once, or if time and cost must be considered, we give it a coat of Japan gold size and turps in equal parts. It is then ready for the final glazing or over-shading, which is also done in beer.

The final glazing of the Pollard Oak imitation I am now describing is a similar process to the first mottling, shown in Fig. 1, but instead of using burnt sienna, we employ a wash of fine blue-black. With the latter pigment we must use a fluid strong in beer, as black is a very bad binder, and this is one of those exceptions in which the grainer—however strong may be his abhorrence to it as a beverage—will find beer to be necessary. If Vandyke brown is mixed with black, the strong binding powers of the former are sufficient for the two; but as nothing is more annoying or disastrous than to find our glazing colour working up with the final varnishing, even in the latter case it is best to use weak beer. Having therefore brushed over our panel with the blue-black wash, we take the wash-leather, and after wiping out a few sharp and small reflective lights amongst the knots, we roll the leather over the panel in such a manner as to get more depth and transparency to the whole previous work. (Fig. 3.) If these methods have been carefully followed the panel will give a rich and natural woody effect, and will make an admirable foil to the maiden oak stiles when used on doors. Where possible, all water-grained imitations should be worked upon the best and finest "brush work," and after having one finishing coat of copal varnish, it should stand a few days to harden. It will then be fit for "flatting" or felting down with finest pulverised pumice-stone rubbed with felt and water, and finally a good flowing coat of copal (painters' "carriage" or "copal oak") will give a finish, fit to last, with occasional re-varnishing, for twenty years.

Another imitation of Pollard Oak, which I have previously alluded to, is obtained with slightly different means, but on the same principle as that already described. The ground being of a richer and warmer cast, we commence with a full wash of burnt sienna; then with the sponge dipped into the Vandyke, and also slightly into the blue-black, we dab in the dark masses of knots, and put in a few connecting touches of dark colour where it appears desirable. With the large mottler we now work the colour surrounding the knots into one sweeping direction, using the brush at right angles to the board, and thus get one natural lead across the plain spaces from one "nest" to another. With the round, stiff fitch we further work the grain surrounding and amongst the individual knots in the same natural flowing curves as the mottler has indicated, and also "open" any knots which may appear too "spotty" or "set." The plainer spaces may also be mottled after the appearance of Fig. 1 in the previous process, but scarcely to an equal extent. The work can now all dry, and should then be wetted over, which our beer allows us to do without moving the colours, and then overgrained. Instead of the pencil overgrainer before used, we take the thin overgrainer (Fig. 13, page 40, Vol. II.), and, separating it into fine divisions, we work in the overgrain with a thin wash of Vandyke. While still wet, as before directed, the grain is softened to a dark edge, and then the fine dark markings which cross the latter are put in with the pencil and blue-black. The varnishing or "binding down" coating is now given, and then the work is glazed with Vandyke, if desired full and rich in complete effect, or with the blue-black or a mixture, if we wish to tone down the warmth. Providing we use beer with our pigments, we can, with care, always wet our work over, and thus see the colour when varnished. In the first process of such imitations we are therefore able to make little alterations or additions by re-wetting the work which may have dried too quickly for us.

In offering these directions to the learner of graining, the writer's chief desire is to make the *modus operandi* and the reason thereof plain and apparent to those readers of WORK who have no better way open to them for obtaining instructions upon imitating woods. The few black and white illustrations which we have attempted in these papers are in no way given as examples or "copies," but solely as pictorial aids to the letterpress. The advice given in my opening paper of procuring either good natural samples of woods, or imitations grained by a good professional worker, must be applied to all these varieties; and when the student has obtained all the assistance he is able to gather from this present aid, his best plan would be to take practical lessons, directly or by intelligent observation, from those experienced workers whose imitations are their best recommendations. As in all arts and crafts, practice will and must beget experience and knowledge, and the young grainer will often produce more masterly effects after a few lessons by actually watching the manipulation of tools and pigments by a proficient man than he would from a long study of real specimens alone, without instructions.

Pollard Oak in Oil may be grained in a similar manner as in water. The pigments, previously ground in oil, should have a little of the best terebine rubbed up with them, and the bright graining colour, or first wash, should be made as the ordinary oil-graining mixtures are. The sponge, mottler, and stiff fitches are used as in water colour, and, to take the place of water, and keep our work moist and amenable to mottler and fitch, we substitute turpentine. The brushes are dipped into clean turps, and then the superfluity pressed out before using them on our panel. The final glazing is worked as in the distemper process; but we have no occasion here to varnish or bind down the earlier process, in consequence of it being oil-grained.

Root of Oak is an imitation much akin to the pollard I first described. The grain of the wood, however, instead of "flowing" from each set of knots, more in the one direction of the length of plank, is found to encircle the masses of knots in irregular rings of overgrain, and is marked by the more decided presence of the dark pencil veins. It may be of interest to notice that one contemporary, an experienced writer and grainer, classes *all* such specimens, with which my first method is identified, as necessarily all "root of oak," and not genuine pollard. My own real specimen, upon which natural appearance the process and imitation is based, was cut directly off a 14 ft. plank, and, therefore, could not possibly be genuine *root*. It is very easy to understand how, when a specimen is cut from a large oak, that an old junction with a branch may be displayed of so large a size as to give it the appearance of a piece of root cut across the stump of the tree. With respect to this same specimen, it will scarcely be credited that, for want of a purchaser, or, perhaps, through ignorance of its value, the plank in question was being used by a country carpenter for *making common coffins*. Surely the want of trade and technical education was never better exemplified.

Knotted Oak—so called—is a useful and effective imitation of combined knotted and figured portions of the wood. It is commonly used, when graining oak in oil, for the panels, with ordinary oak stiles. It is a cheap attempt at the richness and variety of root of oak grained in oil, and although it is often as "nasty" as cheap, there are many grainers who make a good door with the panels so varied. I append a brief description of the working, and a black and white "suggestion" of its appearance. (Fig. 4.)

The colour for Knotted Oak is a warm, rich buff ground with a dash of umber therein, and the graining-colour the best burnt Turkey umber. A little of the pigment having been made to ordinary working consistency the panel is rubbed in evenly, and then one side slightly combed. With a stiff, scrubby, round fitch we now take up a little pure umber, only slightly thinned with terebine, and put in the dark knots; then, with another larger fitch, work round these, and give them and the surrounding space a growing motion towards the other half of panel. We now put in the fine neat lights across the slightly combed half, and with a lead towards the knots; and then with a pencil and rag we work up—adding to or taking from—the knotted half according to

the circumstances, "time and cost," of the job. When dry, we overgrain in distemper with a wash of Vandyke. The combined treatment of figure and knots gives full scope for display in the last process, and a creditable and natural effect may thus be obtained without much more cost than of a panel of *maiden oak*.

CONSTRUCTIVE STRENGTH IN WOODWORK.

BY JOHN WHITFIELD HARLAND.

FRAMING—NATURE OF WOOD—BREAKING AND CRUSHING STRAINS—STRAIN OF CONTRACTION—SIMPLE FRAMES — COMPOUND FRAMES — HOUSE DOORS — DIAGONAL STRUTTING — SWEDISH JOINERY—CUBIC FRAMING.

IN my first paper on this subject (see page 165), I disposed of the different modes of jointing boards together, and alluded to mortise and tenon joints for framing, and now propose to take framing as my present subject. Before attempting to show how strength of construction can be best attained in framing, let me first point out the conditions to be ascertained. Firstly, it is evident that wood being fibrous, that is, composed of fibres closely packed together, familiarly termed the grain, can be much more readily broken transversely than in a longitudinal direction, whilst it is much more easily split longitudinally than transversely; in fact, it is very nearly true to say that wood cannot be split or cleft across the gain. There is, however, another sort of strain to which wood may be subjected other than a breaking strain, which is called the crushing strain, that is to say, that with the grain upright a superimposed weight will, if heavy enough, ultimately crush the fibrous tissue of which the wood consists, whilst experiment proves that this crushing strain will much more easily destroy the tissue if applied on side grain wood. The reason for this is not far to seek. The fibres being laid alongside each other, and cohering by attraction in laminæ or layers, are, so long as the piece of wood is straight, of equal length; but so soon as a sufficient weight is applied to bend the wood, some of the layers of the grain are deflected (*i.e.*, the under side ones) more than others; and as a straight line is the shortest distance between two points, it follows that to some degree, no matter how slight, a movement takes place between the layers where they lie contiguous, which necessarily introduces a split or cleft, and the weight superimposed breaks up their union, and deals with them as separate pieces laid one upon the other, instead of as if they were one united whole. Hitherto, I have been talking of weight acting in the direction of gravitation only, which, to keep a clear ideal of, we designate as perpendicular strain. The science of mechanics teaches us that there are other strains, such as side thrust, *i.e.*, lateral strain; and, going further still, proves to us that where two forces, or strains, act in different directions, these forces neutralise each other in an ascertainable degree, and enable us to predicate with absolute certainty where and in what direction the line of fracture resulting from these combined strains, equal or unequal, will be sure to take. For instance, where a force acts perpendicularly and an equal force acts horizontally, the line of fracture will be in a diagonal direction, equidistant between the two, viz., at an angle of 45°; but if the piece of wood be upright, the resistance to the downward force being greater—let us say, three times that of the resistance of the wood to side thrusts—the diagonal of equal forces will no longer be at an angle of 45°, because either force, if sufficient to fracture at all, would fracture the lesser resistance, in this supposed case, in one-third of the time that would be required to fracture and overcome the greater resistance. Or, what comes to the same thing, one-third the side thrust and the same downward thrust would give the diagonal of the forces at an angle of 45°. This reasoning shows that, given the resisting power of the same wood laterally and perpendicularly—we can predicate the diagonal, in this case evidently, on the former assumption of one-third the former equals the whole of the latter in breaking power—the angle would be altered from 45° to that of one-third to one, viz., 30° (one equalling 90°, *i.e.*, a right angle, because we premise a perpendicular and a horizontal force). Tables are published giving the coefficient strains of all sorts of wood and metals—calculated upon the base of square inch sections—and also giving a third class of strain, which I am about to explain; and these tables give us the power of accurately ascertaining the exact diagonal of both equal and unequal forces acting either against each other, partly or entirely, or in different directions altogether. I do not mean to say that in woodwork it is absolutely necessary that the carpenter or cabinet maker should go into such calculations as those indicated, but I do say, and mean it, that he should have a thoroughly clear understanding in his own mind of these facts, so as to know beforehand where his work is likely to break if strain sufficient were put upon it, so that he may avoid in his construction leaving weak points. He should know how to put his work together so that it shall be strongest wherever the forces are likely to have their strongest tendency to destroy it. He will then be able to avoid heaviness, clumsiness, and waste of material and strength in the wrong place, where the forces actually counteract each other by neutralising each others' effect.

The third kind of strain is the opposite to the foregoing in every way. Crushing strains and side thrusts are pushing strains, not pulling strains. They do not destroy cohesion of particles as do pulling strains, and the latter are, therefore, termed tensile, that is, stretching strains. A familiar example of tensile strains is noticeable in a drawer front, where the self-evident tendency is to pull it away from the dovetail joints with the two sides, which in this case, it should be noticed, is perpendicular to the grain of the sides, which explains why the "pins" are on the drawer front and the "tails" on the sides; if they were reversed the tensile strain of opening the drawer would inevitably draw the "pins" out. Another instance of tensile strains is in the roof principal, where it is very important, though not perhaps so evident at first sight. The beam, usually called a tie-beam, is subject to a tensile strain, caused by the weight of the roof having a tendency to force out the walls which carry it. It is also subject to a perpendicular side thrust (by this I mean a perpendicular strain on the side grain, which, of course, runs horizontally), and evidently this force is greatest half-way between the supports at each end, that is, in the exact middle. Now, although it is almost universally done, a mortise to take the foot of a king-post at this, the very weakest point of the tie-beam, still more weakens it, and must be admitted to be bad construction. Better far to leave the tie-beam its full strength, and plant on it two blocks to maintain the foot of the post in position lengthwise, and bolt to the two side-pieces saddling it, as it were, athwart ships, or even bolting the side-pieces only to the post, as even a hole bored through the tie-beam sadly weakens it. The principal thus constructed may be of considerably lighter dimensions than the former method permits, without loss of strength, but should have an iron tie-strap.

Every one is aware that wood varies considerably in the direction of the grain, which frequently, owing to the more or less exposed situation of the trunk of the tree whence it has been cut, and the angles at which branches have forked from it, runs out, and is termed "cross" or "short" grained stuff in consequence. Such stuff is better able to resist crushing strains than either side thrusts or tensile strains, and to use this for tie-beams would be considered by me as bad construction. It would be usefully employed as a post, for blocking, or any portion of the work where the only strain was a crushing one. Hence I would urge workmen to exercise their judgment in selecting timbers for certain purposes, more with a view to their fitness than their accidental convenience of size, which, even if it entails a little more trouble and labour, is of considerably more importance in good work. This is the more important when we remember that an architect designs a roof on the general lines of habitual calculation, allowing, of course, a margin above and beyond what is termed the breaking strain, but does not, and cannot, make allowance for any improper use of a weaker piece of timber than his usual averages.

There is yet another strain to which wood is inherently susceptible, namely, the internal strain of contraction; and as this is, invariably, unlike metal, in width or thickness, or both, only never in length, no construction which ignores this strain, or does not compensate for it in some way or other, can be considered good. Thus any large surface of wood, either framed together or not, as the case may be, which experience teaches us will shrink in time, should be so put together as not to involve any necessity for the joints to be forced open or the grain to split in shrinking. In other words, table tops, panels, and other surfaces, should never be held by their sides, or in such a manner as to disallow their shrinkage from taking place naturally and without restraint. Something must give way if such restraint be imposed in their construction: joints will open or the wood will split, and no matter how good the general workmanship may be, the result of bad construction will ruin everything, bringing its own disgrace with it. It is no excuse to plead that wood will shrink, do what you will; this only aggravates matters. Your knowledge of the fact ought all the more to have made you careful to obviate its effect by such expedients as have been found to answer the purpose. In tables and drawing-boards this may be overcome by "buttoning" at the ends, or by screwing to battens underneath from the back through slots instead of round holes, so that in contraction the buttons or the screws can move inwards instead of remaining fixed, whilst panels should be left, of course, loose in the grooves, and not glued or held rigid by any means. Having thus, perhaps, too briefly sketched the various strains to which

all construction in wood, as a material, must or may be subjected and their difference in degree, it must not be assumed that I mean that these forces will be by any means constant, nor that any one force alone will invariably act in a given direction. To make this perfectly clear, such member of any construction designed to resist, say, a crushing strain, may instead, or, in some cases, even simultaneously, be also subjected to a tensile strain, or a side thrust, or both, a contingency that in all good construction should be foreseen and provided for so as to eliminate every possible source of weakness. With a view to this, framing is resorted to. By framing, I mean so putting together component parts of any construction that they may hold together under ordinary strains —hence we have simple and compound frames. The simple frame (Fig. 1) consists of four pieces of wood united at the corners, *a*, *b*, *c*, and *d*, in such wise as to be almost as strong and very much lighter than a solid piece of timber of the same outside dimensions. The corners may be halved together (as in Fig. 2), *e* being side view and *f* plan, in which the portion shaded shows where the half of the one piece underlies half the other piece. This is not by any means good construction, as it depends either on the glue or nailing or screwing of the halved portions together; it is therefore seldom resorted to in permanent work. A simple frame may be also mitred together (see Fig. 3) or halved and mitred (as in Figs. 4 and 5). There is very little strength—which in both cases is sacrificed to appearance—in these methods of uniting a frame together, and it is used almost exclusively for picture frames or mirrors, or other similar articles. Then again, framing may be dovetailed together (as in Fig. 6); but this again is weak, because the "pins" may be drawn out of the tails. By far the best means of framing-up is that of mortising and tenoning the corners together (see Fig. 7), where the shaded portion, *g h j i*, shows the tenon passing through the mortise, so that when glued it may be firmly wedged home to the shoulder at *g* and *i*. If the tenon be made as described in my first paper and illustrated in Figs. 13 and 13*a*, page 165, no stronger simple frame can be devised. All simple frames, if of sufficient size to permit of the sides being bent or deflected by strains, are to some extent weak on this very account, and therefore various means are resorted to to strengthen them, and they then become what I have termed above, compound. The cross-bar *k l* in Fig. 8 exhibits one method of stiffening a frame; it prevents the points *k* and *l* from being brought nearer together by a crushing strain or being forced apart by tensile strain, always provided the cross-bar is tenoned into the frame at *k* and *l*, and wedged either from outside or by fox-wedges in a concealed mortise. Sometimes, where the frame is to be filled in either with panels, or, in the case of window sashes, with glass, which (both being square) would add to its rigidity, the former must be only in the lengthwise direction, as we have seen that the width is always liable to shrinkage. Although in the case of glass it acts in both directions, being brittle it ought not to be too much relied upon. The cross-bar may be sufficient to prevent breakage; but in other cases, the size of the frame and the amount and variety of strains to which it may be destined by its purpose to be subjected necessitate changing its character, and it becomes a cross-rail *n*, Fig. 9, tenoned into the frame at each end, and at its centre in its turn mortised to receive muntings *m*, *m*, their other extremities being tenoned into the opposite members of the frame, technically termed top and bottom rails.

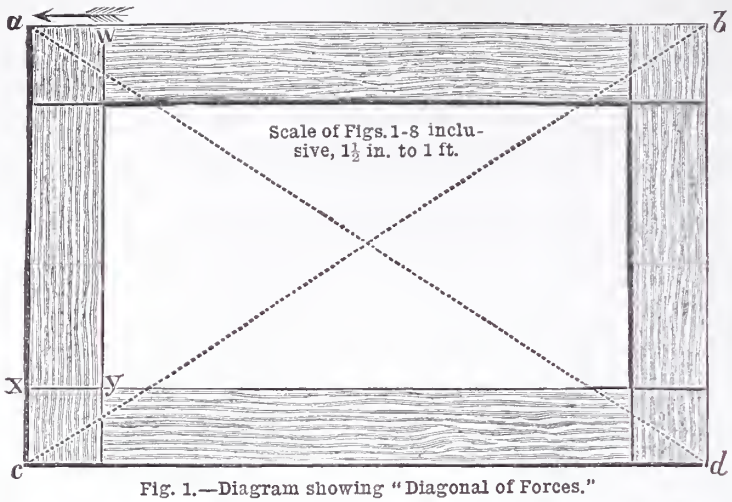


Fig. 1.—Diagram showing "Diagonal of Forces."

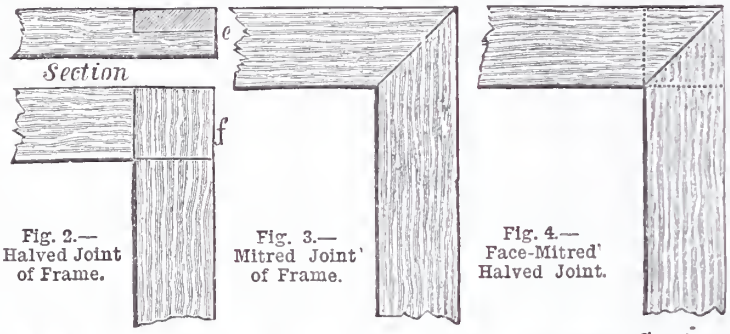


Fig. 2.—Halved Joint of Frame.

Fig. 3.—Mitred Joint of Frame.

Fig. 4.—Face-Mitred Halved Joint.

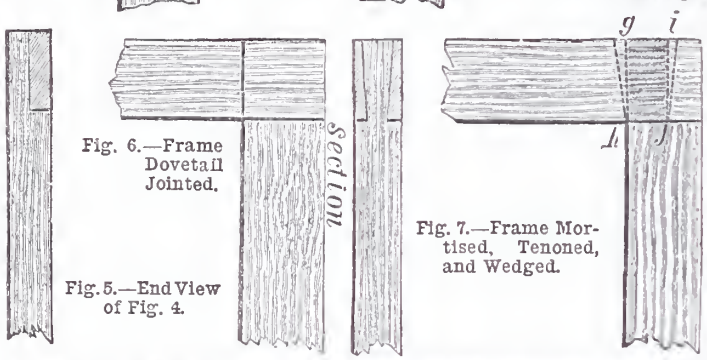


Fig. 6.—Frame Dovetail Jointed.

Fig. 7.—Frame Mortised, Tenoned, and Wedged.

Fig. 5.—End View of Fig. 4.

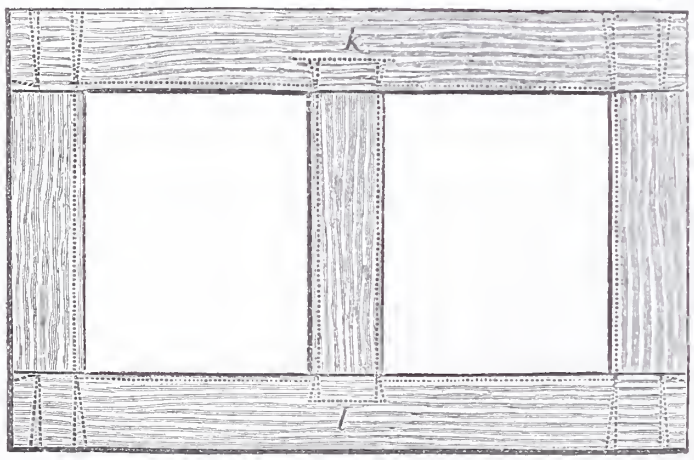


Fig. 8.—Frame strengthened by Cross-bar or Munting *k l*.

Without going into derivations of the term "muntings," it is much more to a useful purpose to consider their functions, and the strains they are designed to counteract. By the squareness of their shoulders, if also fox-wedged, which alas, too often, is neglected, they help to make the framing more rigid; they also serve as struts against compressive strains and as tie-bars against tensile ones, thus holding in and keeping out at one and the same time the top and bottom rails, whilst they also add to the strength of the cross-rail in like manner by maintaining it in its designed position and deriving from it and the other rails, in return for services thus rendered, so to speak, a power of keeping itself in position. It may partake of the character of a fairy tale, or fable, thus to endue what we may call dead or inert matter with any power to resist, even passively, strains from within and without; but in the infinitely lesser degree that man, by studying the laws that the Great Architect of the Universe has designed to govern matter, can command, if not create, combinations of strength and beauty, by thoughtful study, and bright and cheerful labour as a means to an end, is it not possible for the moment to accredit matter directed by man's mind with fanciful powers such as these? At any rate, it will not fog any practical mind thus to play at work, but may tend to true pleasure thus to endow soulless matter with the intelligence breathed into it by man. "It amuses me and does not hurt you," as the man said when he made a harmless joke.

This sort of frame is that used in the ordinary household door, the inner edges of the styles, rails, cross-rail, and muntings being rebated to receive the panels which are more or less well (chiefly *less* be it whispered) fitted into the rebates before being glued and wedged up. Verily, workmen who can and who would prefer to do their work to their own satisfaction and

credit are tempted by the competition of foreign labour and foreign machine-made joinery to slur the details of craftsmanship and produce inferior work far below their capabilities because the public, who are ignorant technically of the wants and demands of constructive strength, never ask the question raised by the old conundrum, "When is a door not a door?"

I have shown that strains act in the diagonal of two forces which may have been and probably was the reason why the "monks of old" adopted in Gothic doors and other framing the principle of diagonal struts and diagonal panelling. Refer to Fig. 1, where you will see a shoulder *x y*. If a force acted in the direction of the arrow at *a*, or the contrary, the result would be, either that *x* or *y* would become the fulcrum of a bent lever, one arm of which would equal *a x* and the other *x y*, or *w y* would be one arm and *y x* the other—a leverage of eight or ten to one. It follows that the frame could not withstand the force however moderate in either direction at *a*. Therefore the point *b* would be moved, or, what is equally fatal, would have a tendency to be moved to the right or left. Supposing that the forces were pretty near equal, the result, as before shown, would give the diagonal of the forces, as the dotted line *a d* would show. Now a strut with *a d* as its central line would absorb the forces competing for mastery, *i.e.*, the force acting from right to left, that acting downwards, that acting from left to right on the fulcrum of the said bent lever, and that acting in a tensile manner from *b* to *c*, as this would be negatived by being exerted at right angles to the strut whose centre line would be *a d*. If instead of framing, as in the ordinary door, a cross-rail and muntings as previously described we substitute on *a d* a diagonal rail, and tenon into it diagonal muntings, also tenoned into the corners *b*, *c* of the simple frame (provided the mortises do not interfere with and weaken those of the style and rail at *b* and *c*), the very acme of strength of construction is reached, especially if diagonal matched boarding be used for the panels. It has been shown that panels shrink in width, but not in length; therefore it follows that panels diagonally put in will not shrink so much in one direction as perpendicular ones, but will shrink slightly more in the other direction, because the diagonal is the mean of their shrinkage (*i.e.*, is between the shrinking in width and the non-shrinkage in length); but as this shrinkage is at an angle it becomes much less than if it were on the square; in fact, it is virtually imperceptible, so that tensile and compressive strains destroy each other if coincident in time and side thrusts through loss of fulcrum for leverage can only exert an infinitesimal portion of their force, the latent remainder being carried down and vitiated in what I have called the simple frame, by absorption in the directions where the material employed, *viz.*, wood, is strongest and most powerful in its resistance. Another consideration that will emphatically assert its existence in door-framing is that the strain imposed on it in opening it and closing it develops a twisting motion or tendency to some extent counteracted by the fixed points or fulcrums supplied by the attachment to the posts by hinges, but which also re-acts in the twisting.

Other developments of this thesis of diagonal strutting in framing are shown in Figs. 10, 11, 12, and 13, which explain themselves and call for no special description, except that it should be noted in Fig. 13 that the cross-rail is dispensed with and the filling in, instead of panelling, is here matched boarding flush on one side, battened by diagonal battens which are tenoned into the simple frame, the enclosed part *o p q r* showing where the battens are halved. When I come to consider and explain constructive strength in metal, I shall have to allude to casting under compression, a most powerful factor, and here let me apply the same principle in a modified form to the material now under consideration—wood—which is as compressible at ordinary temperatures as metal when raised to melting point. Now I suggest that to overcome contraction of side grain wood, a sufficient crushing strain or pressure might be readily used until the width of the board was reduced beyond the point to which it could ever contract before placing it in position. Thus floorboards, matched lining, and other large surfaces, the joints of which notoriously open in time, and in contracting weaken the framing in which they are set, might be compressed sufficiently to take all tendency to contract out of them. In doors, panelled partitions, and similar constructions the framing of which is wood, I do not see why the filling should also be of wood; it would, in painted work, be better to employ sheet metal, paper boards, or millboards, vulcanite, or other non-contracting substance which would always remain of the same size, and thus afford a constant support by close fitting at the bottom of the grooves to maintain the styles square with the cross-rail and top and bottom rails. A filling which by contraction goes away from its work and leaves room for backlash ceases to fulfil the object of good construction, but by substitution of wood which has been deprived of its power of contracting and is therefore to be relied upon not to work mischief, or of some other material which does not contract at all, we can afford to use for framing wood of slighter dimensions and thus effect economy of material. Let me instance a door of what I consider the best construction, say Fig. 10, which, if made out of $1\frac{1}{2}$ in. stuff with diagonal $\frac{1}{2}$ in. panelling, would be subject to a minimum contraction, yet would contract enough to nullify the support it ought to afford to the maintenance of perpendicularity of styles and squareness of rails, and would be still pretty strong. It could, by substitution of non-contractive filling, be made even stronger when made out of $1\frac{1}{4}$ in. stuff, with $\frac{3}{8}$ in. panelling, thus effecting an all round saving of material, weight, and labour, enhancing, rather than detracting from, strength of construction.

WORK readers will perceive that I am thus going a little beyond the recognised boundaries in these remarks, but they need not fear that I shall take them "beyond their depth," even if they strike out in new departures. Those master builders who now

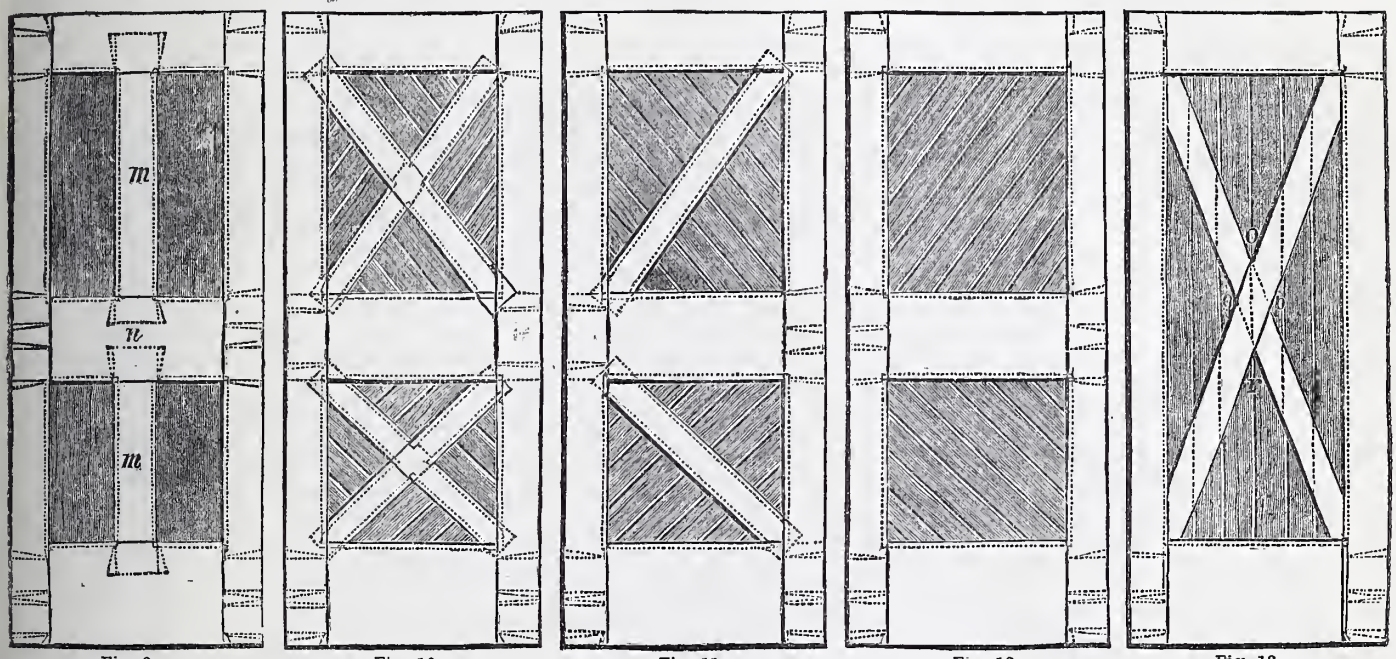


Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13.

Fig. 9.—Ordinary Door. Fig. 10.—Door Cross Panelled with Diagonal Filling. Fig. 11.—Door with Diagonal Struts and Panelling Parallel. Fig. 12.—Door with Diagonal Matched Panelling. Fig. 13.—"Cross Buttock" Door Ledge boarded flush on one Side. (Scale of Figs. 9–13 inclusive, $\frac{1}{2}$ in. to 1 ft.)

buy American and Swedish, or Norwegian doors, instead of using English labour, have the excuse that they are cheaper. But they simply buy "a pig in a poke," taking sufficient care, however, of "number one" to sell it again before the "poke" is removed. But this sort of thing can be foreseen to have a not far distant ending. Timber takes longer to grow than to cut down, and demand will fetch up prices; exhaustion of supply (as in the case of our own coalfields) will again enhance prices. Courted labour will demand in the increasingly enlightened condition of workmen all over the world, better pay, and foreign joinery cannot therefore for any lengthened period dominate the market. To shorten that period I suggest superiority of strength of construction, applied to English work: the substitution of sheet iron panels for doors, enabling the maker of the frame to reduce thicknesses, without sacrificing strength, securing rigidity and extra lightness, at lower cost. But all slovenly work, such as bad mortising and tenoning, too often passed in the case of muntings, which under these conditions only seemingly are of any structural strength at all, should be put down with firmness by all English builders. If the muntings be properly tenoned and mortises be cut deep and square and fox-wedged till they are held home, afterwards pinned with good dowels, they add to the strength of the framing as much or more than the members of what I call the simple framing (or, as the French call it, the *entourage*, that is the surroundings). Then if the panels, non-contractive, fit all round they may be glued in place, thus adding to the strength by holding to the sides of the grooves in which they are set, whereby tensile and side thrust strains are neutralised. If sheet iron be used for panels instead of glue, the iron should be warmed and hot shellac used to fix them in the grooves, which instead of being ploughed can be cheaply cut by circular saws, as is now done in floor-boarding with hoop iron tongues, which ought also to be warmed and cemented in place with hot shellac to ensure good work, and all contraction first compressed out of the boards. Having thus treated of framing, I must defer to another chapter the consideration of what may be termed *cubic* framing, as this subject demands too much space for the present. By cubic framing I mean where the third dimension comes in, as for instance in a table. The top of a table may be a frame, or laid upon a frame, such as I have just treated of, but the third dimension, inclusive of fixing the legs to a frame perpendicularly, which itself is horizontal, involves several intricate questions of strains and strength, which perforce I must defer.

MEANS, MODES, AND METHODS.

Firebricks.

It may not be generally known that firebrick in the shape of cheeks and backs for open or closed stoves and ranges can be manufactured easily, and broken ones repaired, at home, by any one who may have the time and the inclination to do so, and with a comparatively small outlay of money. Of course, the shops advise folk to buy a new set when a brick is broken, but with a view to helping those who wish to help themselves, I will explain the mode of setting to work.

Now, whether the object in view is to repair a broken brick or to put in an entirely new set, the first thing is to mix the fire-clay (sold by most ironmongers in the dry form as Stourbridge clay) into a stiff paste with water, and to do satisfactory work, this paste must be stiff enough to stand by itself when cut into slabs about $1\frac{1}{2}$ in. in thickness. Next, having cleaned out the grate, and, in case of repairs to a broken brick, picked out any loose fragments, thoroughly wet with a brush or the hand all the parts where the new brick is to touch the grate. There is no need to flood the grate, but just give as much water as can be absorbed, and no more. Most grates have some firebrick in them, and the amount of water that can be absorbed will be very easily seen.

Next, without any hurry—for the clay does not set instantaneously, like plaster of Paris—lay the cement into the place it is to occupy in the grate, using a trowel or spatula of wood, and pressing it equally in its place. For my own part, I prefer to use my fingers first, and finish the surface off with a piece of wood.

Where cheeks and a back are required in a grate (and this helps to keep down the coal merchant's bill), I put them in all in one piece, and am inclined to think that the brick lasts longer when in one piece than when composed of three pieces, as usually sold in the shops; and the reasons are these:—that the brick in one piece has greater solidity; there is less chance of fine ashes and dust getting behind or underneath; thus the risk of breakage is considerably diminished, and the brick cools more equally when the fire goes out.

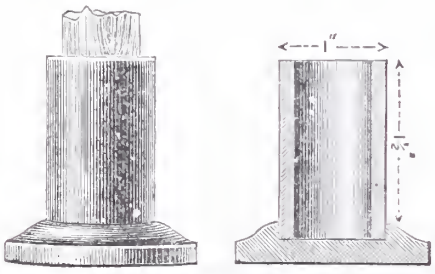
When the fire-clay is firmly in its place, a fire may be lighted at once, or if the work be done overnight, the clay may be left to dry until the morning.

There is no need to go into the chemical details of the action of the fire on the clay, but the result, in my own experience, is a perfectly durable and economical brick—economical in itself, as costing something under one penny per pound, and economical, as lessening the consumption of coal.

In conclusion, I may add that in putting in a whole set in one piece, it is as well, though not absolutely necessary, to let the brick taper slightly from the bottom to the top—say, from $2\frac{1}{2}$ in. at the bottom up to $1\frac{1}{4}$ in. at the top. H. J. L. J. Massé.

Indiarubber Shoe for Crutches.

Many years ago I designed an indiarubber shoe for crutches, the use of which prevents the user from having his crutches slip from



Indiarubber Shoe for Crutches.

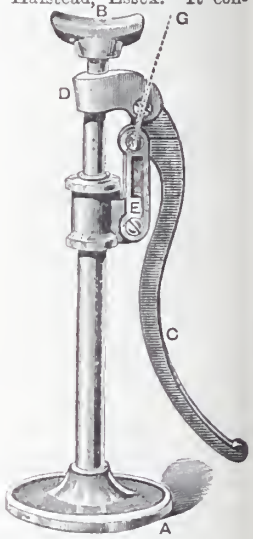
under him, even upon ice or polished marble or oak flooring. It was made by Messrs. Macintosh & Co., but never having been advertised, never got into general use. I enclose sketch of it, also a section, thinking that, as it answered perfectly well, it might be taken up as an article for sale, especially by the hospital surgeons, civil as well as military. It consists of a tube of vulcanised rubber, $\frac{1}{8}$ in. thick, let into a piece of the same material moulded to the section shown, and cemented to it with a solution of rubber in benzine or naphtha. The foot of the crutch should be reduced to $\frac{3}{4}$ in., and then inserted into the tube, a small piece of wood or iron wire being inserted with it, to allow the air to escape, which, when removed, the tube collapses tight to the foot of the crutch, and it will then never come off. These shoes last much longer than leather ones. J. W. H.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

61.—A New Carriage Jack.

A simple and effective carriage jack or setter for lifting carriages by the axle from the ground is shown by the accompanying illustration of this appliance, which is known as "Little Jack," and is made by Messrs. C. Portway & Son, "Tortoise" Stove Works, Halstead, Essex. It consists of an upright cylinder on a base A about 20 in. high; into this cylinder is a rod with a crutch top B, which works freely up and down, to suit the height of axles from the ground; a handle C is fitted to the cylinder and crutch-rod sliding piece D. The jack is put under the axle of a carriage, the handle raised horizontally, and the crutch lifted to the axle to be raised, the downward pressure of the handle acting by pressing the connecting rod E to a vertical line, and the fulcrum bearing beyond a vertical line—as shown by the dotted line G—raises the crutch 2 in., and secures it from sinking till the handle is raised again to the horizontal line. It is made in three sizes, Nos. 1, 2, and 3. The height of these is 14 in., 18 in., and 21 in. respectively. No. 1 will lift the axle of a carriage weighing 5 cwt. 20 in. from the ground; No. 2, the axle of a carriage weighing 10 cwt. 25 in. from the ground; and No. 3, the axle of a carriage weighing a ton, 29 in. from the ground. They are sold at 5s., 7s. 6d., and 10s. respectively.



Portway's Carriage Jack.

62.—The Decorator's and Artisan's Handbook.

I can cordially recommend this book, which comprises from five to six hundred recipes and instructions for mixing and using cements, paints, stains, varnishes, etc., with much useful information with regard to exterior and interior work. It must have cost its compiler and publisher, Mr. W. McQuhae, Cockermouth, much time and research. Its price is 1s., or 1s. 1d. post free. There is no workman, professional or amateur, who will not find something useful to him in its sixty-four pages. The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Mitre Cramp.—KILDONAN (*Inverness*) writes:—"I was spending a hard-earned and all too brief holiday in a remote Highland glen when WORK (No. 69) reached me a week behind time, and as I adhered to my fixed determination to avoid all correspondence, *pro tem.*, hence my delay in replying to the strictures of CODGETO (see page 275). I confess I do not understand what he is driving at. In the mitre cramp described by me and H. B. (*Chatham*), the central triangular piece must have its apex a perfect right angle thus: A B O is a right angle. The saw cut B D equally bisects this angle, making the angles A B D and C B D equal to one another, each being therefore equal to 45°. Now a piece of moulding laid along A B and another along B C and cut in the direction of B D are practically coincident with these lines, and when brought together must necessarily form a perfect right angle. How CODGETO managed to produce a figure such as he has done, I cannot imagine. Does he mean to say that the *lengths* of any two straight lines containing an angle affect the value of the said angle? If so, the correspondence may as well cease. Perhaps he has fallen into the mistake of having the sides A B and B O of *unequal* length, and of bisecting the base A C. This would, of course, throw his mitre out of truth."

Oil Polishing.—KILDONAN writes:—"I am pleased to see Mr. Denning's article on this subject in the current number of WORK. I made a small fancy table, described in No. 1, Vol. I., from an old Indian tea chest, making the legs of light-coloured oak. I don't know what kind of wood was in the chest; it is not unlike oak in colour, while in texture it is more like mahogany—anyway, it works like cheese, and takes a fine skin. Two practical painters—one a house painter and the other a coach painter—advised me to polish with oil, the one advocating raw linseed, the other boiled oil. I tried the raw oil, but, rub as I liked, I never could get it dry. The wood was porous and took in the oil easily, and perhaps this caused me to use more than I should; but for weeks and months afterwards it would sweat and have a greasy appearance. I always took a clean rubber and went over it till the sweat came over my nose, but in a day or two it was as bad as ever. Eventually I rubbed in some methylated spirit, and that cooked it. I cannot say that it spoiled the polish, but it has since continued dry."

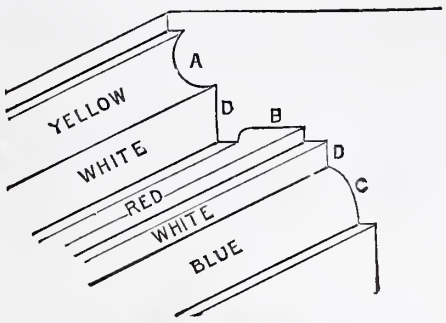
Erratum.—J. S. (*London, N.*) writes:—"I hasten to correct a mistake in WORK, No. 73, page 341, in my reply *re* 'Shut-up Stool.' The word 'bottom,' relating to Fig. 7, should be 'top.'"

Sheet Metal Book.—R. A. (*Salisbury*) writes:—"The price of the 'Sheet Metal Worker's Pattern Book' should be 9s., not 2s., as stated."

Winter Classes.—PATER writes:—"All my knowledge of carpentering and kindred subjects I gained at Polytechnic, and similar classes. Intending dabblers with wood and metals this coming winter cannot do better than look up classes of the kind in their neighbourhoods."

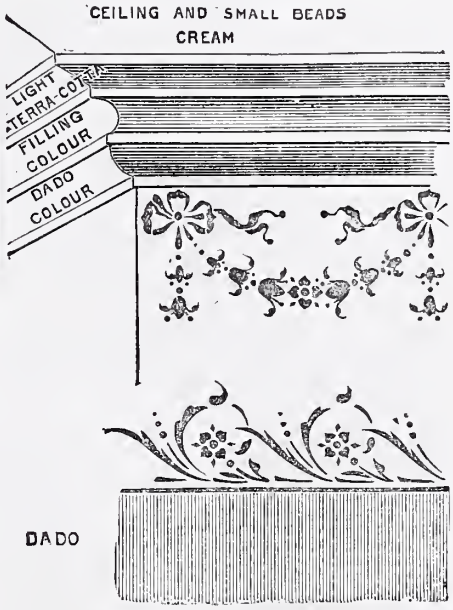
II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Colour.—BOATHOOK.—Turning to your suggestion of giving "sketches of the cornice, doors, ceiling, etc., and the sketches lettered and numbered for the colours to go with the others without having any guess work," this will, I hope, duly be carried out, as much as can be thoroughly useful. You will notice my expedient of advising earnest students to get "Aspinall's" colour card, and which will enable me to make a definite attempt to teach colour harmony. It is quite useless to give instructions on "colour" without colour samples; this has been the weak point of all periodicals and trade literature hitherto, which have "tackled" the subject of practical colouring. Red, blue, green, yellow, mauve, terra-cotta, and such like words, do not represent definite colours in their ordinary use; they are only comparative terms, since that which appears a green hue may, by juxtaposition with a bright yellow, be made to appear decidedly blue. Again, that which I would call a brown, you might term dark red; hence you will see the impossibility of practical lessons on colour without specimens, and the invaluable help we may obtain later on by both writer and student working with the colour card. With reference to the ordinary training (?) of house painters, the introduction with which my papers were commenced will show you to what extent I am familiar with the state of affairs. No book could possibly teach you all you suggest, or make a person, by literary knowledge alone, a colourist. The faculty for colour, like that for music, is to a very definite extent horn in us. The same sensitiveness to hard and harsh effects, discords, and want of balance in colours, comes naturally to a horn colourist, just as similar arrangements of sound strike the hearing of a musically-gifted person. Granted that almost any faculty can be cultivated by study and perseverance to a very



Cornice Colourings.

successful degree, yet but very few persons have any idea of the immense amount of study and patience demanded to originate colour harmonies. Women, whose senses are usually more sensitive to sight and sound, instinctively, so to term it, avoid decidedly bad colouring; whilst their periodicals and wearing apparel further help to teach them what *not* to select. Beyond this, not one woman in a hundred is a colourist, in the true sense of the word. Where the faculty exists, the idea of studying the scientific aspect, and the mathematical equations and works of Brewster, Chevreul, Young, Rood, or Church, is usually scouted and seldom undertaken. If such is desirable, in due time useful papers on the theories of colour alone will be given; but it shall be my special effort to very much assist you when purely decorative house painting is in hand. A few lines of foundation for practice for you I here append; their author was the late Owen Jones:—"It is evident that, as the object must be to cause A to advance, it is here we must put the yellow, both from its position and from its form. On the contrary, we place blue at C as the retiring colour, and assisting the concavity of the moulding. Red, the most positive of all colours, looks best in



Ceiling and Dado Colourings.

shadow—we, therefore, place it at B. The fillets or vertical planes at D we make white, as useful in separating the colours from harsh contrast. The positions of the colours are subject to modification, according to circumstance. Red never looks well when seen in a strong light, it is too positive and painful to the eye; on the contrary, in soffits, in hollows, or depths of any kind, it looks most brilliant." Beyond this, use a faint tint instead of white for all but simple bedroom ceiling flats. Avoid pure or bright colours, especially when they contrast, like blue and yellow, red and green. Mix your tints similar in colour to the wall paper, then place them somewhat as shown. Avoid much contrast of tone—depth.—LONDON DECORATOR.

Tool for Dowels.—CONSTANT READER (*Perth*).—The only way to make dowels across the grain of the wood for stopping screw holes so as to clean off neatly, is to have the dowels turned in the lathe. I have used many of oak and elm for coffin making, and other people that I know do the same. I do not say that CONSTANT READER cannot cut the dowels with a sharp gouge, but the best and cheapest plan is to turn them, or get a wood turner to do so. If you want the plugs 1 in. in diameter, saw 1½ in. off the end of 1½ in. board, take off the corners, and send to the turner. Undertakers keep these plugs in stock for their cases, and they are made as above.—B. A. B.

Scissor Grinding.—LECTIO.—Separate the two blades by taking out the rivet, and grind them on the flat surface—not the bevelled edge—slightly hollow; then take off the edge from the outside. The only book on cutlery I know of is, "Cutting Tools Worked by Hand and Machine," published at 3s. 6d. by Messrs. Cassell & Co.—T. W.

Nickel-plating.—FRITZ (*Holloway*).—(1) All articles to be nickel-plated must first be scoured clean and bright with a surface free from blemishes as in a finished article. To do this it is necessary to use acid dips to clear off oxides, and potash dips to clean off grease and animal impurities. See article on "Brass and Brassing," pp. 597—599, Vol. I., for information on cleaning the articles. When well rinsed, give them a dip in cyanide of potassium solution before placing in the metal plating solution. (2) Iron and brass articles may be plated in the same solution, but it is not advisable to plate them together at the same time. (3) Polish on a proper polishing lathe by means of revolving rag dollies and mops charged with Sheffield lime.—G. E. B.

Magnesium Wire.—INQUIRER (*Walton-on-Thames*).—The wire you inquire about, "which, when lit, burns like electric light," is probably magnesium wire. It is used in some of the more costly firework experiments, and in furnishing a light for photographic experiments by night. You cannot make it yourself, but can get it from any dealer in photographic materials. The price is somewhere about 15s. an ounce.—G. E. B.

Coppering Solution gone Wrong.—WOODCUT (*Edinburgh*).—I think your solution is deficient in metal, although you think it has been supplied with copper as fast as you have taken copper from it. Hang a muslin bag filled with sulphate of copper crystals in the solution, and add a little dilute sulphuric acid to it from time to time until it is restored to its proper condition. If this does not speedily cure it, use a lower battery power, and adjust this to meet the altered conditions of the solution.—G. E. B.

Black Bronze for Brass.—J. M. (*Bootle*).—The process is described in the article on "Bronze and Bronzing," page 643, No. 41, Vol. I., of WORK.—G. E. B.

Electro-plating.—AMATEUR PLATER (*Devonport*).—Full instructions on how to electro-plate with silver, nickel, gold, platinum, and other metals, will be given in WORK as soon as room can be spared for their publication.—G. E. B.

Electric Bells.—A. W. (*Wakefield*).—I am glad to hear of your success with electric bells made from my instructions, and will gladly help you out of your present difficulty. In altering the connections, you have connected up both bells to one battery, and have shut out one battery with its switch, hence you can ring both bells from one end, but cannot ring them from the other end of the line. Make a sketch on paper of your telephones, bells, and batteries, then arrange lines between them so as to make a complete circuit of one battery, one bell, and one telephone. Also arrange a switch to put the bell out of circuit whilst the telephone is in use, unless this is furnished with an automatic switch. Call this first arrangement the home station, and arrange the connections to ring the home station bell with a push at the distant station. Then sketch the distant station appliances in a similar manner. When you have got it right on paper put your ideas into practice. Of course the terminal carbon of the battery must be connected to the bell and the zinc terminal to the earth wire. You may not need the whole battery for the telephone, but should take in all the cells to ring the bell.—G. E. B.

Battery for Coil.—A. R. (*Fulham*).—Either the Bunsen battery described and illustrated at pages 3—22 and 42, Vol. I., or the bichromate battery described at page 442, Vol. I., will be found most suitable for working a coil. Use one, two, or more cells until the full powers of the coil have been developed.—G. E. B.

Patenting Instruments of Warfare.—R. B. (*Highbury*).—Under the 26 and 27 Vict., the Crown had the power of using any patented invention on payment to the inventor of a compensation, to be fixed by agreement, or, failing that, by valuation; also of insisting that the invention should be kept secret, if such a course were considered desirable for the public service; more recent legislation, however, would seem to have somewhat limited the powers of the Crown in these respects. The colonies have their own patent laws, and protection has to be sought in them separately.—C. C. C.

Brazing Lathe Head.—H. N. C. (*South Norwood*).—It is possible to stick cast iron together by means of brazing, but as to making a good job, that is out of the question with such a thing as a lathe head. If I were going to mend it I should drill and tap a stout plate on each side, and screw

it on with countersunk-headed screws; this will be far stronger.—R. A.

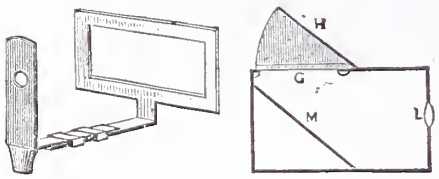
Home-made Camera.—FOCUS.—(1) The circular front is better rebated; the rebate is conveniently made by making the front of two thicknesses of wood, the circular opening in one being a little less than that in the other, thus together making a rebate. (2) Yes, ¼ in. rebate is sufficient. Velvet or cloth is good. (3) Hinge the focussing screen. (4) Strong, close-textured buckram is preferable to leather for hinge to dark slide; use glue to fix. (5) Refer to previous number of WORK, in which will be found drawings and the information desired both as to swing back and reversing frame. (6) Brass fittings can be had of H. Park, 1, Orchard Buildings, Acton Street, Kingsland Road, London, N.—D.

Steel Points, etc.—C. E. S. (*Kingsland*).—I think that this querist has very little idea of the wonderful mechanism of the perfected phonograph if he thinks that he has got sufficient details to enable him to make one from a lecture view, which lasted a few minutes as he says. I am just a trifle curious to know what details he has got, for those which he has *not* got and asks me to supply seem to me the most important; in fact, they are the embodiment of the whole thing. I have promised to give an article on the phonograph, and it is in the Editor's hands awaiting space and other necessaries before it can be published, but I hope that you and others interested in this subject are not expecting the instrument described to be anything like Edison's instrument; let me say here, and once for all, that it is very much unlike the perfected phonograph. It bears somewhat the same resemblance to that instrument, as the single needle telegraph bears to Sir W. Thomson's siphon recorder. I am not possessed of all the details of this wonderful machine, and cannot therefore supply them to the querist. I have a copy of the specification by me and could easily copy from that, but I do not feel at liberty to do so, it savours so much of the plagiarist. The number of the specification is 16,212, and its price is 11d., to be had from the Patent Office, Cursitor Street, Chancery Lane. I may say, however, that the points are not of steel, but of sapphire. The shape of the reproducing point is round, perfectly smooth, and polished. The recording point is cup-shaped and has a very keen edge. The diaphragms are variously described as being of glass, mica, thin sheet metal, gold-beaters' skin, etc. I hope C. E. S. will not think me ungracious if I have not satisfied him in this answer. He must remember that the perfected phonograph is a very much patented article, that it is not yet on sale in this country, and that its interests are jealously watched by those whose business it is to do so. I would strongly advise you to wait until the Editor can publish the above-mentioned article before you begin to make a phonograph.—W. D.

Map and Plan Drawing.—BOTCH.—With our Editor's permission I shall be glad to give you detailed information on the construction of a plane table and other instruments for use in plotting to scale land surveys, alluded to in the "Popular Educator," but such a paper would far exceed the space in "Shop."—J. W. H.

Post Office Adhesive.—J. P. O. M. (*Milford Morpeth*) asks for a receipt for making the adhesive matter used by the Post Office. It is only burnt starch, *i.e.*, dextrine dissolved in water (see D. A.'s answer to E. M. (*Ashton*), No. 49, page 780), which evidently J. P. O. M. has *not* read. In the same letter the writer asks for a composition harder than plaster of Paris with the appearance of ivory. I suppose he means a very common imitation of ivory which is produced by saturating plaster of Paris casts with linseed oil, and then letting them thoroughly harden for a couple of weeks when they may be surface polished with a dry, hard brush, care being used not to damage them by violent brushing. Another plan is to take a soft, broad, camel-hair brush or a piece of soft sponge and cover the surface of the plaster cast with solution of silicate of soda or silicate of potash (water glass), which changes the pure white of the plaster to an ivory colour and dries instantly, being very careful not to go twice over the same part until it is quite dry or you will get it lumpy. Try on something first that is of little value, and when you have got the knack you can proceed to work on the article you have in view. The plaster must be quite dry, not fresh from the mould—at least three days should elapse; when its suction is perfect it will absorb the silicate with avidity to some depth, and it will be found to be case-hardened by this means and quite impervious to damp. This is far better than painting casts or busts if properly done. The linseed oil process, though much longer, is much easier to a tyro. In future write each query separately.—J. W. H. [Questions upon divergent subjects are answered by separate specialists. Hence the necessity of writing each one on separate sheets of paper.—ED.]

View Finder.—P. F. W. (*Dover*).—The most simple contrivance as a view finder is a small rectangular frame made of sheet metal and blacked, the opening being of the same proportionate dimensions as the plates to be used. This is fixed on a sliding bar, marked with the foci of the different lenses to be used. Opposite, and at the other end of the bar, is a small upright strip of metal, with a hole through it to form an eye-piece. This apparatus is fixed centrally on the top of the back of the camera, and the subject examined by placing the eye to the opening. The amount of subject included by the frame will be found on the plate. The sliding bar must, of course, be marked by actual comparison with the image on the focussing glass. This arrangement is generally called a view matter when used, and the hand unattached to the camera. Two small studs fixed on the upper part of the front of the camera and one stud in the centre of the back are sometimes found useful for the same purpose. The eye being placed against the central back stud, a good idea may be gained of the amount of subject that will fall on the plate—



View Finder.

or rather the position of it. The view finder proper is neither more nor less than a small camera fixed on the top or side of the larger one, being used with a lens of fixed focus, giving a small image approximate in proportion to the image on the focussing screen. In detective cameras, these small finders are inside the case. Their construction is very simple: a small box with a lens L fixed at one end projects the image on to a small mirror M, which again reflects it on to a piece of ground glass G, the contrivance being shielded by a small hood H; or the image can be seen direct in the mirror without the intervention of the ground glass. The advantage of the ground glass is that it permits the image to be seen more inverted.—D.

Dulcimer Tuning.—IAGO.—There are several ways of tuning the dulcimer with twenty-five sets of strings (38 notes), but the most useful (at least, I have found it so) is that shown in the accompanying diagram. You will observe that several of the notes are duplicate, and in rapid passages these duplicates are very useful, as by their means long jumps from one part of the instrument to another

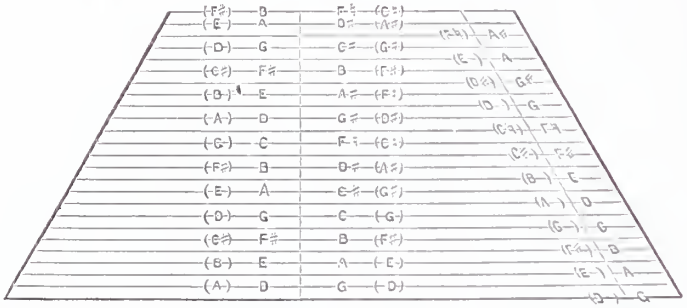


Diagram showing Scale of D Dulcimer with 38 Notes, with actual sounds produced (in brackets).

are avoided, and such passages may be played with greater ease and smoothness. The pitch of the instrument would be D, and the letters in brackets show the actual sounds as they would be produced on a piano, while the other letters show the notes of the dulcimer scale.—R. F.

Gold and Silver Solders.—H. H. W. (*Pimlico*).—These solders, as well as gold and silver in wire or sheet, can be bought in small quantities from refiners, of whom there are plenty in Soho and Clerkenwell; or from jewellers' material shops, which are very numerous about Clerkenwell Road, Jerusalem Passage, or Clerkenwell Green. There are two in Poland Street, Oxford Street, Calipe, Dettmar & Co., and Plucknett & Co.; these are the nearest to the address you give, and at nearly all of them you will be able to obtain a variety of brooch tongues and other fittings. If one firm has not got what you desire, then try another. I do not suppose any of them keep all kinds. Your query as to cost and the way in which gold and silver are sold admits of but a general answer. First, the weight used is troy weight. Secondly, the intrinsic value of each quality varies; but that you will be able to judge from what follows: silver solder about 3d. per dwt.; gold from 2s. per dwt. upwards; 9 ct. gold, in flat or wire, cut to size, would be about 40s. per oz.; 18 ct., about 72s. The intermediate qualities, 12 ct., 15 ct., etc., will be charged at a proportionate rate per oz.—H. S. G.

Rain-Water Tank.—SOMERSET.—From your description your tank seems to be constantly dark, and the cause of the water going bad and smelling foul is due partly to the absence of light. Rain-water, you must remember, is almost free from carbonate of lime: unlike spring water, which becomes impregnated with it and also absorbs carbonic acid gas (carbonic anhydrate), which keeps its atoms constantly in motion: *i.e.*, ventilates it by slight effervescence. If SOMERSET will force air down to the bottom of his tank every day for half an hour altogether, say ten minutes twice or thrice, he will, I think, get rid of the difficulty. An ordinary garden pump or a large syringe should be quite sufficient if the outlet tubing be let down quite to the bottom. Water, like foul air, requires ventilating. If this plan does not succeed, or succeeds only partially, write again, and very explicitly tell how you collect the water, and of what material your tank is constructed, how and what with it is lined, and the material, etc., of your pump. Charcoal, I think, would scarcely deodorise it, as you could not immerse it; or if you did, it would require to be supplied with oxygen or air to act fully. I should be glad if this succeeds to hear again, as many of the readers of WORK will, no doubt, be interested.—J. W. H.

Sticking Iron to Wood, etc.—H. S. M. (*Birmingham*) writes to ask for an effective receipt for sticking iron to wood, but does not explain if he wants to stick a ton of metal to a wooden bed or merely wants to fasten a light thin bit of iron to wood—he does not even say what wood! If there is no great stress, iron, or metal of any kind, may be stuck on to wood by using shellac, the metal being warmed and pressed on until cool, but the surfaces should be as true as a glue joint, and the air well pressed out. It is really, however, only a question of atmospheric pressure, and such a joint cannot be relied upon. If any stress or strain is likely to be brought to bear upon it, it would be far better to fix the iron to the wood with screws. Your second question (which by our rules ought to have been on a separate sheet of paper) as to moulds for vulcanised rubber made of half lead and half zinc, I should say yes, as sulphur melts at 114°, lead at 334°, and zinc at 500° Fahr., although I never tried the experiment; there seems sufficient margin.—J. W. H.

Lead Mining.—ROCK FERRY.—Lead is generally obtained from "galena" (Pb.S.), sulphide of lead. There are several methods of extraction from the ore; the most general is by roasting the ore, when a part is transformed into sulphate of lead, whilst a second part forms oxide of lead and sulphurous anhydride, and a third remains unattacked. When the process has been carried far enough, the ingress of air is stopped, and a much greater heat is applied until the sulphate and oxide re-act on the third portion: *i.e.*, the sulphide disengaging, sulphurous anhydride and metallic lead remain. The lead may be got by roasting, and thus converting the whole of the sulphide—*i.e.*, the ore—into the oxide, and then reducing the oxide with charcoal; or again, by heating the ore with iron, which absorbs the whole of the sulphur and liberates lead more or less pure. Sheet lead consists of the metal rolled from the ingots into sheets at the ordinary temperature, as it is very ductile.—J. W. H.

Tubing for Pencil Cases.—W. L. C. (*Aberdeen*).—I cannot glean from W. L. C.'s letter the purpose for which he wants the tubing. Write to Mr. Charles Whitfield, Factor, 19, Charlotte Street, Birmingham, stating your wants, mentioning WORK. It is almost a certainty that he will be able to give you the information and prices of the various tubings you require.—J. W. H.

Screw Cutting.—E. C. (*Bricrley Hill*).—You wish for the change wheels to cut a thread of 7¼ pitch with a lead screw of 2 threads. Putting 2 for the numerator, and 7¼ for the denominator, you get the ratio $\frac{2}{7\frac{1}{4}}$; multiplying by four, we have $\frac{8}{29}$: that is, teeth of wheel on mandrel are to number of teeth of wheel on screw as 8 is to 29. You will require a wheel of 29 teeth, or of twice 29, or three times or four times 29: that is, because 29 is a prime number, it cannot be divided by any other number.

$$\frac{8}{29}=\frac{40}{29\times5}=\frac{40\times20}{29\times5\times20}=\frac{10\times20}{29\times100}$$

that is, put 40 on mandrel to drive 29 on intermediate along with a 20 to drive 100 on screw; or you can of course double or treble the 20 and 29, provided only you treat them both alike. You will, of course, have read the article on page 438, Vol. I., and understand that it is the *proportion* between the numbers of teeth that matters, not the numbers themselves, as of course a 40 on the mandrel driving a 40 on the screw would produce the same result as an 80 on mandrel driving 80 on screw, etc. So your speed ratio being $\frac{8}{29}$, the number of teeth in the driving wheels multiplied together must bear to the number of teeth in the driven wheels multiplied together the proportion of 8 to 29. A casting of a 29 wheel of 12 pitch (=¼ in. full) costs, from R. Lloyd & Co., Steelhouse Lane, Birmingham, only sixpence; and you can, of course, easily fit it yourself. Messrs. Crosby Lockwood & Co's. address is Ludgate Hill, London. "The Metal Turner's Handbook" is now 2s.—F. A. M.

Polishing.—G. T. (*Oswestry*).—If the surface got by enamel painting is not sufficiently smooth and brilliant you may paper it down and then finish in the ordinary way with French polish. As you say you are well up in polishing, I need not go into details. Instead of using enamel paint you will find the following very suitable for the kind of work you describe. Mix some of the colour required with polish. Coat the wood with it and finish as before. Have you tried the Foochow enamel paint? It gives excellent results, and I much prefer it to the one you name. It dries hard in a very few minutes.—D. A.

Glass Blowing.—H. H. (*Battersea, S.W.*).—You can get proper burners and blowpipes of Messrs. Townson & Mercer, 89, Bishopsgate Street Within, E.C., and also anything else you may require for glass blowing; get one of their catalogues (3s.), it is one of the best I have ever seen.—W. E. D., JUN.

Portable Bath.—A. H. B. (*Birmingham*).—The water for the portable bath you inquire about is usually heated by means of an oil lamp; these can be had specially constructed for the purpose, although an ordinary oil stove would doubtless answer your purpose. I am rather at a loss as to what you infer from your second question; of course it is a vapour bath. I shall be pleased to give you any further particulars if you should require them.—T. W.

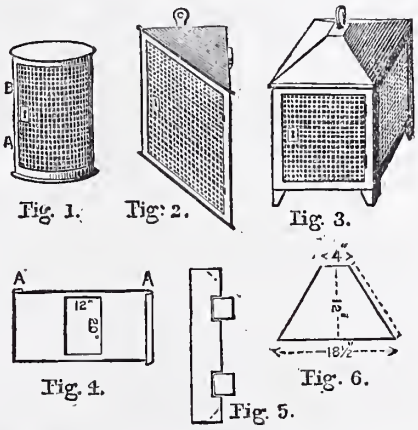
Papier-Mâché.—S. T. (*Newcastle*).—No special paper is necessary. Any porous paper of medium thickness will suffice. The quantity and cost must depend on circumstances, we cannot give an opinion on them. The cost, however, will probably be very small.—S. W.

Work on Lithography.—G. W. R., JUN. (*Camberwell*).—The book best suited to you, so far as I can judge from your letter, is "Richmond's Grammar of Lithography" (Wyman's Technical Series), 5s., 65, Chancery Lane. If G. W. R. can draw in pen and ink on ordinary paper, all he has to do is to obtain from any dealer a sheet of writing transfer paper and a stick of litho ink. The ink should be rubbed in a saucer—dry first (in cold weather warm the saucer slightly until about as warm as the body)—and then rub with the fingers and a little clean water until quite smooth and thin enough to run freely through the pen; then pour off into a small bottle. Fresh ink should be made every day; even if corked it does not go down so sharp to the stone as fresh made ink. Take a perfectly clean new pen (never one that has been used with ordinary writing-ink) and proceed to draw very lightly upon the paper, avoiding going twice over a line, as, when the composition is soft, it rubs up, mixes with the ink, and makes a very rotten line. Let every line dry first before either going over it again or crossing it with other lines. All solids should be painted in with a fine sable brush; indeed, much better work is done by using very fine brushes instead of pens. Litho writers use fine quill pens made by themselves to their own nicety, and steel pens which they cut out of sheet pen steel with fine scissors; but no verbal description would be of any use to G. W. R., he would have to be repeatedly shown, and to spend much time in daily practice; nor could he use such pens in the ordinary way, as they are only just kept in the merest contact with the paper. If any mistakes are made, never scratch out with a knife or you remove the composition; instead, paint over the lines rather thickly with ordinary gamboge and water or gum and water, and when dry make your correction over it with litho ink. To draw upon stone there are two methods: 1st, Line work or "stipple" work; and 2nd, chalk work. The former is done on a polished stone, the latter upon a grained stone; in both the work is done the reverse way it is intended to be printed, that is, as it appears when opposite a mirror, when it will print right way about. Litho ink, rather thicker than for paper work, is used mostly with brushes for line, and pens for stippling, but technical showing how would certainly be necessary to ensure success (as in all technique) and considerable practice.—J. W. H.

Printing Ink for Copying Pad.—R. W. B. (*Poplar*).—I can scarcely say what you require, as you do not explain sufficiently the purpose of the pad. Ordinary printers' ink will not do, you want type-writing ink; you can readily obtain a small bottle of that or violet indiarubber stamping ink of most large stationers—the pads are also sold for a few pence. Second question; write to the Publishing Department, as to the "World of Adventure," Messrs. Cassell & Co., Limited, La Belle Sauvage, E.C.—J. W. H.

Drawing for WORK.—"MIEUX QUE ÇA."—Your query is very kindly meant, but, thanks to photography, even if you send your drawings full size, they can be reduced exactly to scale to suit our columns direct on to the wood upon which they are to be engraved. All that is necessary is for correspondents to make clear drawings that any one can read, to any scale they prefer, provided they state what the scale is. The drawings best suited for our purpose are those made on dull white enamel paper in Indian ink or "*mieux que ça*;" better still, in Stephens' jet black ebony stain, which photographs splendidly.—J. W. H.

Meat Safes.—J. D. (*Manchester*).—I have much pleasure in sending you instructions and sketches of three meat safes, to be made in zinc.: viz., circular, triangular, and square. The circular one is very easy to make: it simply consists of a cylinder of zinc 24 in. high by 14 in. diameter, or any size required, with plain top and bottom, and a perforated door. To make it, take a piece of No. 11 zinc, 44 in. by 24 in.; in the middle of it cut a rectangular opening 20 in. by 12 in. (Fig. 4); fold these edges over, and knock down so as to present a smooth edge, so as not to scratch the hands when putting in or taking out things; notch the corners and fold the edges, turn round and seam together, or if not possessed of the appliances for seaming, soldering will do as well. Next throw off an edge, top and bottom, cut two circles of zinc, $\frac{3}{16}$ in. larger all round than the edge, turn up an edge, and fit one on the top and one on the bottom, and pane them down; solder at A, 6 in. from the bottom, three brackets for a shelf and the same at B, 10 in. from A; this gives three compartments: two narrow ones for cheese, butter, etc., and the centre one for meat or poultry. To make the door, cut a piece of perforated zinc 19 in. by 10 in., cut two pieces of plain zinc 13 in. by 2 in., and two pieces 22 in. by 2 in.; in one of the long pieces cut two notches $1\frac{1}{2}$ in. by $\frac{5}{8}$ in. (Fig. 5); solder these four pieces together to form a frame, and solder the perforated piece on to it, notch the four corners as per dotted lines (Fig. 5) and wire all round; after wiring, the hinges are formed by slipping pieces of zinc through the spaces left by the notches and bending and hammering them together; the door can now be bent to the shape of the safe and a piece of plain zinc soldered where the lock is to come, a keyhole cut in it, and a small brass lock soldered on so that it will lock under the



Meat Safes. Fig. 1.—Circular Meat Safe. Fig. 2.—Triangular ditto. Fig. 3.—Square ditto. Fig. 4.—Plan of Circular Body. Fig. 5.—Detail of Door Hinge. Fig. 6.—Plan of Top of Square Safe.

edge of the safe. The door can then be soldered on by the hinges, and the safe is complete. If wanted to bang, a strengthening piece must be soldered in the centre of the top and a hook affixed. If more air is desired than is admitted by the door, a piece of perforated zinc could be put in the back. With respect to the triangular one, it is obvious that it can be made on similar lines, so no details are necessary. The square one is rather more difficult to make. It consists of a framework of angle zinc of any size required; the best shape is the form of a cube, plain flat bottom, plain sloping top, and the sides and door of perforated zinc or wire gauge; 18 in. square and 18 in. high, before the top is put on, is a good size. The frame should be of stout zinc (No. 12). The bottom and top pieces, eight in number, will be cut $18\frac{1}{2}$ in. by $1\frac{1}{4}$ in., and a notch cut in them $\frac{1}{2}$ in. by $\frac{1}{4}$ in. The $\frac{1}{2}$ in. lap is for soldering the frame together; before soldering, the edge can be folded at a right angle for the bottom and top. This is better than throwing off the edge after the frames are soldered, as that puts them out of shape. Make the four angle pieces for the uprights by cutting them 2 in. wide and bending in the centre; this ought to be done in a folding machine; by any other method the pieces will get more or less bow-shaped. If no machine is available, the next best way is to put them between a pair of clams of sufficient length, squeeze the clams in the vice, and knock over with a mallet. These pieces have then to be soldered upright in the bottom frame and also to the top frame; the eight sides of perforated zinc can be soldered in and the bottom put on. The top is next; cut four pieces, give a lap of $\frac{1}{2}$ in., and solder together; if it is wanted to hang up, a hook must be affixed to a strong piece of stuff that will form the top for the 4 in. hole at the top of the safe. The top is put on the same as a bottle top: viz., a flange thrown off and then an edge turned on that, the body sprung in, and the top paned down, after which it should be strongly tacked with solder at the corners and middles. Four brackets must be soldered on the inside half-way up for the shelf; the details of the door will be similar to the others already described; four little angle feet or four brass knobs soldered to the bottom for feet will complete it. Perforated zinc can be got at any good ironmonger's at from 4d. to 5d. per square foot.—R. A.

Restoring Discoloured Boot Tops.—E. C. B.—(*Leytonstone*).—I am not acquainted with any approved method of restoring to their original whiteness the tops of grooms' boots which have turned brown. For merely cleaning and preserving a good colour, washing with new milk and soft soap is recommended. Pipe-clay would doubtless have some effect in removing discoloration, but hardly to the extent desired. One of the most powerful bleaching agents is chlorine, possibly this, applied in its common and cheap form of chloride of lime, might remove the objectionable colour; but I cannot say certainly what its effect on the leather might be.—M. M.

Fixing Upright Memorial Stones on Bases.—MARBLE JOINT.—In fixing memorial stones there is choice of ways. Perhaps the best is to "shoulder" the bottom of the upright stone—that is, to cut it to a tenon some 2 in. long, leaving a shoulder, as in the annexed section. If the upright stone is, as in one of the cases submitted by our correspondent, a 3 in. slab, the stone should be cut away all round to a depth of $\frac{1}{2}$ in. The hole cut in the base to receive this tenon must be about $\frac{1}{4}$ inch larger each way than the tenon itself, and $\frac{1}{4}$ in. deeper (to allow for the settling of cement). The hole is wetted and half filled with best Portland cement, mixed to the consistency of cream, and into this the upright, also previously wetted, is lowered. The overflow of cement should be cleaned off as soon as possible. To save the trouble of shouldering, the mortise hole is sometimes cut large enough to receive the whole width of the slab; but this is a less workmanlike method, since the shoulder covers and hides the ragged edges of the hole. The second way is by dowelling. Say we are fixing the 3 in. slab: take slips of slate, say, 3 in. by 1 in., and 4 in. long, let them for half their length into the bottom of the slab, and there cement them. Corresponding holes are then made in the base to receive them; cement is put in, and the upright is lowered on the base as before. In all cases care must be taken to make the holes large enough to allow for the cement. In the instance adduced by MARBLE JOINT of a cross with stem 6 in. square, shouldering is to be preferred; but if the length of the stem will not allow of the loss of 2 in. for tenon, it should be dowelled with slate $2\frac{1}{2}$ in. square and 6 in. long. The above methods apply equally to fixing memorials of marble or of stone.—M. M.

Cartridge Ejector.—MACHINE GUN.—Of the many contrivances for ejectors of empty cartridge cases, all effective, it is hard to tell you which is best suited for your purpose. One of the latest patented is excellent, as it is made to serve as a support for the next cartridge to be used. It would be rather difficult to illustrate the action without a long technical description. The number of the patent is 7,915; date of patent, 1889; inventors, Edward Smith Higgins, 6, Thorburn Square, Southwark Park Road, Surrey. There are thirty-four separate drawings with this specification; price 1s. 10d.—J. C. K.

Glass Lamps.—JUBY MACRAE.—An amateur would find it exceedingly difficult to manufacture coloured glass lamps, and the expense would greatly exceed what they could be bought for; I could not advise you to attempt it.—W. E. D., JUN.

Bookbinding.—A. W. S. (*Wheatley*).—I am afraid you have spoiled the cover of your Family Bible, and the best remedy for it would be to have it re-covered. I fancy you have used the white of egg in its thick clammy state without beating it up so as to make it thin. Two coats of the above would spoil any leather cover, and you have made the spoliation complete by using the paper varnish. I have already indicated the best remedy, but you may want to try something yourself to improve the old cover. Well, try washing it carefully over with methylated spirit until not a trace of varnish is left; afterwards wash with water in which a little flour paste has been mixed. If this has been done aright, the natural surface of the leather should show and have a clean appearance. If it is now coated with glaire, that is, the white of an egg beaten to a thick white froth and allowed to settle, and allowed to dry, it may be all right; a coat of thin shellac varnish might also improve it after the above operations have been completed. Shellac varnish is simply shellac dissolved in spirits of wine, and is the varnish used by bookbinders. Great care will be necessary in the above operations, as the gold on the cover, if any, is liable to be washed out.—G. C.

Transfers for China.—CARBON.—If you are referring to the ordinary picture transfers which are used by wetting them on the back, you should have no difficulty in getting them in Birmingham. Try the artists' colourmen.—D. D.

Drapery Book for Upholsterers.—J. M. B. (*London, W.*).—Several books on the subject have been published, but I do not know of any which would assist you unless you are already proficient at the work. If you are, and wish to improve yourself, get into some first-class upholsterer's. Cutting is more an art than a mechanical following of rules. If you want books on the subject, call in at Batsford's, High Holborn, and see what he has; but as they are mostly costly, you may prefer to study them in the library at South Kensington Museum or the British Museum.—D. D.

Gutta Percha for Barbotine Work.—PHILIPPA.—The required material can doubtless be obtained at any of the following places:—In London: Gutta Percha Co., Wharf Road, City Road, N.; Messrs. Anderson, Abbot, & Anderson, 37, Queen Victoria Street, E.C.: J. Smith & Co.,

87, Blackman Street, S.E.; J. Winter & Co., 1, Parkside, Knightsbridge, S.W.; or, in Birmingham (wholesale), Birmingham Indiarubber Co., 124, New Street; Messrs. Binney & Son, Broad Street Mill; (retail) T. F. Pedley, 68, Bull Ring; or, T. F. Pett, 3, Bull Ring.—S. W.

Hot Sand Shading for Inlay.—W. B. (*Glasgow*).—To shade pieces of veneer for inlaying by hot sand, all that is necessary, beyond skill, is a shallow pan filled with sand. This is then heated over a fire or stove sufficiently to brown a piece of veneer. The veneer is inserted edgeways, and gradations of shade are got by careful management. The wood must not be burnt or charred. Try with a few pieces of waste wood till you get into the way of shading evenly.—D. D.

Locomotive Book.—C. G. W. (*Jubbelpore, India*).—The following book should suit you, Roper's "Handbook of the Locomotive," 12s. 6d., Trübner & Co., Ludgate Hill, London, E.C.

Fern Case.—GLESCA YOKEL.—A design for a Wardian case, with illustrated instructions, is in the hands of the Editor, and will appear in due course. The amateur is just the man to be most likely to proceed with a new design, and succeed too; hence the desirability of complete instructions. Our worthy Editor knows nothing of racial distinction between his correspondents, and all share alike.—C. M. W.

Aquarium.—AQUARIUM.—In No. 31, Vol. I., of WORK, you will gather a general idea of how to make rockwork for the aquarium, which you can adapt to the measurements you require. A design is hardly needed, especially as you have a clear idea of what you want; and by following the directions given you cannot fail in producing a pleasing result.—C. M. W.

Aquarium.—A. L. H. (*Liverpool*).—See No. 31, Vol. I., of WORK, for aquarium. Use what part will best suit your purpose. I do not recommend the use of wood.—C. M. W.

Cement for Tank.—J. K. (*Oldham*).—Presuming you want to cover the inside of a wooden tank, to make it waterproof, you can paint it over with two or more coats of cement consisting of one part of gutta percha to two parts of pitch, melted by a gentle heat in sufficient turpentine to make it thin enough to be easy of application; put it on hot, and increase the thickness of the final coat. In tendering you this advice, permit me to add that woodwork is not at all suitable for self-acting fountain. Why not use zinc, which is easily worked? Fretwork designs get a fair share of the space of WORK.—C. M. W.

Solid Glossy Black from Stone.—STONE HOGGER.—Are you perfectly sure that the specimen you allude to was not printed from type or block? It is much easier to get a full solid colour, black or otherwise, by surface printing than from stone, as the moisture interferes with solidity, and the coat of colour is much thinner in the latter case. I think, however, if S. H. takes equal portions of Japan gold size and best copal varnish and mixes his ink (any colour he prefers) with this, instead of ordinary litho. varnish, he will obtain a slight gloss. But, as we all know, it is impossible to get a brilliant gloss on a rough surface; therefore the card or paper should first be rolled until the surface itself is glossy. After printing, the work being thoroughly dry and hard, a final rolling will still improve the gloss. For black, the addition of about one-fifth bronze-blue ink enriches the colour, and will assist to gloss it also.—J. W. H.

Analysing Metals.—CAMANALIST.—For learning to analyse metals you should obtain Thorpe's "Quantitative Chemical Analysis," and Fresenius's "Quantitative Analysis." Nos. 36 and 39, Vol. I., of WORK contained articles on "Iron and Steel: its Analysis;" and an article on "Brass: its Analysis," appeared in No. 75. The analysis of some of the metals mentioned is attended with considerable difficulty, on account of the small amount of impurities present. Refined lead, for instance, frequently contains as little as 0·10 per cent. of impurities, made up of copper, iron, silver, zinc, bismuth, antimony, etc.—CHEMICUS.

Dyeing.—CROQULICOT.—I know of no periodical on dyeing. There is the "Dyeing of Textile Fabrics," by Hummel, price 5s.; and this can be had by order of any bookseller, or free by post of the publishers, Messrs. Cassell & Co., London, E.C., for 5s. 4d.

WORK Exhibition Competitive Designs.—T. H. S. (*Bradford*).—As to competitive designs for medal and certificates—WORK Exhibition, 1890–91—intending competitors should write for full particulars to the Secretary, WORK Exhibition, La Belle Sauvage, Ludgate Hill, E.C., enclosing stamped envelope for reply, stating which competition they are desirous of entering for.—J. W. H.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Pie-Making Machine.—W. E. D., JR. (*King's Lynn*) writes:—"In replying to W. W. (*Sunderland*) (see page 309, No. 71, Vol. II.), R. A. says he does not know of any such machine; will you allow me to say that if it is a pork pie machine for business purposes that is asked for, they can be bought of Mr. John Hunt, Baldwin Iron Works, Bolton, Lancs. Two machines, one for blocking the pies and the other for putting the lids on, cost with tins £15; or one machine can be had to perform both operations at £10. Larger machines can be had, and also, according to his catalogue, 'A great variety of sizes in both round, taper, oval, and dish-pie shapes; particulars on stating requirements. I would advise W. N. to write to him for one of his catalogues, and which also contains particulars of other machines—meat-cutters, paste-rolling machines, egg whisks and mixers, etc. etc."

Fretwork Frame.—W. B. (*Wigan*) writes in reply to A NOVICE (see page 191, Vol. II.), *re* above:—"You will notice that on the top and bottom of design there are small dotted lines running through; these are where the pieces marked M 0·01 to 10 for top, and D 0·01 to 10 for bottom are put in—that is, if you desire to enlarge the design in breadth, you would trace it and insert the size of pieces, M and D, you wished at the dotted lines. This is the purpose they are for, and if you will measure the pieces marked M, and those marked D, you will find that they correspond in lengths, which is from ½ in. to 4 in. Of course you would also have to enlarge the overlays. I made mine from the design, without enlarging, of walnut, overlaid (the four side pieces) with white holly, and it looks very well. I hope A NOVICE will now understand."

Drills.—W. J. B. (*Sidbury*) writes:—"In reply to SPOKES and A. S. P. (see page 210, No. 65), I can supply a drill, nearly as described, with six drills, assorted sizes, for 35s."—[W. J. B. should advertise in our Sale and Exchange Column.]

Pie-Making Machine.—F. H. (*Streatham*) writes in reply to W. W. (*Sunderland*) (see page 309, Vol. II.):—"I presume what W. W. means by a pie-making machine to be the tin hoops used for making such pies as we see in the ham and beef shops and refreshment bars. The tin hoops

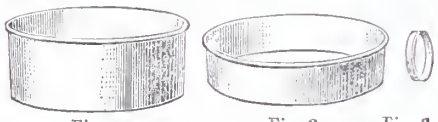


Fig. 1. Fig. 2. Fig. 3.

Pie-Making Tins.

are first well greased inside; a rolled-out piece of pastry is put into them and pressed down to the bottom and round the side with the fingers. The meat is then put in, with the proper seasoning; a large piece of pastry is then rolled out, and the tops are stamped out with an empty tin hoop the same size; the edge of the pie is then wetted with a little water, the tops are put on and ornamented with a fork or a fancy wheel; they are now glazed with whisked eggs, placed on a large tin, and sent to the oven to be baked in the tin hoops. If W. W. were to see the pork pies turned out by the gross, he would think they were made by a machine."

Steel Bronzing.—F. S. (*Exeter*) writes in reply to NEMO (see page 324, Vol. II.):—"NEMO must say if he wants a steel bronze for brass work, if so I can give it him. I suppose him to be a brass worker, who wants a bronze similar to gas chandeliers, etc. These are terms given by the trade to some of the bronzes in use: black bronze, steel bronze, copper bronze, floratine bronze, etc. Fancy iron work is cleaned and scratched, brushed with steel wire brushes, and lacquered pale; it looks and wears well. To do any of the above well requires lathe power to drive the scratch brushes."

Copper Bronzing.—F. S. (*Exeter*) writes in reply to H. T. (*Wolverhampton*) (see page 226, Vol. II.):—"I understand H. T. to be a brass worker, who wants to copper brass bronze work. To do this in a very old-fashioned, but simple way, clean the brass from grease and dip in aquafortis, and dry in sawdust; then lie around the brass some fine iron wire and immerse in the pickle, which is water with some aquafortis mixed with it; this will turn the brass work red wherever the iron wire touches the brass work. Wash off in clean water, and dry out in sawdust; next process is to obtain some Spanish brown and mix with water thickness of cream, adding about a thimbleful of pickle to half a pint of above; allow to dry, and brush well with a black-lead brush; if this is required a darker shade, add a little black lead to the brown. If a brass wire scratch brush is comeatable, use it by all means."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. W. V. (*Leicester*); FRET CUTTER; A. M. (*Brighton*; A. G. (*St. Albans*); M. P. S. (*Kingstown*); S. P. (*London, W.*); FOUR AMATEURS; AN OLD SUBSCRIBER; W. D. (*London, N.W.*); GLASS PAINTER; A. P. (*London, E.C.*); R. H. W. (*Hackney*); W. P. (*Nottingham*), R. C. H. (*London, W.*); GRUPH PRAWNE; L. Q. P. (*Airdrie*); A. A. (*Lincoln*); A. M. (*London, W.C.*); EXHIBITOR; J. T. J. (*Manchester*); W. P. (*Enfield Wash*); K. M. D. (*Norfolk*); W. B. (*Birmingham*); J. W. B. (*Birkdale*); D. G. (*London, E.C.*); AMATEUR; S. S. (*Salford*); SMADA; E. B. (*Bristol*); W. W. D. (*Leeds*); G. H. M. (*Lower Clapton*); H. W. (*Surrey*); J. F. P. (*Rotherham*); W. E. R. (*Nottingham*); A. C. (*London, E.*); F. M. (*Finsbury, E.C.*); G. B. (*Northwich*); E. C. (*Derby*); C. B. (*Islington*); G. G. (*London, S.E.*); C. E. H. (*London, N.*); I. MC F. S. (*Govan*); J. W. (*London, E.*); G. W. (*Lancaster*); C. B. (*Islington*); F. B. (*Blackburn*); COUPLER; J. E. G. (*South Norwood*); C. B. (*Guildford*); W. E. W. (*London, W.C.*); G. F. (*Sheffield*); SECOND HAND; C. L. (*Glasgow*); F. C. B. (*Battle*); AQUA; S. R. (*Newry*); HOBBY; J. S.; E. G. W. (*Westminster*); N. F. L. (*Battersea*); R. L. (*Dundee*); E. M. (*London, S.E.*); A. M. and W. P. (*London, E.C.*); M. M. (*Poplar*); R. F. C. (*Walworth*); S. F. W. (*Lancashire*); T. T. (*Leeds*); W. D. L. (*South Shields*); W. M. (*Shepherd's Bush*); HOPEFUL; J. C. (*Birmingham*); W. Y. (*Birmingham*); E. J. S. (*Maidstone*); DISTIL; H. T. (*Scarborough*); H. A. (*Birmingham*); C. M. (*Brighton*); W. P. (*Wishaw*); J. W. (*Hereford*); W. J. (*Laurencekirk*); J. S. (*London, W.*); J. W. T. B. (*Brighton*); J. F. (*Boston*); R. B. (*Sheffield*); W. H. C. (*Birmingham*); SUBSCRIBER (*Birmingham*); T. D. (*Nottingham*); CONSTANT READER; J. R. (*Newton Stewart*); W. C. (*Hulme*); E. D. (*Birmingham*).

"WORK" EXHIBITION.

(1890-91).

For Classification, Prize List, etc., see WORK No. 70.

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in page 290 (No. 70) of this Magazine:—

For Design for Medal.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

For Design for Certificate.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

If any Competitors wish to submit a Model in Clay, Plaster, Wax, etc., as a Design for Medal instead of a Drawing, they are at liberty to do so.

Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

Prize Competition.
Medal (or Certificate, as the case may be.)

A Motto must be affixed to each Drawing, and the name and address of the sender enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted to three competent judges, who will select those that are considered most worthy of prizes.

The Prize Drawings will become the property of Messrs. CASSELL & COMPANY, Limited, who will return all Designs made by unsuccessful competitors to their respective owners carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced in WORK in due course.

For further particulars, all intending competitors should apply to the Secretary, "WORK" Exhibition, CASSELL & COMPANY, Limited, as above.

THE CARPENTERS' COMPANY AND TECHNICAL EDUCATION.

THE Third Examination inaugurated by the Worshipful Company of Carpenters has lately been held. This examination is of a very stringent character, the candidates having to present themselves on two evenings at Carpenters' Hall for the written work, and on the following day they are examined in practical work at the Company's workshops at their institute at Stratford, and on the fourth day they are orally examined by the committee, consisting of the Presidents of the Institute of British Architects, the Institute of Civil Engineers, the Architectural Association, the Institute of Builders, the Clerk of Works Association, Sir P. Magnus, Sir I. C. Lawrence (Bart.), Professor T. Roger Smith, and Professor Banister Fletcher, etc. etc., so that any candidate gaining the Company's certificate may certainly be considered as qualified in the subjects in which he has passed.

The examiners did not award a gold medal, but gave one silver and two bronze medals.

The following are the successful candidates:—

1st Class Certificates.

T. VEST, Silver Medal.	I. GODDARD.
T. I. EVANS, Bronze ,,	W. M. DIXON.
I. DAVISON, ,, ,,	D. BRYANT.

2nd Class Certificates.

J. INKPEN.	W. H. MASTERS.
G. A. MITCHELL.	W. E. CUTTER.
I. DAVIES.	H. I. PROSSER.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, ,, ...	3s. 3d.
12 months, ,, ...	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

Fretwork, Carving and Repousse Work.—Catalogue of all requisites, 700 illustrations, 6d. each—HARGER BROS., Settle, Yorks. [13 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [14 R

Water Motors! List 2d.—P. PITMAN & Co., Aubrey Road, Withington, Manchester. [1 S

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

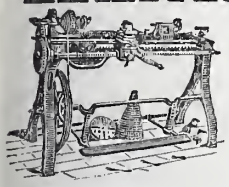
Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

Seventh Thousand. Price **1s.**; *post free,* **1s. 1d.**

Working Men Co-operators: What they have Done, and What they are Doing. By ARTHUR H. DYKE ACLAND and BENJAMIN JONES.

"The co-operative movement is one of great social and economic importance, and those who wish to learn what hold the principle has obtained over working men cannot do better than consult the little book prepared by Mr. Acland and Mr. Jones. It cannot, we imagine, but prove a useful little manual for those for whom it is intended." *The Times.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets, containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill,* with brass handle and Three Bits, will be ***SENT GRATIS*** with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

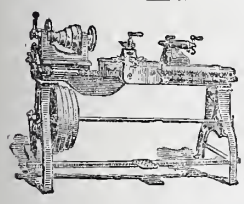
J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

JOHN AARON,

Engineers' Tool Merchant,

GAOL LANE, HALIFAX, YORKS.



Lathes, Pillar and Bench Drills.

SAWBENCHES.

SHAPING AND PLANING MACHINES.

All kinds of Tools, Chucks, &c.

SPECIALITIES IN AMATEURS' LATHES.

Catalogues free on application.

All inquiries have prompt attention.

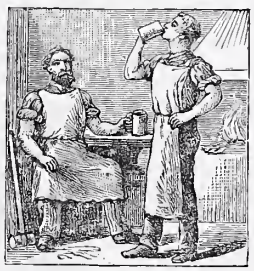
60th Thousand, price **1s.**; *post free,* **1s. 3d.**

CASSELL'S SHILLING COOKERY. This new and valuable work contains 364 pages, crown 8vo., bound in limp cloth.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

CASSELL'S CLASSIFIED CATALOGUE

will be sent on request post free to any address.

CASSELL & COMPANY LIMITED *Ludgate Hill, London.*

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

NEW AND ENLARGED EDITION, price **1s.**; or in cloth, **1s. 6d.**

Photography for Amateurs. A

Non-Technical Manual for the Use of All. By T. C. HEPWORTH. *With Illustrations.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers.*

AMATEUR PHOTOGRAPHY.—J. H. SKINNER & CO., *W Department, East Dereham, Norfolk.*

J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description.

CHEAP SETS FOR BEGINNERS.

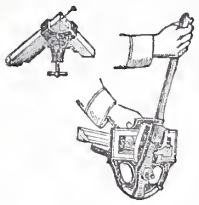
3/6 The Eclipse Camera Set. 3/6
Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6
Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6
Including Polished Mahogany Camera, with Folding Tail-board, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at 20 per cent. to 50 per cent. discount to clear. Send post card for Sale List.



PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine**, any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,
TOOL MAKERS, DUBLIN.

C. BRANDAUER & Co.'S
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT
SAMPLE BOX 6d. OR FOR 7 STAMPS
BIRMINGHAM. [33

London Warehouse: **124, NEWGATE ST.**

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic **WEAKNESS** speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,
President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS
Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,
52, OXFORD ST., LONDON, W.
(Corner of Rathbone Place).
All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 77.] SATURDAY, SEPTEMBER 6, 1890. [PRICE ONE PENNY.

PACK-SADDLES.

PATENT OF CAPTAIN H. R. NEWBURGH-STEWART, R.N.

BY J. C. KING.

THE word pack-saddles has an archaic ring about it with ordinary readers, recalling old world travelling, and with the more recent use of such things, as late as the Abyssinian and Egyptian wars; but readers, who are travellers, know that in some parts of the world a pack-saddle is one of the most important means of aid for the transit of goods from distant parts to their destinations: perhaps as many as a million are in constant use in commerce. Even armies depend, for the transport of guns, stores, and munitions of war, on the pack-saddle, on the backs of either horses, mules, camels, or donkeys, in many parts of the world. Without it the human shoulders would have to serve the purpose, as in very primitive times. The British Government's Stores contain nine different sorts and sizes of pack-saddle for military use. They are classified as follows:—

Pack-Saddles—Artillery.

No. 1...R.M.L., 2·5
„ 2... „ 3·3 Jointed Howitzer.
„ 3... „ 4 Howitzer.
„ 4... „ 7 per 200 lbs.
„ 5...Donkey Pack-saddles.

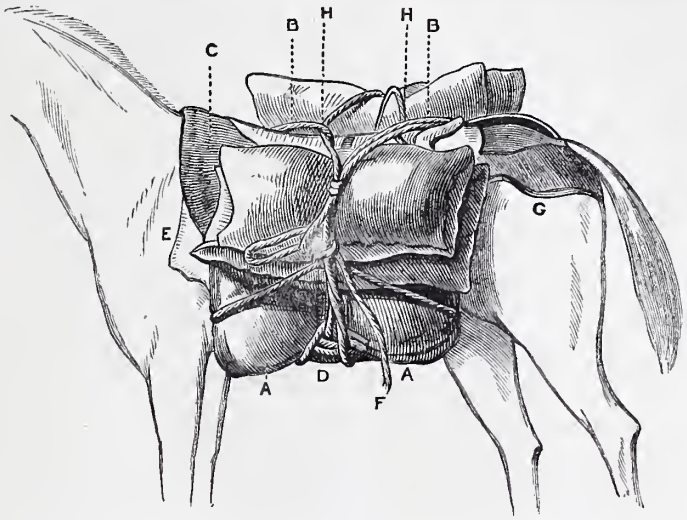


Fig. 4.—A A, Lower Edge of Aparejo; B B, Showing where the Aparejo rests on the Mule's Back; H H, Showing where the "Riata" is tightened upon the Load; G, The Crupper; E, Corner of Sweat Cloth; C, The Corona; D, Synch; F, Loose End of the "Riata," 60 Yards Long.

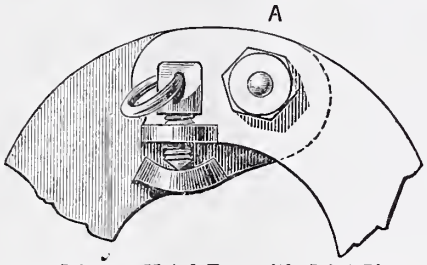


Fig. 1.—Joint of Metal Tree with Joint-Pin and Nut (A).

General Service Pack-Saddlery.

No. 6...Mark II., Large.
„ 7... „ Small.
„ 8...Mark III., Large.
„ 9... „ Small.

The first four pack-saddles indicated above, it will be seen, are employed for the transport of guns, whole or in parts, ammunition, etc. They are distinguished by having solid heavy iron clamps fixed to the "tree" framing to hold the heavy weights loaded on them. The donkey pack-saddles, and general service ones, are without these clamps, but they have an iron "tree" of great weight, but uncertain strength, in shape somewhat like a Saint Andrew's Cross, one angle clipping the back of the animal, the other angle upstanding to receive any stores that can be strapped on to this iron frame. The very first impression derived from this description is, how can the unyielding iron angle fit animals that vary so much in size of barrel as horses, mules, and camels? Behold! nine sizes! is the ready answer; but if animals vary in nine degrees, and vary continuously on the march of an army, by the arrival of fresh animals they must be fitted somehow, though a dominant number of either large or small animals are presented for use: changing loads or transferring saddles, like giving change in a chandler's shop, is the result, not now and then, but incessantly.

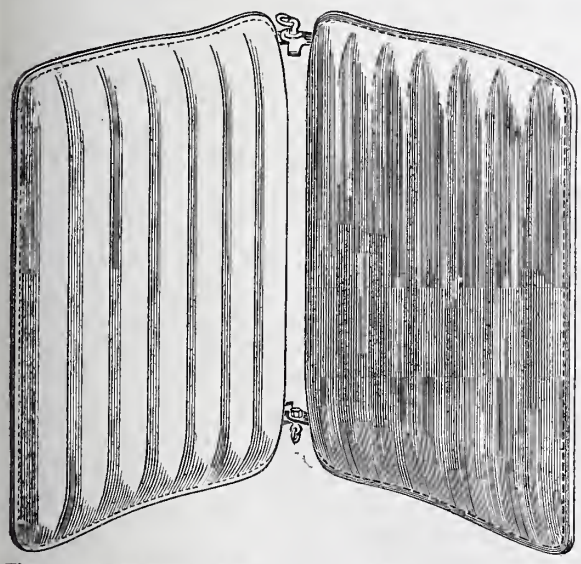


Fig. 3.—Panels stuffed with Cork arranged in Horizontal Ribbing for Ventilation, showing Under Side.

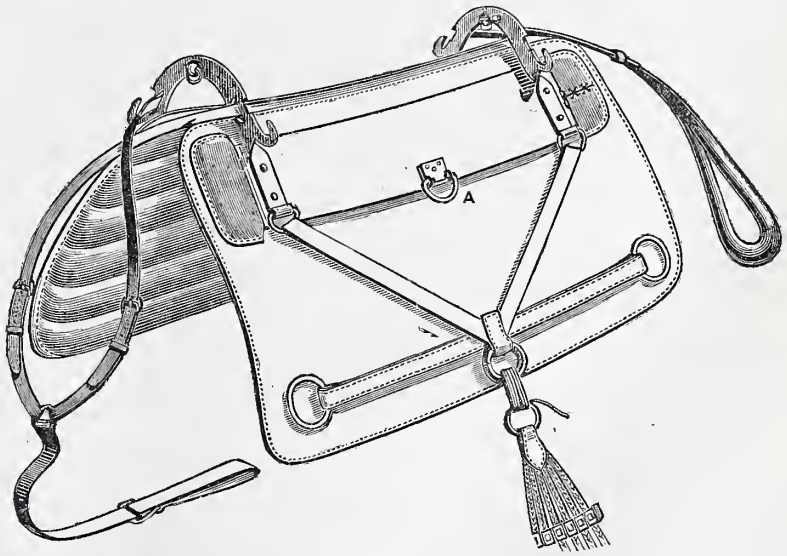


Fig. 2.—Pack-Saddle, showing Metal Trees above Panels, Tie-bars, etc., and Ring (A) placed on the Bars of the Tree for Girthing up to a Donkey.

This is non-military, yet it is the rule; and the cost in labour, time, and the good *morale* of fighting-men can be imagined, where some of the essential materials of combat are left to chance medley like this.

Take the weight of the full-size pack-saddles, 54 lbs. This is an excessive weight to carry only about 200 lbs. Surely, in these days of light equipment of armies on the march, this amount of weight might be lessened by the use of suitable metal, as steel, or some of the alloys of bronze.

Pack-saddles being out of the ordinary range of every-day manufacture, governments are constrained to rely on their own resources for contrivance and construction. But there are travellers and skilful mechanics who have used pack-saddles of simpler and lighter make. Perhaps foremost of all is Captain H. R. Newburgh-Stewart's, R.N., whose world-wide journeyings, and a life of nine years under canvas, give ample warranty for assumption of merit in any contrivance he may offer for notice—to simplify the make, economise the cost, and lessen the weight of pack-saddles for army or commerce. Travellers do not take nine different size pack-saddles about with them, though their *impedimenta* is often as heavy and awkward as army stores. The wooden "tree," packed out with rugs to make the big or little pack-saddle fit the little or big animal—camel, mule, or donkey—this was, and is, the usual traveller's plan, but it is not Captain Stewart's plan. He has chosen galvanised manganese steel for his "tree" frame, and shaped it like a pair of callipers, to open and close to the size of the animal, be it camel, mule, or donkey. The ingenuity of easily altering the size, and securing it fixedly in one position of span for the size wanted, is as simple as it is effective. Fig. 1 shows the joint of the metal "tree," with a joint-pin and nut A. On each of the jointed framings near A is a lug: one has a screwed nut through it to act on the other lug at its point; this nut, when turned, causes the curved "trees" to open or close. Fastening the "tree," when adjusted to the animal's back, is done by screwing up the hinge nut A by the hand. This is the leading feature of a simple, yet effective, invention; but it at once determines the whole strength and lightness of the pack-saddle, built upon two of these metal "trees" and two tie-bars. They weigh, with their complete complement of straps and ropes, 11 lbs. The panels weigh 7 lbs., and the lining or "numnah" weighs 3 lbs.; total, 21 lbs. (Fig. 2.) It is only natural to suppose that collateral improvements are made in panel and "numnah.' The panels are the source of sore backs, as well as the ill-shaped "trees" of the ordinary pack-saddles. They are usually of felt, wool, skin, or matting—in fact, anything is supposed to be good enough to go next an animal's back. These are pressed by the weight tight on the animal's skin, and there act as a sucker or blister, and if the load be lifted, and the back exposed to the chill of a draught of air, inflammation is set up, and incipient blistering occurs, which is confirmed by the renewal of the sucking process and chilling exposure, till a sore back is the result, and the animal has to be cast out as useless till cured.

Captain Stewart supplements his expanding "tree" by panels of waterproof canvas, made up like corduroy, forming a corrugated, or fluted, surface, which allows the air to be pumped through the channels with every motion of the animal, so that no sucking action or heating process takes place. The ribs of canvas of the panels are stuffed with granular cork, hence their lightness—3½lbs. each—making them buoyant in water (Fig. 3), saving the moving of the unloaded pack-saddle in swimming animals across streams.

It is mainly as a merchant's vehicle for the transport of goods that its high merit will be found so essential for economy of cost, and valuable in saving the lives of pack animals. A mule with pack-saddle is shown in Fig. 4, and all the various parts fully described, and their actions explained.

The load in Fig. 4 is supposed to represent four 50 lb. sacks of flour.

It is usual to pile smaller packages that are not very heavy betwixt the sacks, upon the centre of the aparejo. This has been purposely omitted in the cut, in order to show how the riata acts in securing the load. (Note.—After the riata or baggage rope is passed, there would be hardly any breakage strain on the adjustable pack-saddle joint.) When the pack-saddles are parted at the jointing, they are packed more closely, saving much in freightage.

Adjustment of Saddle.—(1) Loosen the centre screw, and contract the "tree" as much as possible. (2) Then place the saddle on the animal's back, and expand the "tree" with the side adjusting screw (shown in Fig. 1) until the saddle is properly fitted. When adjusted, screw up the centre screw.

This pack-saddle has the exceptional advantage of being suited for use as a riding saddle, being supplied with safety latches to take stirrup leathers, hung on the side bars of the "tree." This is not possible with any other pack-saddle that is made. Its importance, from a military or commercial point of view, cannot be over estimated.

In the large display of pack-saddles from all parts of the world at the late Paris Exposition, the crudeness of design and patched-up make was obvious, the French military pack-saddles being no exception.

The military authorities there are about to test one of these patent pack-saddles, and a large merchant in Turkey, using many pack-saddles (if they can be called such), is about to introduce them in that part of the world, so that wayfarers and merchants may anticipate reaping some benefits from this invention.

Recently, by special request from the French Government to Captain Stewart, the patent pack-saddle was sent through the French Embassy for trials in France, which are now being carried out.

In India, where it has been fully tried in General Roberts's late tour of inspection, it was considered a great success by the Indian officers, who tried it thoroughly.

HINTS TO WATCH WEARERS, AMATEURS, AND OTHERS.

BY HERR SPRING.

THE MAINSPRING: ITS NATURE AND TREATMENT.

IN my last article I referred to the common fallacy respecting the cleaning of watches, and now I must allude to certain other fallacies which are even more widespread. There is among some people an idea that a watch mainspring which easily breaks is a bad one. Even among men who consider themselves practical hands I have often heard this idea expressed. In point of fact, the exact opposite is the true case. A bad mainspring seldom breaks; a good one often does. The reason becomes obvious the moment the facts are stated. An ordinary watch mainspring as it comes from the maker's hands measures in length about twenty-five or thirty inches. The spring generally requires shortening before being fixed into the watch, but not to any great extent. When loose and in its natural state, the mainspring forms a coil as large, perhaps, as the palm of one's hand, and this has to be tightly wound up and put inside the barrel, which is a little round brass box, probably the size of a shilling, or much less, in diameter.

The great object aimed at in a good mainspring is elasticity and power. A common mainspring, when wound up into the narrow compass of a small barrel or drum, loses all its vitality, and remains cramped and feeble. When it is drawn out of the drum, it scarcely expands beyond the limits within which it has been accustomed to work. But a first-class mainspring is totally different. It is like the story of the fisherman in the "Arabian Nights," who brought up a vase from the bottom of the sea with his net. He set the vase down before him, and while he was attentively observing it there issued from it so thick a smoke that he was obliged to step back a few paces. When the smoke had all come out of the vase, it again collected itself and became a solid body, and took the shape of a genie of a gigantic size. The genie, looking at the fisherman, exclaimed, "Humble thyself before me, or I will kill thee!"

A fine mainspring is instinct with life and love of liberty, and when it is drawn out of the drum, it expands with one bound to its original size.

For good time-keeping purposes it is such a spring as this which is required. But mainsprings that possess so much vitality are very highly tempered, and are extremely liable to break. Common ones, on the other hand, being soft and pliable, rarely break. But as the object of a spring is to be springy, a soft spring is no good. The only alternative is to adopt a fine spring and take the risk of breakage. I have seen as many as four and five mainsprings break merely in winding them into the barrel. They rebelled against being robbed of their liberty and cramped up in the drum of a watch. But a little judicious coaxing is necessary in order to tame their fiery spirit. Great care must be taken that the end of the mainspring winder is as nearly as possible the exact size of the eye of the spring, so that when you begin to wind the spring up in order to get it into the barrel there will be no sudden wrench or change in the shape of the eye. And before being put upon the winding machine the eye of the spring should be carefully manipulated with a pair of concave pliers to the size of the barrel arbor. The eye having been made the proper size, the handle of the winder should be turned very cautiously. The more slowly the mainspring is wound into the barrel the better, for a spring of high temper is always liable to break with rough treatment. But a common spring, which is to a great extent like crinoline steel, will go on almost for ever, without any danger of breakage.

One important matter in the preservation of the mainspring is the careful use of the key during the operation of winding. Many people when winding treat a watch like a roasting-jack. They hold the watch in the left hand and move it half round as they wind, while with the right hand they twist the key as rapidly as they are able to do. Nothing could be more injurious than this

very general custom. The watch should be held perfectly still while winding, for if it is moved round, the motion given to it will interfere with the rotation of the balance or fly-wheel, and that very materially interferes with the time-keeping qualities of the instrument. The key also should be used carefully, the winding being performed with a slow and steady pressure. A watch-key should never be kept in the pocket, where it gets full of dust and dirt, which falls into the works when winding. The key should be kept in the bedroom in a clean and dry place. The same caution may be wisely exercised in relation to pendant winders or keyless watches. But in this class there is not the same danger of breaking the spring by rough usage, for the reason that, owing to the construction of the keyless work, you cannot wind so fast and so abruptly as with a key winder. A great deal might be written about the mainspring itself, for there are many qualities and many makes. But that is scarcely my purpose. At the same time, I may as well throw out a few hints which may prove useful, more particularly to amateurs. Mainsprings are practically all made in Switzerland. They are sold in bulk at prices varying from, say, 12s. a gross and upwards. A good average mainspring is bought in wholesale quantities at 24s. per gross, and sold at the material shops at fourpence each. Taking into consideration the trouble of fitting and the loss by rust and from other causes, the charge of fourpence is very reasonable. For ordinary jobbing purposes this class of mainspring is quite good enough; but for the finer work a fourpenny mainspring is not of sufficiently good quality. Some of the London material depôts fit a really first-class mainspring for one shilling, and the barrel can be sent up from the country by post, so that the jobber obtains a beautiful spring fitted with precision. One of the salient advantages of a fine mainspring is that, to use a paradox, while it is weaker it is stronger. The steel of which it is made is thinner than that of a common spring, and for all that it exerts more power owing to its fine temper and the trueness and smoothness of its make. The ideally perfect watch is one that will carry the largest possible weight, in the shape of a balance wheel, with the smallest possible motive power, in the shape of the mainspring. The ideally imperfect watch is one that carries the smallest possible weight in the shape of a balance wheel, even when driven by the most powerful mainspring.

English watch manufacturers have in the past been very great sinners in regard to the proportions of the ideal watch, but in recent years there has been a most marked improvement. Upon this point, however, I shall be glad to enlarge on some future occasion should any readers be anxious to hear more about this particular part of my subject. At any rate, I may say that the mainspring plays a vital part in the organisation and performance of a watch. Perhaps, therefore, I cannot do better than close this article with a homely illustration of my meaning.

Suppose there is a certain piece of heavy work to be accomplished. You pick out to perform the work a big, heavy, powerful-looking man. Before he has proceeded very far you discover that he is all blubber and no muscle. He tears away, doing injury to himself and to everything around him, but with little result. Then you select a thin-looking, compactly built man, whose muscles have been highly trained, and whose excess of unnecessary fat has been all removed by exercise. Such a man will do double the work of the former man with half the fatigue. The man of blubber, I need scarcely say, is like the common mainspring, while the man of muscle is like the fine one.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

The "Little Wonder" Extractor.

It is generally admitted that a modern apiary cannot be profitably "run"—to borrow an expressive term from our American cousins—without employing an extractor. I therefore give this piece of apparatus a prominent position in the present series of papers, taking it after the hives and ever-wanted smoker.

There are two forms of extractor, very different from each other both in style and price; the "Little Wonder," invented by Mr. Abbott, and the "Cylinder Machine."

The principle, however, is the same in both; the honey being compelled to leave the cells by centrifugal force, just as the water is driven from a mop by whirling it violently.

In the "Little Wonder," the can (seen in Fig. 1) is whirled round the handle, the latter revolving on the spike shown in the lower end, which is stuck into the floor; and the loose piece on top which turns on a long spike driven into the top of the handle. The honey passes through the netting, shown in Fig. 1, into the can, and may be poured out through the neck C on top when desired. The netting is a very important item, its object being to prevent the comb breaking from the frame and following the honey into the can. It should therefore be kept very taut and rigid; and this is one of the difficult problems in connection with the extractor.

No zinc or galvanised iron should, on any account, be used in the manufacture of any article which is to contain or come in contact with honey. The consequences of the neglect of this rule might be very serious. Even the netting should be of tinned iron, not galvanised.

The cost of the materials for this extractor is very little, about two shillings in all; and, as the cheapest that could be bought would cost seven shillings and sixpence, the amateur would be well repaid for his time; and if he uses the best materials, will have a superior article.

Three sheets of the boat tin, twelve inches by eighteen—which we used for the Bingham smoker—will be more than enough. We will require, also, the handle, four feet two inches by one inch and three-quarters square, and some eighth of an inch iron wire.

Take one of the sheets of tin and scribe the line A B (Fig. 2) along the middle, five and a quarter inches from one edge. Then, with its centre on this line, draw an arc of a circle, having its radius eight inches. Complete the construction to the dimensions given in Fig. 2; the extreme breadth being ten and a half inches, and the complete length eight and a quarter, slack. The inner lines are to be drawn a quarter of an inch from the others, with the exception of the long, straight sides which have the inner lines three-eighths from the edge.

The tin may now be cut with the snips to the outer lines, and the six pieces M taken out. Fig. 3 is to be marked and cut just in the same manner, both pieces differing only in length. The long, straight edges may now be wired with straight pieces of wire nine and three-quarters long, and all the other edges turned up along the lines at right angles to the broad part. The back is simply a bit of tin eleven and a half inches by seventeen; but, when a quarter of an inch is turned in at the edges to fasten it to the wings B, B (Fig. 1), it will be reduced to eleven inches in breadth, and will thus fit nicely the curved lines of the top and bottom. The wings B, B, are three inches wide; when finished, therefore, the strips of tin for their manufacture will be seventeen and three-eighths by three and five-eighths to allow for wiring the front edges and tops, and for the lap joints to the back.

The best method of procedure is, I think, to cut out the back and wings to the sizes given, turn out the edges of the back, wire the front edges and tops of the wings, turn in the other long edges, hook them into the back, hammer down, and then run a little solder along the joints. The back is then to be bent to the curve of the top and bottom, and secured to them with solder; the wings, also, being firmly fastened on. When all the soldering has been satisfactorily done inside, the low front (A, Fig. 1) may be bent up along the line C D (Fig. 2), and the turned-up edges will fit over the wings and be soldered to them, thus forming a receptacle for the honey. At this stage, a three-quarter-inch hole may be bored, and a tapered tube of tin made and soldered in, as at C (Fig. 1). The tin tube should not project into the extractor, or all the honey would not pour from it. It should therefore be flush with the inside.

The body, now, is complete and ready for the netting. This is removable, and secured to a light, wooden framework, the outside dimensions of which are nine and a half by sixteen and a half by an inch and a half deep. It is made of half-inch pine. It is nailed together firm and square, the centre member being planed to an edge so as not to impede the honey when leaving the cells. A bit of wood nailed along the lower edge prevents the frame from falling down too far, and keeps the comb opposite the netting. Fig. 4 represents the netting and its frame. They should be attached together with a number of little staples, each wire, or two if they cross, having a separate staple. I need scarcely say that the netting should be very tight. The piece required will be nine inches by fourteen and a half, and would be supplied by most makers of hives. Its price I cannot say at present, but I hope to be able to do so before these papers are completed.

When the frame is in place the netting will be on a level with the front edge of the top, and an inch and a half distant from the wired edges of the wings. This is the space allowed for the thickness of the comb, so, if two inch sections are required to be extracted, the wings must be either half an inch wider or the frame for netting half an inch narrower. The frame will fit firmly against the back, and will require to be slightly rounded at the edge for that purpose.

A light shutter of wood E, Fig. 5, slips down over the wired edges of the wings and covers in the comb during the process of extraction. This is only shown in section in Fig. 5 at E. Its dimensions are fifteen and a half

by nine and three-quarters by a quarter thick. Two little cleats are nailed across it; and the upper one, F, Fig. 5, two inches from the top of the shutter, is long enough to permit its shoulders to catch the strap which holds the body and handle together. The lower cleat is cut short so as to allow the shutter to be slipped down into place.

We now turn to the handle, for which nothing could be better than the piece of ash, which, in some districts, is used for a spade handle, and can be bought, square and undressed, for sixpence. It should be cut to three feet nine long, and planed square to inch and a half or three-quarters. The corners can then be planed off all along to the depth of a quarter of an inch. Four inches at one end may now be rounded and tapered until it reaches about an inch and a quarter in diameter, and a ferrule an inch long fitted to it. The next sixteen inches are left square, and the remaining two feet one inch rounded and tapered, as before, to one inch and a quarter and fitted with a ferrule. Holes are now bored through the axis of the handle to take the spikes. The lower one may be three or four inches long, driven in until only an inch is sticking out. This part is to be brought to a nice round blunt point. The spike at the other end may be nine inches long, and driven in until five and a quarter are left sticking out. Both spikes are of three-eighth round iron or steel.

A piece of wood five inches long must now have a hole bored axially through it, large enough to fit easily on the top spike and revolve on it. It is good practice to bore this with a three-eighth inch bit, and then burn it out with a piece of round iron the size of the spike. The burning hardens the wood and makes it work nicely. When bored it should be rounded to an inch and an eighth, and secured in place with a washer and a few taps of a hammer to slightly rivet the head. The rounding of this top piece as well as of the handle could be done with great ease and quickness in a lathe.

The body and handle being both complete, we must next prepare the straps with which they are held together. To do this, cut two strips of tin two and a quarter inches wide and eighteen long, wire them on both edges, and then bend them to the form shown at Fig. 5. The straps in this figure should be drawn full size on a bit of board, and bent carefully until they match it. They are then to be firmly soldered to the body, the lower edge of the lower strap being three inches from the bottom of the body and the straps eleven inches apart.

As Fig. 5 is a section through the body, it will explain the relative positions of the body, netting, comb, shutter, strap, and handle. An important measurement is the distance of the netting from the handle, which should be four and a half inches, or thereabouts, at their nearest surfaces.

The handle is secured to the strap by means of a short, large-headed screw at the back, and, if necessary, one at each side as well. From the point of the spike to the lower edge of the lower strap is four and three-quarter inches, and with this measurement the extractor can stand by itself, without leaning in a corner.

It would make the working much easier if a metal plate with a hollow in it were sunk in the floor of the manipulating house, or wherever the extractor is mostly used. The plate, which could be of cast iron, would be about three-eighths thick with a half-inch hole drilled nearly a quarter of an inch deep with a round-pointed drill. The rounder the bottom of the hole is the smoother it will work, but any hole will soon wear to the proper shape. A little oil dropped into it will make things go smoothly. To work this extractor the comb is uncapped with an uncapping knife, the uncapped side is laid against the netting, and the shutter slipped into place. The lower spike is then put into the hollow prepared for it, and a slight circular motion of the handle will make the body revolve rapidly, and the centrifugal force thus set up drives the honey from the comb. The machine should not be driven too quickly or the comb would probably be broken. When one side is extracted the other can be uncapped and placed in turn against the netting and emptied likewise.

It will be noticed that in the connection between the back and top and bottom, I give a plain, soldered joint. A better and harder job would be with a folded joint. If any of my readers wish to try their 'prentice hand at this, another line will be scribed a quarter of an inch outside the outer of the lines in Figs. 2 and 3, and the back will be half an inch longer. When the doubling is done, a quarter of an inch being allowed for each fold, the measurements will be found right. It is scarcely necessary for me to go into minute details of these joints, but I may just say that they are found in any ordinary tin can, the study, and even the dissection, of which I can strongly recommend to any one who starts at sheet metal work, or tinkering, as it is commonly called in the country.

The making of this extractor will not take long, and if my instructions are followed carefully, a really good machine will be the result.

To the five or six shillings saved the amateur may add the inexpressible pleasure of looking proudly on his own handiwork, and feeling in himself the sense of power which difficulties overcome always produces.

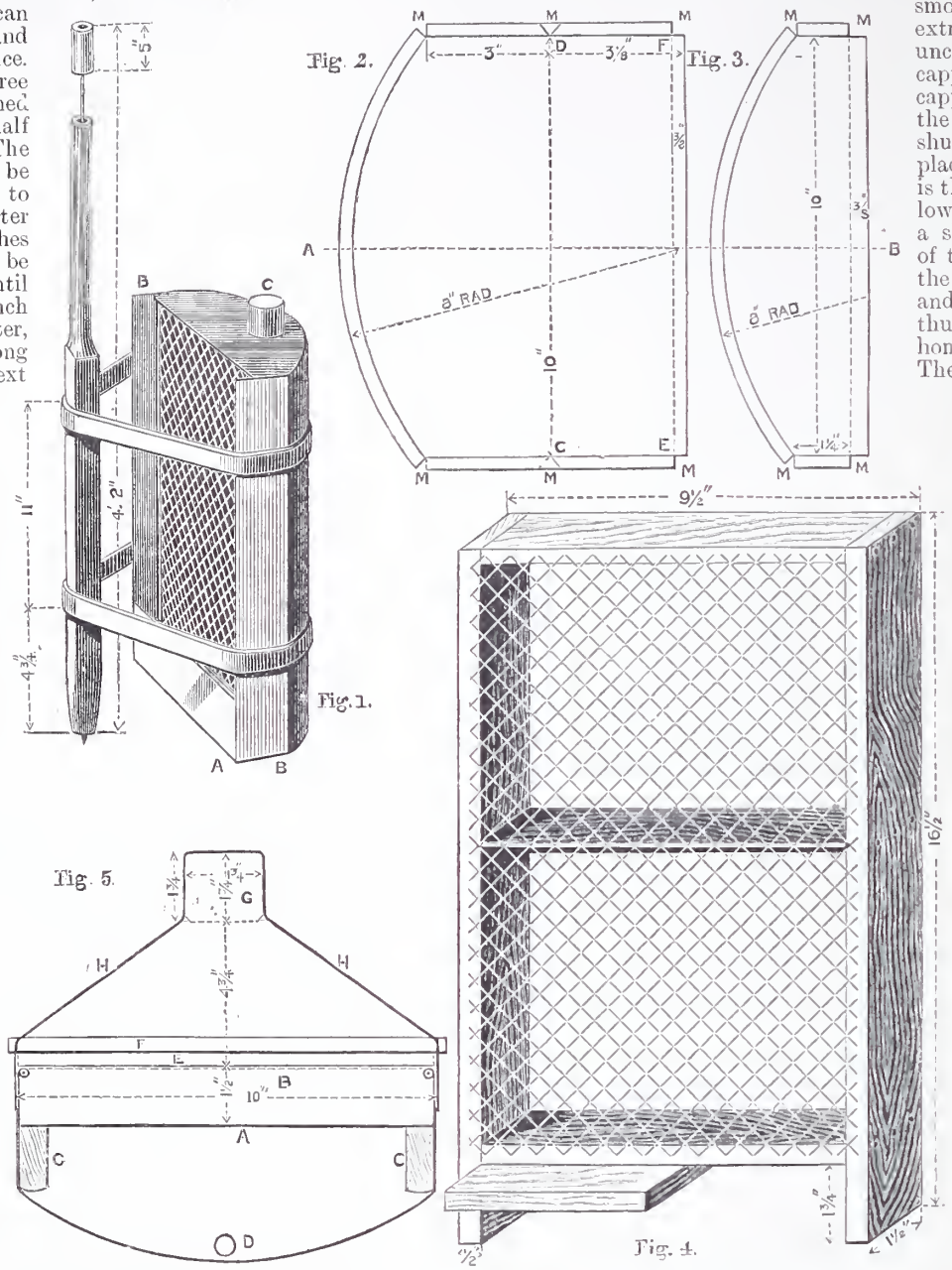


Fig. 1.—"Little Wonder" Extractor. Fig. 2.—Pattern of Bottom and Low Front (A, Fig. 1). Fig. 3.—Pattern of Top. Fig. 4.—Wire Netting and Frame. Fig. 5.—Section through Extractor at Upper Strap. A, Netting; B, Space for Comb; C C, Frame; D, Tube; E, Shutter; F, Cleat on Shutter; H H, Strap; G, Handle.

MODERN FORGING.

BY J. H.

WELDING.

THIS is the method which often becomes the alternative of drawing down or of upsetting. The property of weldability is one of the most valuable that is possessed by wrought iron and mild steel; and to a practised smith the art of welding presents no difficulty at all. The correct heat and due cleanliness are the chief requisites.

What is termed the "welding heat" corresponds with that temperature at which the metal is in a partial state of surface fusion. At that temperature it is extremely plastic, and a little hammering will cause two surfaces to adhere and possess as much strength as the unwelded part of the metal. But the welding heats for iron and steel are very different, and even also the heats for different qualities of iron and different qualities of steel. The better the quality of the iron the higher the welding heat that it will stand without becoming burned; and any iron will require a much greater heat than steel. At a welding heat iron gives off an abundance of dazzling sparks; steel only shows an intense yellow, with little sparking. These colours are a matter for experience entirely, and no description or illustration can take the place of practical lessons. But in the mere mechanical part of the work illustration can give correct ideas as to practice, and to this, therefore, my remarks will chiefly have reference.

Reserving more difficult examples for future articles, I will in this elementary chapter take two plain examples of welding: one shall be a collared rod similar to that which was upset in the last article, and drawn down in the article previous; and the other shall be a plain straight rod.

Taking the shouldered end (Fig. 34), first cut off the rod A, and then prepare the ring B to fit over it. For the ring take a square bar, rather larger, say $\frac{1}{8}$ in. larger than the finished section required, and either cut off one end *diagonally* with a hot set, or else fuller it down. Then turn the bar roughly into the form of a circle over the anvil beak (Fig. 35). Before proceeding farther, the bar will be cut off to the required length, with a sloping face to lap upon and match the first diagonal. The metal must not be skimped, but sufficient lap must be allowed for welding and for neat dressing off and finishing. If the ring is fairly true now, it will be ready to go back into the fire for welding; but if not, it will be further treated as follows: and if there are several pieces all alike it is better to get all the rings turned into neat circles before welding any of them.

Get a mandrel (Fig. 36), and slip the ring over it, and hammer the scarfed joint into a neat appearance, either with the hammer alone or with one of the hollow tools (Fig. 37, A). Then slip it off the ring, and flatten the faces (Fig. 38). This is precisely the plan that would be adopted in welding a separate ring.

To weld the ring to the rod, the ring will be slipped over the end of the rod, care being taken to remove any scale adherent to either, and then put into the clear fire together. Sand may be sprinkled over the work, but with a clear fire it is not necessary, and is frequently not done. At the welding heat, which for wrought iron is of a dazzling whiteness, when the iron seems ready to melt, and particles appear ready to drop off, and a rapid evolution of sparks takes place, the work is removed from the fire, placed on a V block (Fig. 37, B), and the scarf joint and the ring are hammered all round with a hand hammer, the rod with its ring being turned into continually fresh positions on the V block the while. Then, if a hammerman is available, the hollow tool (Fig. 37, A) is taken up, and a few blows upon it consolidate and finish the surfaces. Then the faces and shoulders are finished by means of a heading tool (Fig. 39), having a hole of a size suitable to take the rod, a few blows with hammer and flatter finishing off both the under shouldered face and the upper flat face. Then it may be necessary to work over the circular part again with the hollow tool as a matter of finish. All this is for finish merely, for the welding heat is soon past, and if the union of the joint faces is not fully effected in the first few seconds it will be more or less imperfect. Most of the welding is, in fact, effected by the hand hammer, unless the work is heavy, when it is either done by the sledge or under the steam hammer.

To weld a rod, a scarfed joint is employed. Since plenty of metal is wanted to allow for hammering the joint together and for finishing it afterwards without reducing below correct sizes, the ends of the bar have not only to be scarfed, but to be slightly upset. First, the bars whose meeting ends have been cut off square are laid horizontally upon the anvil, and the ends upset or beaten over, while nearly at a welding heat, with hand hammer, or, if large, with a sledge or with the pendulum monkey shown in page 336, Fig. 33. Then they are laid over the edge of the anvil, and scarfed or beaten down diagonally with a fullering tool, the face being made rounding rather than hollow. Both ends being served precisely alike, they are put back into the fire and raised to the welding heat. By moving the coal aside now and again the smith judges of the proper heat for removal: which must not be too low, or the metal will not weld, nor too great, or it will become burnt. When taking the work from the fire, *lift it vertically out, not drag it through the coal.* If any particles of dirt are present, they will show as dark specks on the white-hot iron. If there is any dirt present brush it off with a bundle of brushwood. The smith and his helper lay the scarfed ends together, as shown in Fig. 40, and then two or three blows with the hand hammer will cause union to take place. The two ends being first united, the bar can then be rapidly turned about on the anvil while the joint is consolidated all round with hand hammers or sledge, and then the top and bottom swages can be used for imparting the finish required. It will be apparent that without the first enlargement or upsetting of the rods, the process of welding and swaging would have immediately reduced the diameter of the rod at the welded section below that of the other portions. How much to upset and how much to scarf are matters for experience. The drawing gives ordinary proportions accurately.

This is an elementary chapter, and descriptions of the various methods by which weld joints are made will be best reserved for the miscellaneous examples of forged work to be embodied in successive chapters.

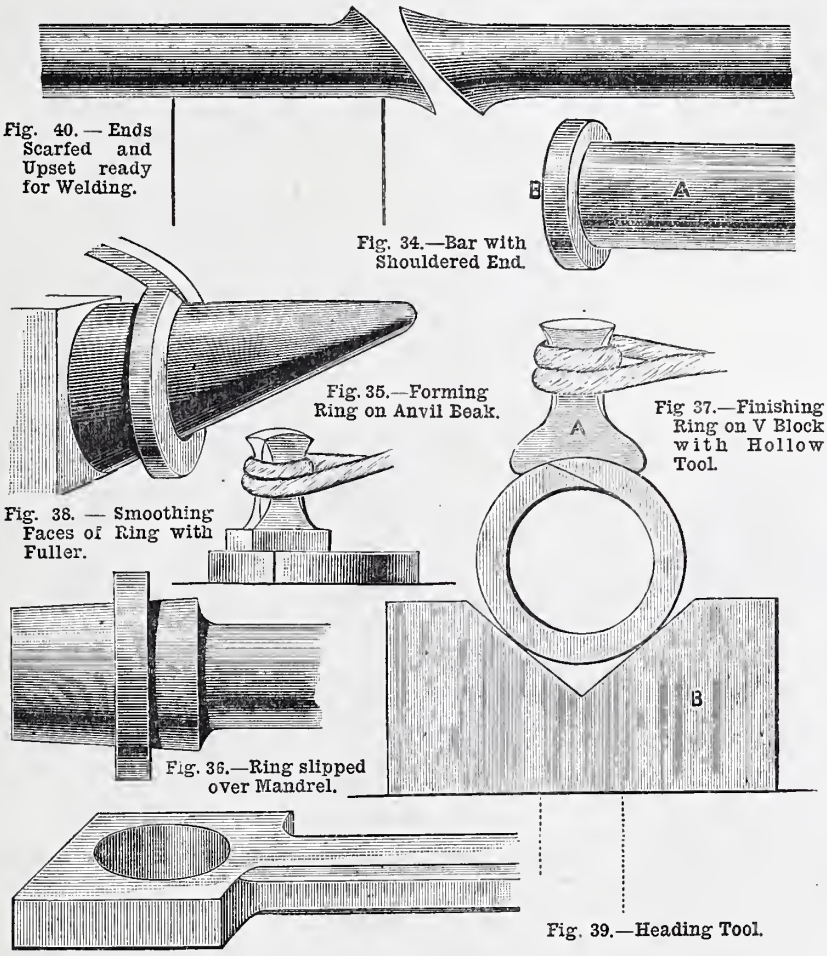


Fig. 40.—Ends Scarfed and Upset ready for Welding.

Fig. 34.—Bar with Shouldered End.

Fig. 35.—Forming Ring on Anvil Beak.

Fig 37.—Finishing Ring on V Block with Hollow Tool.

Fig. 38.—Smoothing Faces of Ring with Fuller.

Fig. 36.—Ring slipped over Mandrel.

Fig. 39.—Heading Tool.

A NEW USE FOR SPOILT NEGATIVES.

BY ARTHUR BOWES.

IT may be taken as granted that every photographer produces, to a greater or less extent, negatives which are useless. It may be from faulty manipulation or, let us charitably assume, more often from circumstances which are beyond his control. To find a use for these spoilt negatives is a

problem which is difficult to solve in a satisfactory manner. It is true that the smaller sizes may be used as cover plates for transparencies, and others, when sufficiently large, may be utilised for covering-in greenhouses or ferneries; but there are many amateur photographers who will not care to resort to either of these methods of using up their waste plates, and still are unfortunate enough to find themselves accumulating failures in a very annoying manner. The suggestion that I have to make here, and which is the outcome of my own practice, is to convert these spoilt negatives into plates for etching in the manner detailed below. The process of development reveals whether the negative is a success or a failure; if there be any error of exposure, or if the object should have moved, the evil effects are visible during development and before the fixing of the plate. If it should be found that the negative is spoilt, do not put it on one side just as it is, but expose the whole plate to the action of light, either daylight or artificial; immerse it again in the developer, and you will, naturally, find the plate develop all over to a dense black deposit. All traces of the picture

Imaginary Landscape Etched on Spoilt Negative.

will be obliterated when viewed by transmitted light, though, perhaps, some signs of it may be seen by reflected light on the back of the plate. Give the plate a rinse under the tap, and, when dry, it is ready for etching upon. There is no need to use the fixing bath, as there are no residual silver salts to remove; they have all been acted upon by the light and by the developer.

Obviously, the final results of the etching will vary in artistic merit with the ability of the artist. It must not be expected that every one, however unskilled in draughtsmanship, will be able to produce a pleasing and artistic picture, but for any one with a slight amount of talent in this direction, the process offers very great facilities, and is infinitely less troublesome than etching in copper, both in the method of etching and in the after production of prints. All the tools that are necessary are two or three needles set in handles, and a penknife. There is no "biting in" with acids, and the prints are to be produced on bromide paper, just as from an ordinary photographic negative. The needles should be stout, strong ones, broken short and set into wooden penholders so as to project about a quarter of an inch. They must be quite rigid and have no spring. Before commencing, sketch on the film with a lead pencil the outlines of the picture, so as to serve as a guide, then with a needle point scratch firmly on the film, and a fine, clear line will be produced going quite through the film, and leaving the glass underneath exposed. If the needle be held rigidly, it will be found that a free, decisive stroke can be given, and all the details of foliage, etc., can be drawn with quite as much character as they can be with pen and ink. For drawing long parallel lines a rule can be used to guide the needle point. The penknife blade is useful for removing large portions of the film, and for putting in strong, thick lines. It must be remembered that where the film is removed a perfect black will be obtained in the final print, and where the film is left untouched pure white will be the result. The intermediate tints are to be arrived at by the use of lines, broad or fine, wide apart or close together, exactly as in pen and ink drawing.

As to the style of drawing to be adopted, it is little use offering any advice, for every effect can be obtained, from the most minute and finished etching to the broadest and boldest sketch. Perhaps the easiest effects are to be got by the bold, strong-lined treatment which is to be seen in the etchings of John Constable, Geddes, or Wilkie. It is when the plate is finished, or approximately finished, that the advantage of the process over copperplate etching makes itself felt, for both in taking proof prints and in adding to or rectifying effects on the plate the operations are of the simplest description. Instead of pulling off a "proof" with printers' ink, a piece of bromide paper is exposed behind the plate, developed and fixed in the usual way. Additional touches can then be made on the negative where required, while any part of the picture that it is desirable to remove may be simply blocked out on the plate with thick Indian ink and a fine brush. A dozen prints in pure black and white can be turned out in an hour or an hour and a half, and they are as permanent as if executed in printers' ink. In printing from the copper plate, the method of "overlaying," or putting extra thicknesses of paper over certain parts, is adopted where it is desirable that the impression shall be strengthened. In the photographic process, the same effect is obtained in a much easier way by shading parts of the negative from the light during exposure, and exposing for a longer time those parts which it is necessary to print darker than they would otherwise appear.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

Casting in Plaster.

Repairing Injuries done in Casting—Plaster Spatulas—Toned and Coloured Casts—Moulding High Reliefs—Casting Medallions—Working in the Mould—Moulding from the Round—Precautions against Discolorations in Casts.

In the last chapter I gave a tolerably comprehensive account of ordinary waste-moulding, and it is by waste-moulding that a clay model is always transferred to plaster. It is, therefore, to those concerned with sculpture, by far the most important part of casting. Many matters connected with it still remain to be spoken of; but before I have done, I shall have something to say about piece-moulding and other processes for the multiplication of casts.

The relief of Apollo which we saw freed from its mould was presumed to have been cast successfully. Yet even the most successful cast will rarely be altogether free from injuries or defects. A projecting bit or two may have been chipped off; the chisel, slipping through the inner mould, may have made an indentation; or an air-hole may have shown itself. Accidents such as these, if of any considerable size, are best repaired at once. A piece broken off is most quickly replaced with a little shellac dissolved in spirit—or, more neatly, with thin liquid plaster. Liquid plaster is also mixed for stopping holes; but for this latter purpose it needs to be "killed"—that is to say, it must be allowed almost to set, and must then be beaten up with a little more water; without this precaution it would set harder than the surrounding parts, and be of a slightly different colour.

For these operations steel spatulas are used. Figs. 20, 21, and 22, are examples of plaster spatulas, drawn, like all other tools shown in these articles, to half-size. Fig. 23 gives a spatula combined with a scraper—a kind of tool of which more must be said when I come to speak of working on plaster.

In the case of the Apollo we were content to leave the cast perfectly white; but some think the natural plaster cold and raw, and a warmer tint more artistic. The tone most liked is that produced by a mere suspicion of yellow ochre. Should this be given, the colour must be added in the same manner as in tinting the mould—that is to say, in the water with which the plaster is mixed. The powdered ochre must be put in, well stirred, any scum which may rise skimmed off, and the coloured water poured into another vessel for use. Care must be taken, in doing this, not to disturb or to pour too near the sediment at the bottom, since, should any of this get into the plaster, the cast will be disfigured with yellow specks. Some persons tint busts and statuettes with such colour as will give them the appearance of terra-cotta; and sometimes a moulding, or ornamental corners are added to a relief, differing in colour from the relief itself, Prussian blue being sometimes used for these purposes. Indeed, there are various ways in which colour may be made useful in plaster work; but in every case it should be mixed in the above manner, and enough water tinged at once for the whole operation, as it is difficult to bring a second mixing to exactly the same shade as the first.

The moulding of high reliefs may be a little more trouble than such works as the Apollo, and some little time and patience are often required in removing the clay from the mould upon those parts which are prominent and much undercut; and when limbs and heads are quite isolated from the background, the easiest, and often the only practicable, way of dealing with them is to cut them off with a wire, to mould them separately, and to fix them in place again after casting.

When speaking of modelling medallions, I mentioned the facility with which a correct circle at a proper distance round the head, as ground for a medallion, might be struck in the mould. In casting a medallion on such a slab as I described, there is no necessity for continuing the mould over the edges of the slab—it is enough to cast a sufficient extent of the flat face. When the mould so cast has been washed, it is easy to lay a bit of flat wood across the hollow which represents the head, to take the compasses, and by making a trial or two, without touching the plaster, to ascertain where upon the wood will be the centre of that circle which will leave

an effective space all round the head. It will probably be found somewhere just in front of the middle of the ear, or rather, on the projection which lies over that point. A good deep circle can then be cut in the plaster with the travelling leg of the compasses. In filling the mould, the plaster must extend a little beyond this line, which will show plainly as a ridge on the cast after chipping out, and to it the ground can readily be pared with a knife in the moist plaster.

This is one thing most advantageously done in the mould; but there are others. Levelling the ground is one of these. When a relief has been long on hand, the background is apt to become somewhat battered; it will get indentations from tools and fingers which it would be a work of time to fill up with clay, and to smooth down with accuracy; but if allowed to remain, these unsightly hollows, which will appear in the mould as elevations, may then be scraped down to a perfect level with a few strokes of the drag.

Another is in the case of raised letters, etc. To model an inscription of any kind in raised letters is a work of considerable labour, but to sink them—reversed of course parts that catch the eye; whilst the second gives but a short line, and that wholly upon the hair, where it is scarcely seen. We will suppose therefore that our moulder makes a "pot-lid."

Some moulders form the division by keeping a number of strips of zinc some 2 inches or so wide, and these they stick edgewise into the clay, making them so to overlap each other where they meet as to prevent the plaster from running between. Others make strips of clay about ¼ inch thick and 1½ inches wide, and attach these edgewise to the model along the line of parting, blending them together at their ends so as to form a perfect wall. To prevent their being displaced by the weight of plaster to be thrown against them they stick wire skewers into the model, at intervals, behind them. The metal parting is the least trouble, but it makes a more unsightly seam than the strips of clay.

This wall built, the first portion of the mould (which will, in our present case, be the "pot-lid") is made in the usual way with its inner coloured, and its outer uncoloured, divisions. The slips of metal or clay—whichever are used—are then have, of course, been formed on the edges of the second piece, and no inaccuracy is possible. Before they are filled, it is necessary that the two pieces should be bound together quite tightly, and in such a manner that there shall be no chance of the tie becoming slack during casting. Our moulder's plan of doing this is to tie a cord *slackly* round the two pieces, to thrust a stick through it, and by turning this stick to twist the cord till absolutely tight. He then secures his stick by tying one end to the cord with a piece of twine. Fig. 25 explains his plan. He puts two or more of these ties, as may be required, and generally contrives to slip his cord under one of the irons of the mould to prevent it from slipping.

In filling this, or any other mould, from the round, a less thickness of plaster than was needed in our relief of Apollo will suffice, anything approaching the cylindrical and spherical form being in its nature stronger than a flat one; but the weak part of our bust—that is, the neck—will need to be strengthened. Wood swells and shrinks too much to be good for the purpose, and iron, though too frequently used by professional moulders, in figures as well as busts,

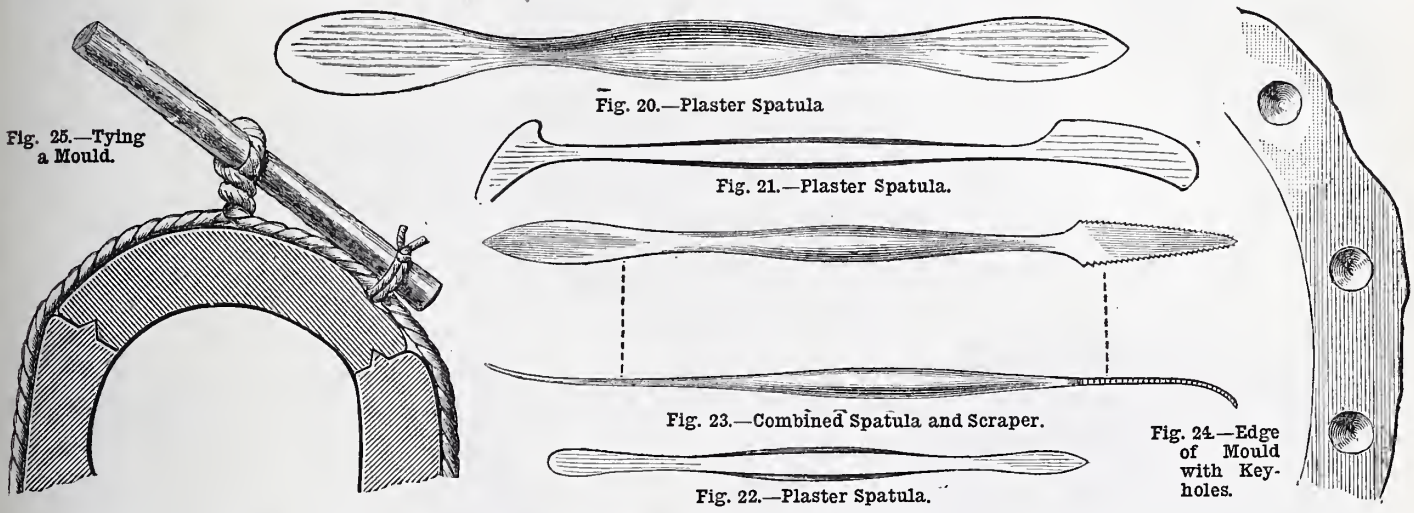


Fig. 20.—Plaster Spatula

Fig. 21.—Plaster Spatula.

Fig. 23.—Combined Spatula and Scraper.

Fig. 22.—Plaster Spatula.

Fig. 25.—Tying a Mould.

Fig. 24.—Edge of Mould with Key-holes.

—in the mould is quickly done, and the result in the cast is the same. It may be as well to say here that any simple flat ornament is often most readily worked in the same manner.

The moulding of a relief is a simple matter because (with the trifling exceptions mentioned) it can be done in one piece; but works in the round give more trouble, because from them the moulds have to be made in two or more pieces. Our modeller has, we will say, a life-sized bust ready; let us see how he will set about casting it.

There are two ways in which he may divide his mould. He may either part it into two nearly equal halves, front and back, by a line up the ridge of the shoulder, over the ears, and across the top of the head; or he may make a "pot-lid"—that is, a circular piece may be enclosed on the back part of the top of the head some 4 or 5 inches in diameter—such of that portion of the head, in fact, which in representations of Saints is marked out by the nimbus—whilst all else is moulded in a single piece. Special circumstances may render one or the other arrangement desirable, but it will be seen that the second is in a general way the best. After casting, the line of division is sure to show itself, and more or less labour will be needed to obliterate it. The first plan gives us a long line, and one running over removed, and any ragged edges which might interfere with an easy separation cleaned carefully away. Along the edge of the mould our moulder then bores a series of funnel-shaped holes with the point of his spatula or scraper, as shown in Fig. 24. That done, he brushes clay-water over the edge, holes and all.

After the remainder of the mould has been cast, it is not difficult to insert a chisel into the line of partition, and to induce the two portions of the mould to separate. The clay-water has effectually prevented them from uniting. A slight chink having been opened, water can be poured in, and the piece of mould worked by the hand as before described—persuasion being, as was before remarked, better than force. In the present instance our moulder has only to raise his "pot-lid," which, owing to its small size, is easily done. Yet the opening made is sufficient to allow the clay of the head to be removed through it. The cross-arm of the wooden frame can then be pulled from its mortise, and that done, the frame generally can be drawn out from the bottom of the mould. The removal of the clay of shoulders and neck is now an easy matter.

After cleaning, no difficulty is found in fitting the two pieces of mould together with absolute precision. This is ensured by the "key" holes bored in the edges of the first piece, for corresponding conical lumps is to be avoided, since by rusting it discolours and in time destroys the adjacent plaster. Copper, though more costly, has no such fault, but for our present purpose a sawn slip of slate answers admirably, and is inexpensive. Our relief of Apollo was too small to require strengthening, but for larger reliefs these slate slips are excellent. For statuettes and small figures copper wire of appropriate size is the best thing to strengthen limbs, etc. The slate, copper, or whatever else is used for strengthening, should not be laid on till the facing of the cast is pretty well set, and it then becomes embedded in the backing.

The moulding of statuettes and larger figures in the round is essentially the same as moulding busts, only that the moulder has to use his judgment more in laying out his divisions.

Though fine plaster looks so daintily white when newly cast, a yellow discoloration—owing, doubtless, to the presence of sulphur—sometimes appears as it gets dry. This colour seems to be carried to the surface by the moisture, as the latter is drawn out and evaporated; and by placing the cast with its *back* to the fire, the face may be kept unsoiled. This is an important point to remember as regards medallions, small reliefs, etc. In busts and large matters which are to be painted, the discoloration does not so greatly matter.

A LADY'S COMBINED TOILETTE AND WRITING TABLE.

BY JAMES SCOTT.

To an exceedingly large proportion of my readers the ideas embodied in my present design may not be welcomed, on account of the article being intended for the ladies' use. It may, however, happen that I am mistaken in my conjectures, and it is for this latter reason that I give the design this week. But if there should be any among the number who feel inclined to verify my surmises, I would ask them to fully consider the matter before finally deciding, as there are, no doubt, very few who have not one or more female friends or relatives to whom an article similar to the present design, either as a present or by sale, would be very acceptable.

Probably it will be urged by some that, if for a present, too much material and labour will be required to be spent upon it; and that, if for sale, the same reason will hold good, on account of the ladies' funds. To these imaginary grumbles I will reply by saying what, perhaps, I might leave unsaid—that it is far easier, in a great many cases, to curtail a design than to add to it, and that, therefore, it will only be necessary to leave out any part which may be considered superfluous or unnecessary; although I think that, if the design is carried out as shown, a more appropriate and useful article would be made than if altered. Being a combination for purposes of toilet and writing, even if more elaboration is bestowed upon it, the expense and labour incurred will not reach the amount necessary if a toilet and writing table be made as two separate articles.

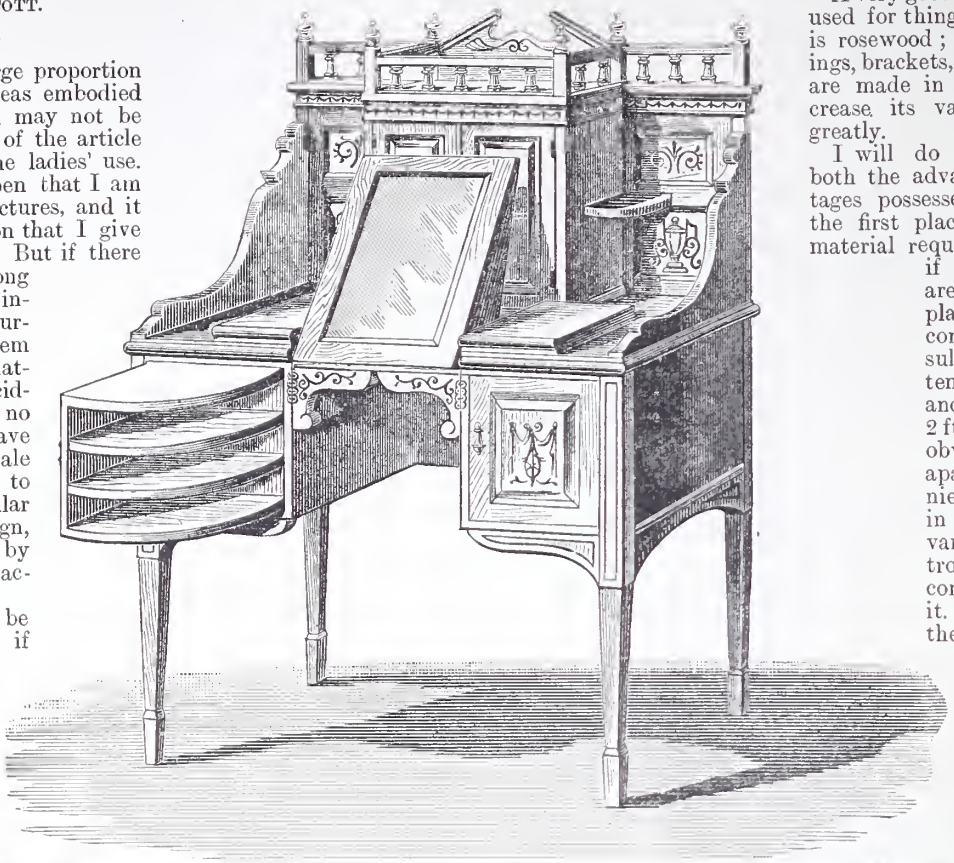


Fig. 3.—Table represented as Toilette Table.

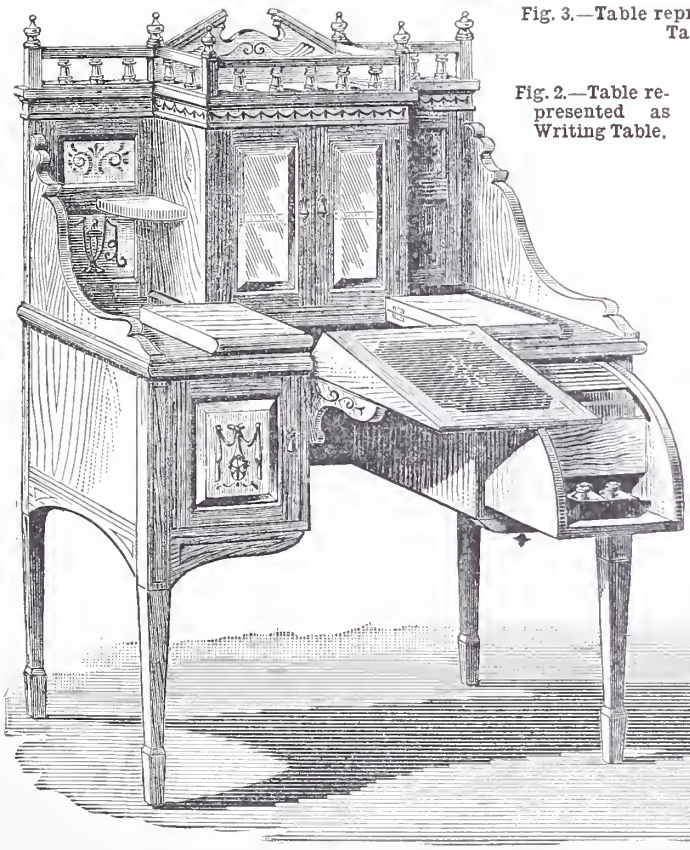


Fig. 2.—Table represented as Writing Table.

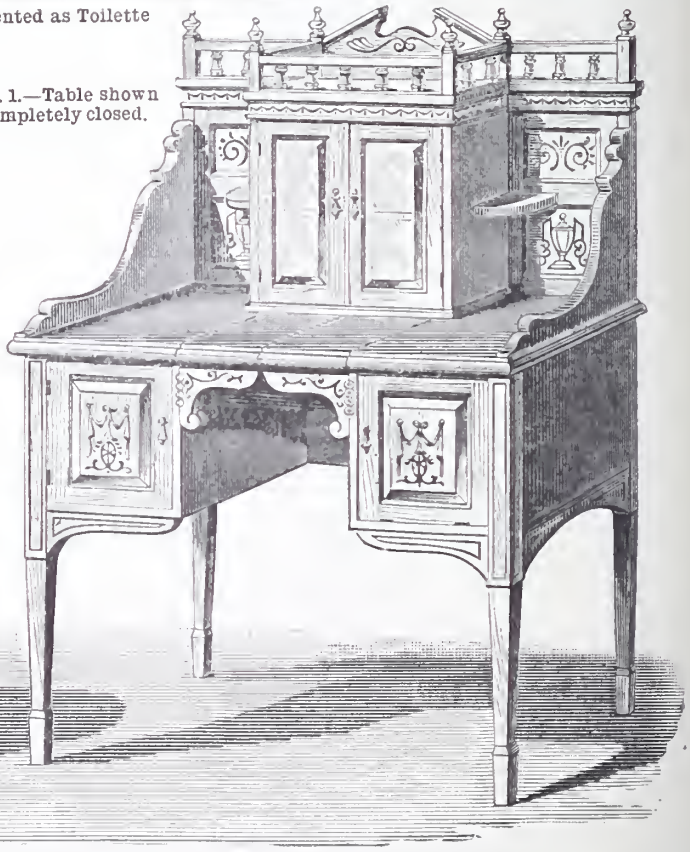


Fig. 1.—Table shown completely closed.

A very good wood, and that mostly used for things made for the ladies, is rosewood; and if panels, mouldings, brackets, shelves, and pediment are made in satinwood, it will increase its value and appearance greatly.

I will do my best to set forth both the advantages and disadvantages possessed by this table. In the first place, as before said, the material required will be less than if two separate articles are made. In the next place, space has been considered, with the result that this table is intended to occupy in length and width, when closed, 2 ft. 6 in. by 15 in. It is obvious that a very small apartment will conveniently accommodate it in this size. Another advantage is the very little trouble necessary to accomplish the changes in it. It may chance that the particular lady who is using it tries to economise time in the same manner that the table economises space, by writing a few letters while she is curling her hair, or during some other performance of the toilette; and, in my own little experience, I am perfectly aware that the ladies — especially the young ones—consider hair curling a very delicate operation, and are frequently

heating—I had almost left out the "h" in this word—their curling tongs, thus having a few odd spare moments, which might be utilised in the manner I have suggested.

I have spoken of a few of its advantages, now I must mention its drawbacks, but they are not so numerous as to outweigh the advantages. Firstly, no article could be conveniently placed upon the front part of the table top, on account of the square flaps having to be opened; but as there is plenty of room elsewhere for such articles, if the table top is nicely inlaid, *that* will be a better ornament than anything made in either china or glass. Secondly, another drawback is, that, when used as a toilette table, as in Fig. 3, anything that is within the top cupboard cannot be conveniently abstracted from it, but as there is plenty of room elsewhere, this drawback should not be considered of much importance.

opposite directions, thus permitting the glass, etc., frame to be adjusted, as in Fig. 3.

The construction of the brackets must be particularly noted. They will be made as shown in Fig. 5, in which diagram I have given one of them in two positions, in order to convey a better understanding of them. To the back of each curved piece, and close up with the edge, is fitted a triangular piece, the back edge of which will fit nicely against the bottom part, between the glass frame and the writing flap. If the brackets are fitted by means of hinges (ornamental ones should be used) fitted *outside*, it will be found that, when they are fully opened, nothing will impede the free movement of the glass, etc., frame. They will also support the frame as desk, and, although the latter overhangs, as it were, the weight of the article behind will be sufficient to keep it steady.

the stationery box is raised, the lower half of the inkpot case being heavier than the upper half, if the pivots work freely, the case will always remain in the same position; as, of course, it will be observed that, if it were stationary, when the stationery box was raised the case would lie upon its side, and the ink contained in the bottles within it would part company with it.

Fig. 6 conveys an idea of this inkpot case, and also the most convenient way in which the compartments for envelopes and note-paper might be made. The complete box is hinged or pivoted at its right angular corner to the bottom board of the right-hand cupboard.

The revolving shutter is not absolutely necessary, as, when the box is closed, the stationery within it will lay horizontally; but should the box be closed with a sudden jerk, the contents will shoot out, so that the

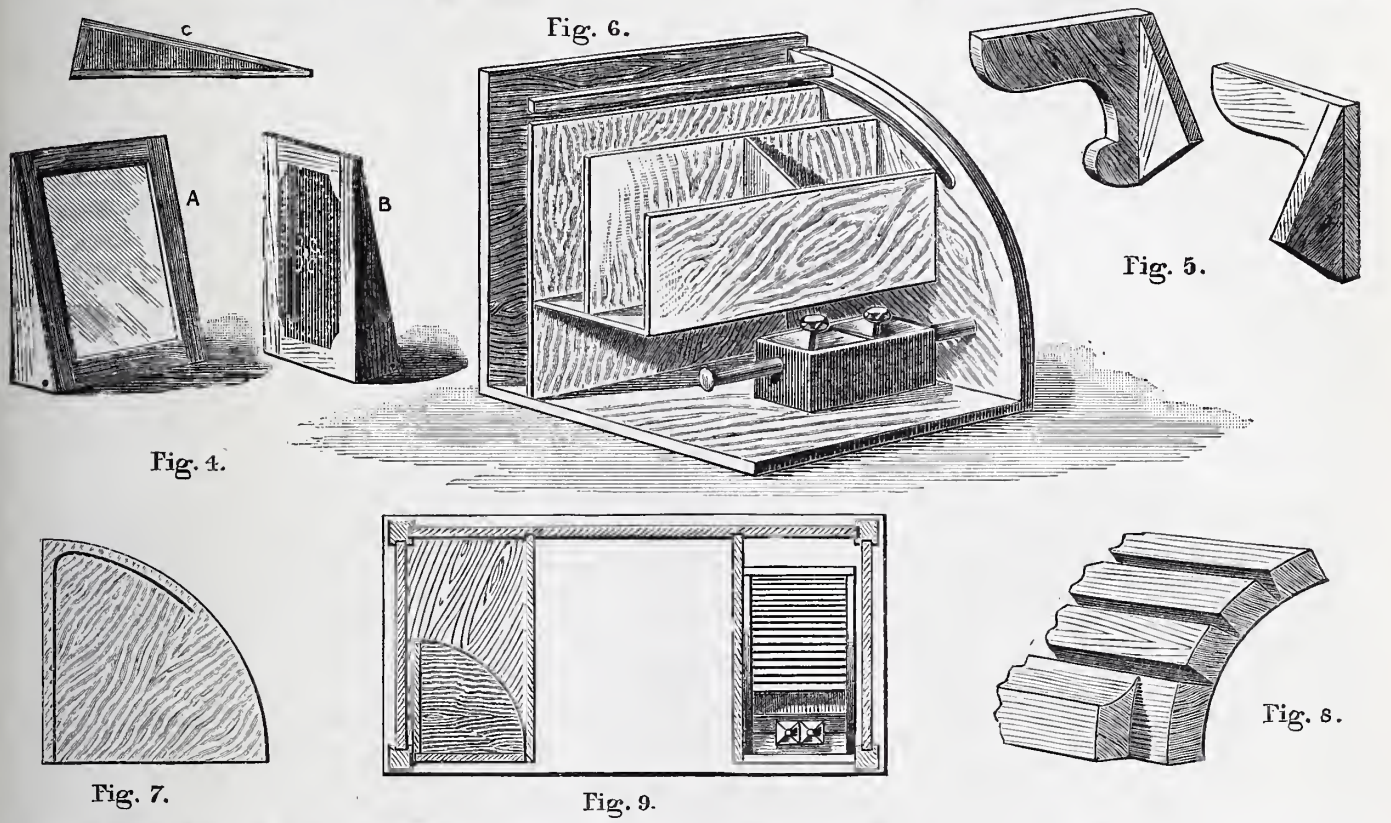


Fig. 4.—Diagram showing Desk and Glass Frame—A, Looking Glass Side; B, Desk Side; C, Section. Fig. 5.—Two Views of Bracket to support Desk and Glass Frame. Fig. 6.—Inside of Right-hand Lower Cupboard as Stationery Box with Revolving Inkpot Case. Fig. 7.—Side of Stationery Box, the Black Line indicating how Groove should be cut to receive Revolving Shutter. Fig. 8.—Bottom Lath. Fig. 9.—Plan of Lower Carcase.

In Fig. 1 the table is shown closed. The main feature of the article is here almost concealed. It consists of a glass frame joined immediately at one end to a writing flap, and at the other end to it by means of a narrow board, two triangular pieces being fitted at the sides, in order to give strength to it. This combined glass frame and writing flap is pivoted at the corners indicated by dots in Fig. 4 (A, B, C) between the two lower cupboards, in such a manner that it will revolve and fit exactly underneath, and in contact with, the top board. Along the edge nearest the pivots must be fastened a narrow strip of wood. The brackets (concerning which I shall say more lower down) cannot come close up against the edge of the glass frame unless the latter is pivoted to the thickness of the top board, in which case it will appear unsightly, as part of the glass will always be exposed, whereas I have intended it to be hidden by two small square flaps, which should be hinged to fold in

When the glass and desk frame is underneath the table top, it is apparent that the heavy weight of it will need a strong support, and for this reason, if the brackets are made as shown, the pressure of the glass frame will be resisted somewhat. Numerous methods could be adopted to prevent the brackets flying open, one being by means of an ornamental hook on the front connecting them at the top corners, which come together; or by having a plain hook, answering the same purpose, at the back of the brackets.

The bottom compartments must now be dealt with. The right-hand one (being the most convenient for the purpose) consists of a stationery box, with inkpot case, and revolving shutter. The first is accomplished by making a small box with a partition across the middle, and pivoting it to the sides of the compartment. The pivots must be *above* the centre in each side of the inkpot case, the reason for this being that, when

use of the shutter will be found to be the best course to adopt. The end of it need not come below the front of the stationery compartments, as shown in Fig. 6. To make this shutter, glue a sufficient number of laths or narrow strips to a piece of canvas, then cut a groove along the inside of each sideboard along the line indicated in Fig. 7. The bottom lath should be something like that shown in Fig. 8, the shape of it preventing the shutter being pushed too far, if a narrow rail is fastened at a little distance above the edge of the back partition in the stationery box, as in Fig. 6.

The left-hand cupboard is intended to open in a different manner to the right-hand one, being hinged to the leg block; but I have placed the handle in the same place for the sake of appearance. The bottles and pots of various preparations that a lady considers necessary for toilette purposes are generally very small, so that I think if this cupboard is fitted with shelves, as per

drawing, it will be as useful as in any other shape.

The top cupboard will be found useful, so also will the small corner shelves. The side brackets will serve a useful as well as an ornamental purpose, inasmuch that they will prevent any article on the top of the table being pushed off.

The pediment and spindle-rail, if made as I represent them, will look better, I think, than if a pediment is fitted right along the top. The back may be panelled or glazed. In the latter case, the light will be reflected, and perhaps, as a writing table, it will be found best fitted so; but as the desk projects beyond the front edge of the table, if inlaid panels are used, very little shadow will interfere with it.

Small brackets fitted under the lower cupboards will add an effect to the table. The brackets under the centre of the table must be so made that the top of each will fit against the edge of the narrow strip on the glass frame.

I will now give some sizes as a foundation to work upon, although, as I have so often remarked, this is so much a matter of individual choice that it almost seems as if space were being wasted by giving them; but as I am aware that such details are welcomed by a number of readers, I ask no further excuse for proceeding with them. Well, then, briefly treated, the following measurements are suitable, but it must be borne in mind that allowance must be made in them for joinery. Table top, a trifle over 2 ft. 6 in. by 15 in., and about $\frac{3}{4}$ in. thick; lower carcase backboard, 2 ft. 6 in. by $12\frac{1}{2}$ in., and about $\frac{1}{2}$ in. thick; four boards forming the lower cupboard sides, each 15 in. by $12\frac{1}{2}$ in.; bottom boards of cupboards each 15 in. by 8 in.; top boards of cupboards each 15 in. by 8 in.; doors each $11\frac{1}{2}$ in. by 8 in., and $\frac{3}{4}$ in. thick; top backboard 2 ft. 6 in. by 15 in., and about $\frac{3}{4}$ in. thick, surmounted by mouldings, pediment, and spindle-rails, and panelled with $\frac{3}{8}$ in. or $\frac{1}{2}$ in. stuff inlaid; cupboard bottom board a trifle over 15 in. by 9 in.; cupboard top the same size; cupboard sides 15 in. by 9 in. One or two shelves might conveniently be fitted within this cupboard. The doors would look well in clear glass. The total depth of the cornice and frieze should not be more than $2\frac{1}{2}$ in. or $2\frac{3}{4}$ in., and the whole should be made to fit nicely over the top of the cupboard and backboard in one piece, being filled in by a board to answer the purpose of a shelf on top of the cupboard. I have given my measurements (where not otherwise stated) as intended for wood $\frac{1}{2}$ in. thick, but if thought preferable to have thicker stuff, they can easily be altered.

The glass frame will be $13\frac{1}{2}$ in. by 12 in.; the writing flap 13 in. by 12 in., both joined together, as previously stated, the back piece being 4 in. wide. Do not have a bevel to the glass nor a moulding to project, unless the frame is pivoted deeper down than I advise, as, if used, the two square flaps in the table top will not lay flat.

The bottom board of the stationery box must be a little longer than the door (which latter may be panelled or solid), and the sides should each be a quarter of a circle in shape. If the top board in the cupboard be cut thinner at about $\frac{1}{2}$ in. or so distance from the front edge for about an inch, the projecting end of the stationery box bottom board will catch against it, and prevent the box coming right out in front. Of course, there are other ways of effecting this result, but this method is as simple as any.

The backboard of the left-hand cupboard will also be the same size as the front, and the top and bottom boards of it, and also the shelves, will likewise each be a quarter of a circle in shape.

The height of the table from the floor to the large top board will be about 28 in.

Square legs, I think, will look much better than turned ones, and can be fitted with castors, if desired; but in this latter case, when the table is used as a writing table, it will be rather unsteady.

In Fig. 6 I show a small division in the front opening, thus making it into two compartments. Now, as the width of the box will only be $7\frac{1}{2}$ in., according to my measurements, these spaces will be found too small for some purposes; but if the sizes are enlarged, the treatment of the box as in Fig. 6 would be the best course.

For those who require an insight into details of joinery sufficient to enable them to accomplish the completion of one of these tables, I should advise the careful study of such articles as "Some Lessons from an Old Bureau," "A Small Sideboard," etc., in past numbers.

Of course, the sizes that I give may not be quite to the taste of a number of readers, and there may be others who would follow them blindly. To the former I would say, alter them accordingly; to the latter, pin up a large sheet of white paper against a wall and mark on it the heights, etc., that I give, then on another sheet draw a plan according to my measurements, and by so doing a fair idea of the proportions will be conveyed.

Even if the article were made smaller—say, 2 ft. by 12 in.—a useful table would be the result; but this, and also the suggestions of any improvements, I will leave to the reader, bidding him not to be entirely selfish, and make everything for his own use, but to remember the pleasure to be given by the presentation to a female friend or relative of an article of use and ornament—not particularly one exactly according to this design, but of any kind.

OUR GUIDE TO GOOD THINGS.

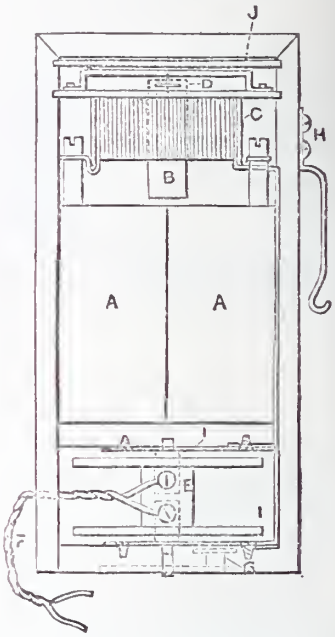
*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

63.—Polytechnic Series Technical Scales.

Every draughtsman and every workman who is accustomed to make drawings to scale, knows how much nicety and exactness are required in the construction of proportional scales, and the time that is taken up in preparing them. It is true that scales are given on the flat boxwood or ivory rule that is to be found in most cases of mathematical instruments; but these, to use a common expression of the time, "are not in it" when compared with the Polytechnic Series Technical Scales which have been prepared by Mr. C. F. Mitchell, and which are published and supplied by Messrs. Cassell & Company, Limited, La Belle Sauvage, Ludgate Hill, E.C., at the nominal price of 1s. per set. The set before me contains eleven strips of card, and on each card, except I, are two scales, the surface of every card being coated with a clear white varnish. The cards are distinguished by letters which run from A to J. Card I contains four scales. Thus there are twenty-two scales to show feet and inches, and two to show mètres and mètre scale $\frac{1}{4}$ size. Card A contains scales of 12 in. to the foot or full size, and 6 in. to the foot or half full size; Card B contains scales $\frac{1}{6}$ and $\frac{1}{3}$ full size; Card C, $\frac{1}{8}$ and $\frac{1}{4}$ full size; Card D, $\frac{1}{5}$ and $\frac{1}{10}$ full size; Card E, $\frac{5}{96}$ and $\frac{5}{48}$ full size; Card F, $\frac{1}{24}$ and $\frac{1}{12}$ full size; Card G, $\frac{1}{16}$ and $\frac{1}{32}$ full size; Card H, $\frac{1}{48}$ and $\frac{1}{96}$ full size; and Card I $\frac{1}{36}$, $\frac{1}{72}$, $\frac{1}{60}$, and $\frac{1}{120}$ full size. Card J contains mètre measure and mètre scale $\frac{1}{4}$ size. It is not possible to conceive, or to procure, a more welcome addition to the appliances usually found on the draughtsman's desk than this capital and correct set of scales. Every workman who uses his pencil should have a set.

64.—Improved Electric Testing Apparatus—Provisional Patent, No. 882.

This instrument is designed for use by electrical contractors for testing fittings and for general installation work in place of the ordinary detector galvanometer. It consists of a mahogany or walnut case, the dimensions of which are $5\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{3}{4}$ in., divided into two compartments, the upper containing a small galvanometer (the needle of which is controlled by a small magnet) and a battery. The lower compartment contains



Improved Electric Testing Apparatus—A A, Battery; B, Magnet; C, Coils; D, Needle; E, Spool; F, Testing Cords; G, Winder; H, Suspending Hook; I, Contacts; J, Glass Cover.

a spool and winding arrangement to which the testing cords are fixed. A hook is fixed on to the back of the instrument, by which it can be attached to the body of the workman.

The chief advantages of this instrument are that by means of the hook the instrument can be firmly fixed to the body of the workman, thus leaving the hands free for testing, ascending ladders, etc., and by permanently fixing the testing cords to the spool they can be drawn up into the case, and thus are not liable to get lost or broken, and are always ready for use.

65.—Proctor's Slate Composition.

Messrs. John Proctor and Co., St. Ann's Ink Works, Nottingham, makers of the "Defiance" Writing Inks, send a small sample board covered with their slate composition for putting a good surface on boards intended for use in the school-room, class-room, or lecture-room. It has an excellent effect, and from the appearance and handling, seems never likely to wear bright or glossy, so that anything written or drawn on it can be readily seen in any position. Boards 4 ft. by 3 ft., coated with this desirable preparation, are supplied at 16s. each. The composition is supplied for use at home, etc., at 1s. 6d. per lb. Care should be taken not to mark any board thus prepared with lead pencil. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

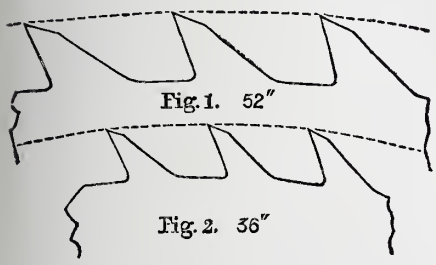
NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Circular Saw Teeth.—A. R. (*Scorrier*) writes:—"I have read from time to time papers in reference to the working of circular saws, etc., by makers and others. Now a man may be able to make a good saw, and give a lot of information in reference to working it, and after all fail to give the information that can be given by a man that has had experience in working and keeping the saws in working order. Some remarks by M. Powis-Bale, in recent numbers, are good, but, like most other writers, he fails to give the length and number of teeth, also form of teeth. They say teeth should not be too long, neither should they be stumpy. Now, the question may be asked, what is too long, or what would be considered stumpy? Now as these important points are not given, I have come to the conclusion that the writers of these papers would prefer one who has had some experience to give his opinion as to what has proved to be the best space, length, etc., of saw teeth. Now for soft wood generally, the space between the teeth should be greater than for hard wood, the teeth longer and the angles more acute. A saw that is used for cutting nothing harder than yellow, red, or white pine, teeth to the number of 50 will answer well if properly sharpened. Then the question may be asked, 'For what sized saw?' My reply is of any diameter. It is the custom where there is more than one saw bench at work, when the saws for the larger benches are reduced to a certain diameter, to get them ground thinner and work them in a smaller bench. As the saw is reduced the teeth of course become closer, and the speed of the smaller bench or saw is increased, so that at the point of teeth the traverse is as great as in the saw of greater diameter. The annexed sketches give the distance of teeth in a 52 in. circular saw with 56 teeth, and the distance of the teeth when reduced to 36 in. So you will at once see if a 52 in. saw was, with the distance of teeth, not greater than in one of 36 in., there would be far too many teeth. The reason I give sketch of 56 teeth is, in many sawmills the same saws have to be used in cutting elm, ash, beech, etc., occasionally; therefore, I draw a line between the number of teeth for soft and hard wood generally. The length of teeth in Figs. 1 and 2, space and rake, I have proved



to answer well for general work; it will also be seen by the difference in the length of teeth in Figs. 1 and 2, how the length should vary in proportion to the diameter of the saw. As to a greater number of teeth in a thin saw, should a saw be kept for special work, such as a swage saw, the number of teeth should be greater than above mentioned. Again, would you recommend teeth as in Figs. 1 and 2 for saws cutting English-grown timber, such as ash, elm, oak, etc.? Precisely the same form, but the rake and bevels not so acute. Some may say that the teeth should be as in Fig. 3, but I objeet to this form of tooth; in the first place, it requires more topping and more power to drive it; secondly, it is more difficult to set; thirdly, although there is more steel in the tooth, it will not stand to its work well, the back of teeth being more upright and the angles so sharp at A, A; the tooth is not so strong as if there was more bevel at the back and round at the angles, as in Figs. 1 and 2. The back being bevelled, supports the tooth as it is thrust into the timber, and round at the angles strengthens it. Teeth for cutting the last-named woods only should be about ½ in. shorter than given in Figs. 1 and 2, and the number from 60 to 66; if much longer, and come in contact with a hard knot, or a "curl," as we term it, the teeth will chatter, lose their set, and, in consequence, cause the saw to run out of truth. There are many forms of teeth given by makers, but it has been proved the chisel form, as in Figs. 1 and 2, is the best form for general work. Again, I believe it is generally understood that the greater the diameter of the saw the stouter the plate. Now to set the teeth of a stout saw is not an easy matter for an amateur: many a good saw has been considered inferior through the ignorance of the one that had the sharpening of it. Not having a fair knowledge of how to set the teeth, they often break a tooth; they take a one-handle 'set,' and on a thick plate commence to bend away and press on the handle as though they were trying to break it off; finding the tooth does not bend so easily as they would wish, they put more strain on the handle of the 'set' and off snaps the tooth. Then it is said the saw is of inferior quality, and that saws made by such and such a maker are not as good as those made by so and so. This tale is carried around, which in the long run does the abused maker no little injury, and all through the ignorance of the abuser. I might say that I have set circular saw teeth of thin and

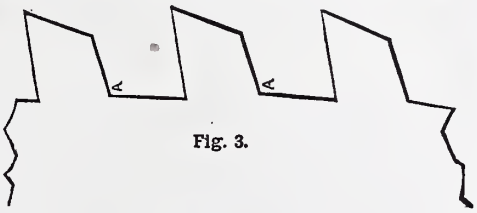


Fig. 3.

stout gauge many thousands of times, and have not broken on an average one tooth a year in setting, unless the tooth was defective before setting. The way I set all stout circular saws is as follows:—I use a two-handle set about 20 or 21 in. long, as Fig. 4. I place it down over the tooth about one-third its depth, and if the tooth is to be set toward the right hand I gently pull the handle in

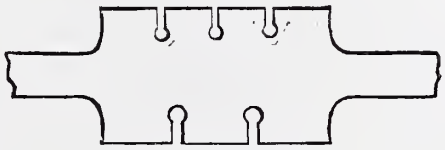


Fig. 4.

my right hand toward me, and push the handle in my left from me. Then I take a gauge made of a thin piece of steel (as Fig. 5) and place it against the saw plate, holding it at right angles and bearing at G, G; if the point of tooth touches the gauge at S, it has set enough; if not, twist the tooth a little more until it touches the gauge; then move on, and set every alternate tooth on that side. Then take the gauge in the left hand, and set every alternate tooth in like manner on the left hand. You will clearly see, by using the set as described, that the point of tooth is twisted and not levered down on and sprung. Now the question may arise, 'Will the same gauge answer for saws of any diameter?' Of course not. A saw that will cut through a piece of timber 24 in. deep requires more set than one that will only cut through 12 in. deep; therefore, where several saws of different diameters are at work, some five or six gauges will be required to keep saws in good order; to give the amount of set for each saw, and for every kind of wood, would take a deal more space, on which I am afraid I am encroaching, but shall be always pleased to answer any question on the above. In reference to fence projecting 3 or 4 in. beyond root of saw teeth, as stated by M. Powis-Bale (see Vol. II., page 203, cause 14), I beg to say it is a mistake: only in cutting very thin stuff should fence projeet beyond the teeth at all; as in general work, it will cause binding on the saw, which should by all means be avoided. Much more might be said in reference to saw teeth, but enough for the present."

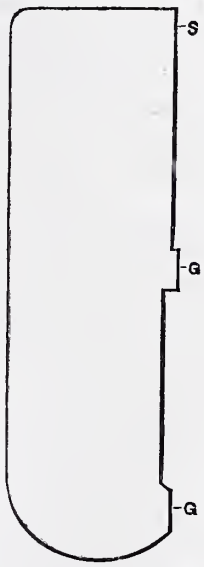


Fig. 5.

II.—Questions Answered by Editor and Staff.

Telephone Parts.—H. S. (*Stoke Newington*).—I am very sorry that I am unable to make out your sketch of telephone connections, and therefore cannot tell you whether you are right. If you have made all the various parts and connected it up as shown, you will lose nothing by experimenting, and perhaps you will then be able to answer your own question. You might have easily designed a simpler switch than the mahogany wheel; certainly it seems quite ingenious, but I think I should prefer an arrangement not quite so complicated. With a single cell of the Leclanché type you could not expect to establish a communication of any great distance. It would be much better to have a little spare current, so I would advise you to get one or two more cells. Your former query reached me all right and was replied to; have a little patience, and you will see it in due time.—W. D.

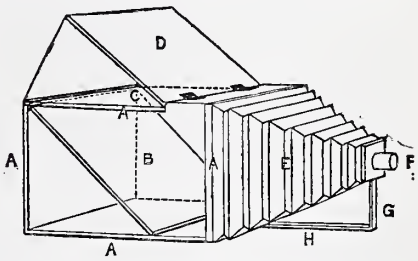
Speed of Band Saw.—P. F. (*Liverpool*).—The speed of your band saw for your work should be from 4,000 ft. to 4,500 ft. per minute. You say you are using ¾ and ⅝ band saws with teeth three to the inch, and want to know if two to the inch would be better. Certainly not; it would be making a bad matter worse. The number of teeth in the ¾ saw should be 4½ or 5 points to the inch, and in the ⅝ saw 4 points to the inch. I have band saws at work running at the above speed and cutting hard wood, chiefly doing superior work. If your saws are properly sharpened and speed regular, with the above speed and number of teeth they will do good work. You should have given diameter of wheels and number of revolutions, so that I might know whether you have rightly calculated the speed of your saw. Your wheels may be 36 in. diameter, and you may be calling the circumference 9 ft. or three times the diameter; if so, the speed of your saw would be greater than the speed you give. To find the circumference of your wheels you should multiply the diameter in inches by 22 and divide by 7; this will give the circumference in inches, which, divided by 12, will give the number of feet.—A. R.

Pattern Making.—Square Centre.—It is intended to give articles on pattern making in Work, but it is not possible to say when they will be likely to appear. I am quite aware of the desirability of such papers, and when they are given I wish them to be the best possible.

Copyright.—M. McQ. (*Cockermouth*).—The cost of entering title, etc., of a book at Stationers' Hall is about 5s.

Moulding Shellac and Emery.—Bristol.—If you give your moulds an even coating of black-lead and beer, I think you will overcome the difficulty mentioned in your query. Not knowing shape or size of the articles you require to make, I cannot, of course, give you more explicit directions. I have not found this substance difficult to manage in the way you complain of; remember always to *keep up the heat* until the moulding—*i.e.*, pressing into the moulds—is accomplished; do this "by hook or by crook," even at the risk, I may say *certainty*, of burning your fingers; otherwise you will find any mixture in which shellac is the chief ingredient will *go against you*.—Opifex.

Camera Obscura.—G. McK. (*Glasgow*).—Make a light box 10 in. square with a cone in front to support the lens and provide sufficient focal length. A piece of silvered glass is placed at an angle of 45 degrees to the lens, and to a sheet of ground glass directly above it, a screen to cut off outside light and assist in seeing the image on the ground glass, complete the arrangement. The instrument should be stained a dead black inside. The accompanying diagram will explain its construction.



A A A A, a wooden box, 10 in. square; C, ground glass screen, on which the image is reflected; B, mirror, set at an angle of 45°; D, lid over the ground glass, hinged to box with thin side pieces to act as a screen when raised, and fitting down by the side of the box when closed; E, conical extension made of any opaque fabric; F, lens supported by rod G, attached to sliding bar H, slipping under box, when out of use for portability, or the whole might be made as a simple oblong box. The kind of lens may be either a single landscape lens or double convex lens of about 12 in. focus.—E. D.

Lessons on Turning.—J. M. B. (*London, W.*)—No doubt this subject will be treated; meanwhile, if you can buy or borrow Holtzapffel's "Turning and Mechanical Manipulation," Vol. IV., you may see the subject about as clearly treated as it is possible, and it will probably leave on your mind the impression that, though description may assist, a little "showing" is still more essential to a beginner.—F. A. M.

Building Trades Examinations.—STUDENT, WORKMAN, W. B. (*York*), and others.—Below you will find the questions asked on the above subject by the Science and Art Department of South Kensington for this year (1890). I have appended the rules for the benefit of readers generally. I have omitted the honours questions, as you did not ask for them, but if you wish it I will let you have them in another number of WORK.

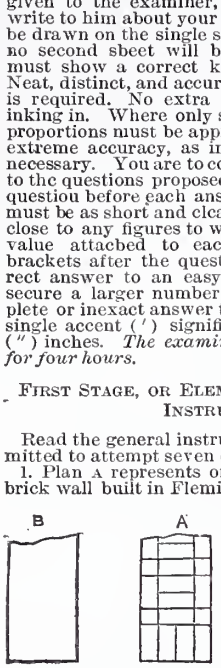
GENERAL INSTRUCTIONS.

If the rules are not attended to, the paper will be cancelled. You may take the elementary or the advanced or the honours paper, but you must confine yourself to one of them. Your name is not given to the examiner, and you are forbidden to write to him about your answers. All figures must be drawn on the single sheet of paper supplied, for no second sheet will be allowed. All drawings must show a correct knowledge of construction. Neat, distinct, and accurate pencil drawing to scale is required. No extra marks will be allowed for inking in. Where only sketches are asked for, the proportions must be approximately correct, though extreme accuracy, as in drawings to scale, is not necessary. You are to confine your answers strictly to the questions proposed. Put the number of the question before each answer. Answers in writing must be as short and clearly stated as possible, and close to any figures to which they may refer. The value attached to each question is shown in brackets after the question. But a full and correct answer to an easy question will, in all cases, secure a larger number of marks than an incomplete or inexact answer to a more difficult one. A single accent (′) signifies feet; a double accent (″) inches. *The examination in this subject lasts for four hours.*

FIRST STAGE, OR ELEMENTARY EXAMINATION.—INSTRUCTIONS.

Read the general instructions. You are only permitted to attempt seven questions.

1. Plan A represents one course at the end of a brick wall built in Flemish bond. Draw to a scale of 1 in. to a foot, making any alteration you think necessary. Also draw plan B, showing the arrangement of the bricks in the next course.

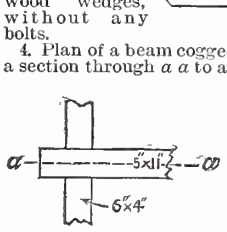


2. Give a sketch elevation showing a portion of a stone wall built of squared rubble worked up to courses.

3. Elevation showing two 13 in. square balks of timber halved together. Draw the joint to a scale of ¾ in. to a foot, but showing it tabled and secured by hardwood wedges, without any bolts.

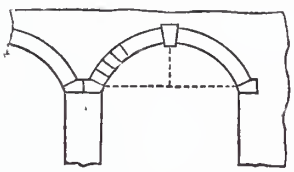
4. Plan of a beam cogged on to a wall plate. Give a section through *a a* to a scale of 1 in. to a foot.

5. Elevation of a stone arch. Draw to twice the scale, and write on it the names of all the different parts of the structure.

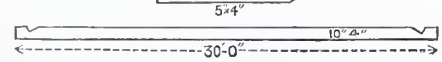


6. Explain by aid of sketches the meaning of the following terms:—wood plugs, lead dots, double quirk bead, wood lintel.

7. Parts of a roof truss. One member of each kind being given. Draw the truss to a scale of four feet to an inch, writing down the name of the truss and of its different members, including any ironwork.

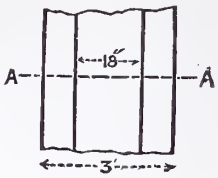


8. Plan of part of an 18 in. brick wall built in English bond, showing also the width of the bottom course of footings. Draw the plan to a scale of ¾ in. to a foot, filling in the bricks in the 18 in. course only. Draw a vertical section through A A, showing the arrangement of the bricks in the footings; no offset to be more than a ¼ in. brick.



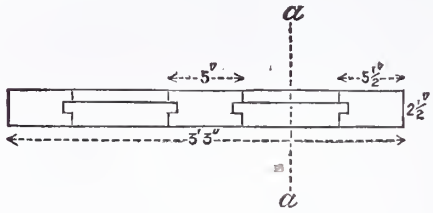
9. A cast iron cantilever is 10 in. in depth, and its flanges are respectively 4 in. by ¾ in. and 8 in. by 1¼ in. Draw its section in position, one-third full size.

10. Horizontal section through a four-panelled door 7 ft. high. Draw its outside elevation and a vertical section through *a a* to a scale of ¾ in. to a foot, showing the top panels, bead, and butt, and the bottom panels, bead, and flush.



11. Draw to a scale of 1½ in. to a foot a section through the eaves of a roof, showing 4½ in. by 2 in. rafters, 3 in. by 1 in. battens, carrying 24 in. slates. Show four courses of slates, centre nailed, and laid to a 4 in. lap.

12. An iron roof truss over a 24 ft. span consists of T iron principals 3 in. by 2½ in. by ⅜ in., two angle iron struts, 1½ in. by 1½ in. by ⅜ in., and five tension rods of ⅞ in. diameter. Draw the elevation of about half the truss to a scale of 2 ft. to an inch.



13. Draw a cross section, to a scale of 1 in. to a foot, through an 8 in. lead gutter with step flashings, formed at the end of a boarded and slated roof butting against the brick wall of another building; also show the step flashings in elevation.

14. Draw a vertical cross section, to a scale of 1½ in. to a foot, through the foot of a wooden kingpost; and a tie beam 5 in. by 11 in., showing all the details of a stirrup iron ¾ in. thick properly wedged up with gibs and cotters.

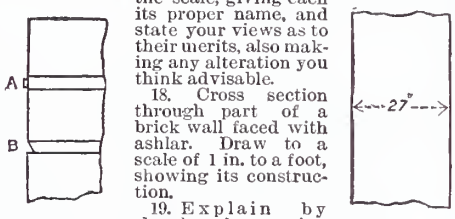
SECOND STAGE, OR ADVANCED EXAMINATION.—INSTRUCTIONS.

Read the general instructions. You are only permitted to attempt six questions.

15. What is the difference between single and double laths, and what does the first coat of plaster on ceilings ordinarily consist of?

16. When ought timber to be felled, and why? What is American yellow pine chiefly used for?

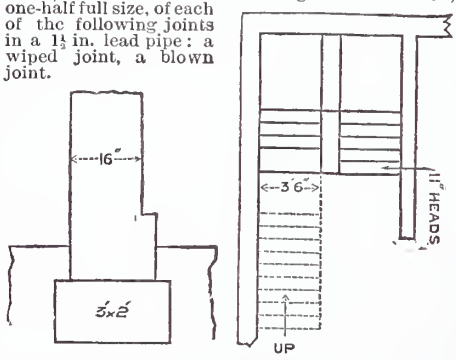
17. Sketches of two forms of mortar joints, one being known as tuck pointing. Draw them to twice the scale, giving each its proper name, and state your views as to their merits, also making any alteration you think advisable.



18. Cross section through part of a brick wall faced with ashlar. Draw to a scale of 1 in. to a foot, showing its construction.

19. Explain by sketches the meaning of the following terms: "facia and soffit boarding to eaves," "dragging tie or dragon beam," "flitched girder," "torus moulded skirting."

20. Give an elevation and longitudinal section, one-half full size, of each of the following joints in a 1½ in. lead pipe: a wiped joint, a blown joint.



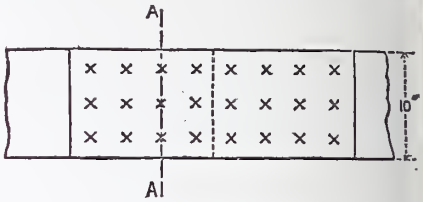
21. Cross section of a hollow brick wall resting on a concrete foundation. Draw to a scale of ¾ in. to a foot, showing the hollow space next the outer face, iron wall ties, and an asphalte damp course.

22. Plan of a stair. Draw to a scale of ¼ in. to a foot, showing the handrail by double lines and newels; also giving the name by which it is known, and the names of its different parts. Give to a scale of 1½ in. to a foot an end elevation of two of its steps, showing return moulded nosings and a sunk and moulded string.

23. Line diagram of an iron roof truss. Draw to twice the scale, showing the members in tension by single lines and those in compression by double lines.

24. Elevation of a beam of a traveller running on a gantry. Give an end elevation of the traveller to a scale of ½ in. to a foot, showing how it is carried on the gantry.

25. Plan of a double cover riveted joint in a ¾ in. tie bar, showing the positions of the rivets. State the nature of the joint, having regard to the arrangement of the rivets, and draw a section, one-third full size, through A A, showing ¾ rivets to a 3 in. pitch, with snap heads above and pan heads below.



26. Draw, to a scale one-sixth full size, a vertical section through a window back, showing a coursed rubble wall 12 in. thick, with both stone and wood sills, and the bottom rail of a 2¼ in. double hung sash. The back lining to be 3 ft. high to sash, with moulded panels, and to be box framed, showing vertical sliding shutters in two 3 ft. 6 in. leaves.—E. D. [The working out of these questions will appear subsequently.—ED.]

Electro Motor.—F. H. (*Euston Road, N.W.*).—To make an electro motor capable of driving a sewing machine, I should advise you to get a set of Manchester type motor castings to the following dimensions:—armature, 3⅜ in. diameter by 2 in. deep; field magnet cores, 1½ in. diameter by 4 in. long, connected by yokes 8 in. long and 2 in. wide. Wind the armature with 1 lb. No. 20 double cotton-covered copper wire, and the field magnets with 1 lb. of No. 16 double cotton-covered copper wire, connected in series with the armature coil. This machine will take about 4 ampères of current at a pressure of 12 volts to drive a sewing machine. The current can be furnished by a battery of 6 quart-size chromic acid cells, or one of 12 nitrate of soda cells. The castings and wire, together with instructions, can be obtained from Mr. S. Bottone, electrical engineer, Carshalton.—G. E. B.

Safety Bicycles.—S. B. H. (*Birmingham*).—Your letter is not quite explicit as to what kind of an article on safety bicycles you require. Would you read the article on the front page of WORK, No. 66, for week ending Saturday, June 21, 1890, and say if that is what you want. A continuation of that article, giving hints on riding, pedalling, etc., is to appear in WORK shortly. Probably you would like an article on how to build a safety machine. If not, and the above printed article does not suit your requirements, kindly write again, saying what style of paper you wish to appear.—P. B. H.

Turning Oval.—W. B. (*Crosland Moor*).—There have appeared several sketches of "oval chucks" for turning work of elliptic (not oval) section, and I understand a contributor has written a paper on the "oval chuck," which will probably give you the information you require. It is not easy to thoroughly understand the action of the "oval chuck." If I had you here to look at mine, you would see it work, and might easily learn to use the chuck, but you would probably not be able thoroughly to grasp its action. It cannot be explained in a few words in the "Shop" column, and you had better wait for the article. The chuck is a very beautiful mechanical contrivance—well worth studying.—F. A. M.

Phonograph.—H. W. (*Strabane*).—I cannot say whether the articles on the phonograph will be published in the present volume of WORK or not: that remains with the Editor, who will doubtless do what is possible in the interests of the readers.—W. D.

Clockwork.—J. W. (*Wolstanton*).—Britten's "Watch and Clockmakers' Handbook, Guide, and Dictionary" may be had through any bookseller, or from the editor, I think, at the Horological Institute, Northampton Square, Clerkenwell, London; or Grimshaw & Baxter's, 35, Goswell Road, Clerkenwell, or any other watch tool shop. By ordering from the booksellers you save postage, and may get a reduction beside.—A. B. C.

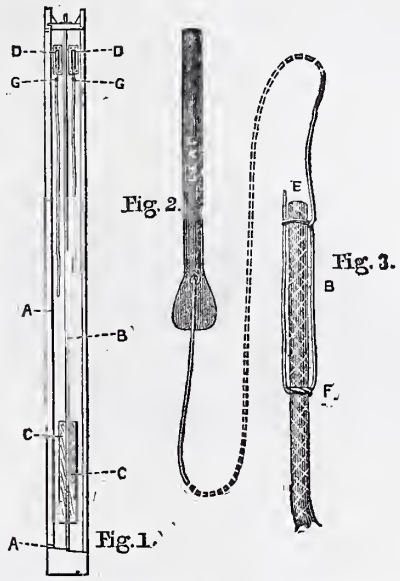
Polished Cast Iron.—J. D. (*Birmingham*).—Assuming you desire a blue colour, try the following:—Fill an iron pan with clean brass filings, sand, powdered charcoal, or mahogany sawdust, heat the pan to a low red heat, and pass and repass the articles through its contents until the desired colour is obtained. There must be no trace of grease on the articles to be blued. Dissolve four ounces of hyposulphite of soda in a pint and a half of water, and add a solution of one ounce of acetate of lead in one ounce of water. Boil this and let the articles remain in it until blued.—J.

nlaying.—JOE (*Liverpool*). — Busschott, Park ne, Liverpool, generally has a fair stock of inging for inlaying. If you have not done so, try n for what you want. For centres go to Urqu- rt & Adamson, Cabinet Makers, Bold Street. If ey have not got them they will make them for u.—D. D.

Inlaying.—W. D. (*Perth*).—There is only one ok published which gives the process of marque- y inlaying as practised by professionals, viz., The Art of Fret Sawing and Marquetry Cutting," David Adamson, published by Ward, Lock & o. The subject will be treated of in WORK in urse of time, but I am unable to say when. Do ot attempt to dye the veneers yourself. They can e bought at very low prices in almost any colour, nd the process is both difficult and tedious.— . J. P.

Hammock Stand.—L. W. (*Wantage*).—You do ot say whether you want your hammock stand to e for out or indoor use, or whether it is to be a xture or movable. I am, therefore, at a loss to now how to help you with minute details, as you nust see it is impossible to go closely into construc- ion of all kinds. I may, however, suggest posts tuck into the ground for permanence out of doors, r a couple of tripods over which the hammock opes can be slung and fixed beyond to stout pegs n the ground, or hooks screwed into the flooring. If you want further assistance, send full particulars of what you want.—D. D.

Hanging Sash. — NUR THENE. — I think, by telling you how to put new sash lines to both top and bottom sashes, I shall answer your three queries at once. For if you can put lines to both sashes it goes without saying that you can put them to either top or bottom, as the case may be, always bearing in mind that you must take out the bottom sash to put a line to the top one. Some men who are accustomed to this work only undo one line of the bottom sash, letting it swing out of the way, resting it on any available projection or piece of furniture, or held by an assistant, when putting a new line to the top sash. But it is not to be recommended except in the case of very light sashes, and certainly not by an amateur. We will now suppose that all four lines are broken in an ordinary window. The first thing necessary to do is to take out the sash beads, marked A in Fig. 1: this will release the bottom sash, which you now lift out, taking out the broken pieces of cords, noting how they are fastened off, and stand it aside. Now take out the parting beads, marked B. If you have any difficulty in doing this it can easily be managed by inserting a thin chisel behind them and prising, being careful not to break them. You can now take out the top sash, and serve it the same as the other one. Next take out the pocket pieces marked C (if only one line was broken, it would only be necessary to take out the corresponding pocket piece): this will enable you to lift out the weights, noting which are for the front and which for the back sash. Sometimes when two lines are broken on one side it is rather awkward to get out the weights, but it can easily be managed by lifting one straight up above the aperture and pushing the parting slip aside. If you hold this tightly against the raised weight, you can readily take out the other; and when one is out the other is an easy matter. Next take out the pieces of broken cords from the tops, taking notice how the knots are tied. You are now quite ready to put in the new lines; and to do this the first thing necessary is to provide a small piece of lead about ¼ in. round and 4 in. long, also a piece of whipcord about as long as the sash frame is high. Tie a knot in one end of the cord, flatten out one end of the lead, and lay the tied end of the cord on the flattened part of lead, as Fig. 2. Now close the lead tightly round the cord, and the knot will prevent it pulling out. This is called a mouse. Next fasten the other end of the cord on one end of your new sash line, as Fig. 3. The lead should now be pushed carefully over the pulley wheel D, just bending the mouse to enable it to fall into the space behind. The weight of this will drag the light cord after it. Gently guide this cord over the wheel (taking care it does not get between the wheel and cheek of pulley) until you can see the lead directly behind the hole from which you took the pocket piece. Now take hold of the lead and carefully pull the rest of the cord over the wheel: this will pull the sash line after it, and when you attempt to pull the sash line through the pulley you will at once see the advantage of tying the thin cord on the sash line, as sketch: for the harder you pull the smaller the end E becomes, and the turn at F prevents it slipping off. If you have any trouble in getting the sash line over the pulley (providing it is not too large), you must guide it over, letting someone pull the mouse at the bottom. Pull sufficient of the sash line through to enable you to pass the mouse through the hole at the top of the weight, and pull the sash line after it. When the sash line is through the hole in the weight, take off the mouse and tie a knot in the end. Now insert the same end back in the hole at side of weight, and hold the weight by the cord with one hand, and hammer the knot in the side hole. This method prevents the end of the cord sticking out from the side of the weight and catching against the sides of the frame, and preventing its running up and down freely. The weight should now be got into its place by pulling that part of the lines left standing out from the face of the pulley, pushing the parting slip aside and leading the weight into its place. Next pull the weight right tight up to the back of the pulley, stretching the line as much as possible; and whilst you hold the weight up as far as it will come by the cord, lightly drive a clout nail through the cord into the wood below the pulley, as G. This will hold the weight up for the time being, letting the rest of the cord hang loose. If you now stand the top sash upright on top of the window sill, you can at once see how long you want the line to be, and it can be cut off, taking care that you do not leave it too long. If it is too long the bottom of the weight will touch the sill before it has pulled the sash quite home, and you will have to take the sash out again to shorten the cord after the said sash is hung. This is also the reason that you stretch it as much as possible before cutting it off. Now proceed with the line for the front sash in the same manner, with the difference that when you stand the bottom sash on the sill to get the length of the cord, be sure to allow it long enough to enable the sash to come right down on the sill when it is hung. This completes the lines for one side, and you can now serve the other side in the same manner. You need not offer the sashes up again, because you have the lengths of the cords already determined. A man that is



Sash-Hanging Parts. Fig. 1.—Sash Beadings, etc. Fig. 2.—Lead flattened and then bent round Cord. Fig. 3.—Method of fastening Mouse on to End of Sash Line.

used to the work would thread the whole of the lines at once by passing the cord over one pulley and out at the hole at the bottom, and over the opposite pulley and out at the hole at the bottom, and so on, without taking off the mouse. But this sort of thing only comes with practice. Next proceed by nailing or fastening with knots the ends of the lines to the top sash, and put the sash in its place. The weight of the sash will now be hanging on the two nails G under the pulley. Pull out these nails, and your top sash will be hung. Now try it, and remedy anything that is not quite right before replacing the pocket pieces. If it is all right, put in the pocket pieces and parting beads, and follow with the bottom sash in the same way; after which put in the sash beads, and if you have not broken a square of glass it will be finished. This seems a long explanation for a little job which I could explain to you personally in a few minutes, and even now I have had to omit several little wrinkles which I would have liked to mention. But if you will read this carefully before you start you cannot fail to succeed, if not at the first attempt, for certain at the second.—E. D.

Composition for filling Pearl, etc. — ANXIOUS.—Sealing-wax dissolved in methylated spirit of wine will very well answer your purpose. Put into a strong glass-stoppered bottle as much sealing-wax as the spirit will dissolve, and add to excess, so as to get a saturated solution; do not put the stopper in until the solution is made. If you place the bottle in a basin of hot water more wax will be dissolved. Always wipe off inside of neck with a rag and fresh spirit any solution that remains after pouring, before putting stopper in. Then paint in all lines in the pearl, or ivory, or metal (for it answers also for any metal) with a brush, until quite full. When dry, rub over with a bit of cuttle-fish bone till the hard wax is level with the surface, and polish the pearl or ivory if scratched, and burnish with an agate burnisher. Then spirit off as in French polishing. If the engraving is on metal, warm the metal over a lamp as the wax dries, and leave to cool; when cold, level down with crocus and oil on a cork pad or with a piece of oily charcoal, and finish with crocus on a felt pad; rub bright with a piece of clean buff leather and whiting. For coloured filling, use red, blue, green, or other sealing-wax, according to requirements. Get the best.—J. W. H.

Turbine to drive Dynamo.—T. L. (*Peckham*). —A one-man-power Thirlmere water motor, costing about £3 3s., will drive your small dynamo to light up three 5 c. p. lamps. This could be adapted to be driven from the water supply of your house if this is constant; but you would have to make special arrangements with the water company before you could use their water for such a purpose. Write to Bailey & Co., Salford, Manchester, respecting turbine.—G. E. B.

Platinum Pin.—W. H. H. (*Huddersfield*).—Try W. Bowker & Co., electricians, Henry St., Huddersfield, or Messrs. Sunderland, Halifax Old Road, Huddersfield, and ask them to oblige you with a bit of No. 18 or No. 20 platinum wire, telling them what you want it for. It may cost you 6d. A pin of platinum is best, but you may use German silver as a makeshift, or solder a fragment of platinum foil to a brass pin.—G. E. B.

Copying Apparatus.—C. W. (*Airdrie*) asks for a practical opinion of the "Eclipse" copying apparatus. I have made a personal trial of it in the interests of C. W. and other readers of WORK, and am thus enabled to give the following description of it:—Firstly, on any fairly good hard-sized paper write or draw, with the ink supplied, any required matter or subject. Secondly, damp with a sponge any one of the six graphs (supplied with the machine), and lay your original down upon it with a slight pressure, just sufficient to expel the air and to ensure contact. Let it rest thirty seconds. Gently raise one corner and peel off the original. Thirdly, having spread the printing ink (supplied) on the slab, roll it evenly until the roller (supplied) is evenly charged; roll up the graph till it is quite black and clear. This requires no previous experience. Then lay a sheet of any paper you like down on it and gently press it either with your fingers, your palm, or the rubber (supplied). Pressure enough to secure intimate contact is sufficient, no force being necessary or advisable. The first proof is not the best; as the job gets evenly charged it prints better and better. Copies of typewriting can be thus transferred and reproduced. Each graph will give six perfect originals. They only cost 1s. each for renewals. After an original is done with, wipe it off with the solution (supplied) for thirty seconds; the negative is destroyed, and in a few minutes the graph is again ready for another original. If desired originals, written with the special ink, will last any length of time, and go down as well as if quite fresh, large numbers can be printed from one transfer if required. The ink for printing is black, and can only be distinguished from writing ink used with the ordinary pen by an expert. Ferns, leaves, grasses, etc., can be copied direct by rolling them up with the ink, and being printed in oil, they can be readily transferred from paper to mirrors, silks, calico, wood, etc., for decorative purposes. It is claimed that no special pen, no special paper, no stencil, or wet parchment sheets, no aniline dye or ordinary graph, and no preparation, are required. In one minute after the original is dry a proof can be obtained, and the requisite copies can be gone on with at once. The prices are as follows: octavo, 6½ in. by 9½ in., in box complete, with all requisites, and six graphs, £1 10s.; quarto, 9½ in. by 11¾ in., £2; foolscap, 10 in. by 15 in., £2 5s.; brief, 14 in. by 18 in., £2 10s.; 14½ in. by 22 in., £3; Messrs. Fordham & Smith, Helmet Buildings, Wormwood Street, E.C., are the sole proprietors.—J. W. H.

Ink for Graph.—CENTUMGRAPH. — For black ink for graph (which is protected by patent) I should recommend you to write to the makers of the "Eclipse" copying apparatus, Messrs. Fordham and Smith, Helmet Buildings, Wormwood Street, E.C. (see also above reply to C.W. (*Airdrie*). The "Eclipse" gives a very large number of copies in *black*, jet black, ink.—J. W. H.

Celluloid.—J. B. H. (*Barnes*).—I cannot give you particulars of the manufacture of celluloid, which, in any case, you could not make yourself without a very large expenditure and skilled assistance. If you want some, your best plan will be to write to the British Xylonite Company, 124, High Street, Homerton. They sell it at 4s. per lb. and upwards.—D. D.

Mail Cart.—A. O. (*Manchester*).—Instructions and designs have appeared in No. 30, Vol. I., of WORK, which can still be procured from the publishers. The general height of a mail cart is 2 ft. 6 in., measuring from the ground to the top rail.—W. P.

Engine Governor.—J. M. P.—J. M. P.'s experience would seem to show that, in my desire to be on the safe side, I have recommended a governor rather larger than was quite necessary. Still, if the throttle valve should stick at all, the larger size would, of course, have the advantage. I am glad J. M. P. has given the result of his experiment, and should like to know how he estimated the variation in speed permitted by his governor, trying it with work full on, and then suddenly thrown off, as when driving band comes off fly-wheel.—F. A. M.

Violin Bass Bar.—M. H. T. (*Birmingham*).—The correspondent you name did not disclose the nature of his "discovery," so therefore I am unable to give any information regarding it.—B.

Bicycle Makers.—E. G. (*Sheffield*).—The following are a few of what are generally considered the best bicycle makers, together with their addresses:

—Humber & Co., Limited; works—Beeston, Nottingham; depôt—32, Holborn Viaduct, London; Rudge & Co., Limited; works—Coventry; 23, Holborn Viaduct, London; Starley Bros., St. John's Works, Coventry; 21, Holborn Viaduct, London; Coventry Machinists' Company, Limited; works—Coventry; 15 and 16, Holborn Viaduct, London. There are other makers nearly, if not quite, equal to some of the preceding, but most probably these will be sufficient for your purpose. I have heard it often remarked that as regards design of machine, the first of the firms here mentioned cannot be surpassed. Most probably these firms will have either depôts or agents in Sheffield.—P. B. H.

Violin Making.—R. J. C. (*Deptford*).—Papers on this subject are in the Editor's possession, and only wait their turn for insertion.—B.

Detective Camera.—Yes; the lens is quite suitable for magic lantern. In your case the plates might be covered on the back with ruby paper—gummed on—and set one behind the other in the camera: the paper to be folded over the edge of the plate about the eighth of an inch; a piece of card projecting a little above the plates placed between each, and nicked on the top edge with one cut for each plate 1, 2, 3, 4, and so on. The apparatus may be enclosed in a light bag, with a sleeve contracted with elastic at two points, through which the hand could be thrust to change the exposed plate from the front to the back. The nicks on the edge of the cards, which can be easily felt with the finger tip, indicate which plate is used, the card and plate being simply lifted together from front to back after exposure. A spring at the back is required to keep the plates pushed forward to register, a thin piece of wood dividing the exposed plates from the unexposed ones. When this is reached, it is known that, providing the plates have been removed in rotation, all have been used. The number of plates is only limited by the capacity of the camera: a few or many can be worked with equal facility.—D.

Mixing Materials for and Glaze for Porcelain.—E. J. C. (*King's Cross*).—I am unable to advise as to the exact proportions of China clay and Cornish stone. I believe they vary in the hands of different makers and for different purposes. In English porcelain rather a large proportion of calcined bones is also used. The white glaze for English porcelain is said to be ⅔ felspar and ⅓ lead. For the harder kinds, felspar only or felspar and a little gypsum are used; and for the softer, something like half lead. Much has been written about china and china-making, but I am not able to give the title of a book such as E. J. C. requires.

Truck Coupling.—H. J. B. (*Cirencester*).—A very large number of automatic truck couplers have been patented, and I should advise you before taking any steps involving expense to search the patent records and assure yourself that you are not anticipated in your invention. Provision is made in most to obviate men passing between the trucks. Not knowing the character of your design I cannot advise you on this point. I do not think any of these contrivances are extensively used. If, however, you wish to bring your invention out, the best course is to get the authorities of some important railway to give you permission to make a trial of it in connection with their rolling stock, when, if perfectly successful and simple, you may find capitalists to take it up. If you send a sketch I may be able to give you an opinion as to the probability of success.—F. C.

Metal for Valves.—ALKAME.—Neither gun metal nor cast iron would be very durable. Manganese bronze or delta metal would be far superior. But you should state what you want the valves for when ordering, because each alloy is made in various grades.—J.

Metal Work Black.—T. H. (*Borough, S.E.*).—Use Judson's artists' black.—J.

Steel Lamina.—W. W. (*Torquay*).—Butterworth & Co., Marsh Street, Bristol, sell steel sheets from which you can cut your strips.—J.

Cement for fixing Iron in Wood which will resist Water.—G. H. (*Small Heath*) wishes to fix wire nails firmly in holes bored in wood with a waterproof cement. I do not know that he could have anything better than half red and half white lead thinned as far as necessary with boiled oil; or he might try dry white lead mixed with gold size to a paste; or again, indiarubber heated till it smokes and becomes viscid, mixed with half its weight of red lead, and a little powdered whiting or lime.—S. W.

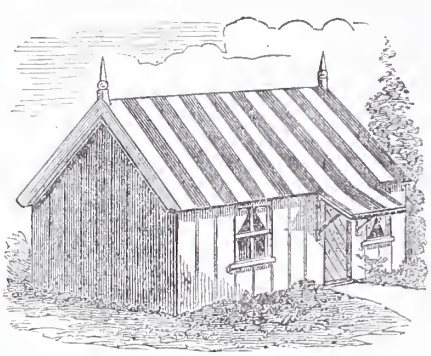
Pulping Paper.—HARRY.—As it is presumed that HARRY does not propose to set up regular pulping apparatus, he is advised to soak his scraps of paper for several days and then to pound them in a mortar. Boiling for a while before pounding will facilitate the pulping. If in pounding it is found necessary to add so much water as will make the pulp too thin, any superfluous moisture may afterwards be easily squeezed out.—S. W.

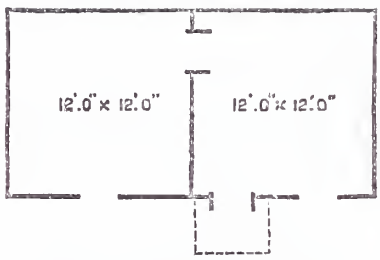
Guards for Electric Lamps.—W. R. P. (*Kentish Town*).—Arc lamps are enclosed in a wire netting to protect the light and the glass globe from accidental injury by birds flying against the light or substances thrown at the light. The netting also protects persons and property from injury caused by falling pieces of glass in the event of rupture to the glass globe. Large incandescent lamps are also similarly protected, for the same reason.—G. E. B.

Removing Discolorations from White Marble.—B. X. E. (*London*).—Make a strong solution of American potash, stir in powdered whiting so as to form a paste, and paint the mixture over the marble. If washed off in a few minutes it will bring with it ordinary discolorations, but deeper stains may require that the mixture should remain on for several hours. It should not remain on longer than is necessary, as the caustic potash has a tendency to injure the surface of the marble. That potash should be used which is bought as a somewhat moist powder, not that which is bought in hard lumps. There are some stains, such as those said to be caused by the urine of dogs, etc., which resist all efforts to remove them.—M. M.

Paquelin Lamp.—NED.—In Vol. I., No. 32, page 505, will be found the first mention of the Paquelin blow lamp: there is a sketch of it with direction for use; and in Vol. II., No. 57, page 78, there is a more detailed account, giving sectional drawings and full particulars of its construction.—R. A.

Wooden House.—P. I. (*Leytonstone*).—I do not think you will be able to build yourself a house of the size you name for much under £40, especially as you want it to last ten years. Before deciding what material you will cover it with, I should advise you to call at the Patent Wire-wove Waterproof Roofing Co., Limited, 108, Queen Victoria Street, London, E.C., and I have no doubt they will give you some useful information. It is claimed for this material that it resists sun, and is not one quarter so heavy as galvanised iron, both of which





Wooden House: Design and Plan.

are great considerations in your case. As regards construction, whatever covering you use, I should not be persuaded to use any timber under the scantlings given below:—

Ridge-board ..	..	1½ in.	by 7 in.
Rafters ..	..	2¼ ,,	4 ,,
Plates ..	..	4 ,,	3 ,,
Posts (door and corner)		4 ,,	3 ,,
Uprights ..	..	2 ,,	4 ,,
Sills ..	..	4 ,,	3 ,,
Sleepers ..	..	6 ,,	4 ,,
Piles, if necessary ..		6 ,,	6 ,,

If possible, bed the sleepers on concrete or brick foundations, keeping the floor of house at least 12 in. above the ground. I send you a little sketch of one of the above Company's houses, showing the material used both for roof and sides. I am glad you are pleased with WORK, and hope you will show your appreciation by trying to circulate it in your new home.—E. D.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—MICROPHONE; E. P. (*Stroud*); NEMO; F. J. B. (*Bristol*); SCULPTOR; MUSICUS; BURNT ONE; C. W. (*Kilburn*); E. P. (*Hackney*); C. H. (*Bloomsbury*); W. H. S. (*Crieff*); A. M. (*Frome*); W. H. T. (*South Hackney*); W. R. S. (*Brixton*); A. S. (*London, W.*); W. B. (*Whitfield*); J. S. (*Deptford*); J. P. (*Wolverhampton*); W. S. (*Ipswich*); J. G. W. (*London, N.*); D. S. (*Aberdeen*); C. F. L. (*Bradford*); A. R. B. (*Dublin*); J. S. W. (*Macclesfield*); TIMA; R. E. H. (*North Wales*); R. A. D. (*Forest Hill*); G. D. P. (*Aberdeen*); F. J. D. (*York*); T. G. (*London, S.W.*); A. S. (*London, N.*); B. (*Ascot*); A. J. W. (*Essex*); F. H. (*London, S.E.*); W. M. (*Oldham*); J. B. (*Sunderland*); D. R. (*London*); T. P. (*Woolwich*); COUNTRYMAN; A. R. (*Newry*); J. E. B. (*Dalston*); URGENT; R. A. C. (*London, E.C.*); F. C. (*Ulverston*); T. H. (*Tooting, S.W.*); G. F. W. (*Birmingham*); G. B. (*London, N.W.*); B. J. (*South Wales*); J. T. (*Hull*); F. J. (*Ireland*); G. T. H. (*Poplar*); A. G. A. (*Sand Pits*); C. B. (*Islington*); D. B. (*Glasgow*); J. T. (*Bedford*); H. G. (*Stoke-on-Trent*); PRENTICE BLACKSMITH; DICK; J. L. (*Manchester*); J. R. D.; P. B. (*Stromness*); TRAMCAR; A. B. (*Suffolk*); SPAR; TRIPOD; F. C. (*Cardiff*); R. H. (*Bradford*); CONSTANT READER; G. H. (*Paddington*); W. T. H. (*Redhill*); T. H. (*Wandsworth*); W. R. O. (*Llandudno*); J. K. (*Bethnal Green*); INDEX; PAINTER; VICTOR CYCLE CO.; J. R. (*Edinburgh*); J. S. B. (*Plymouth*); H. J. T. (*West Ham*); A. S. (*London, S.W.*); R. F. (*Hamilton*).

"WORK" EXHIBITION.

(1890–91).

For Classification, Prize List, etc., see WORK No. 70.

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in page 290 (No. 70) of this Magazine:—

For Design for Medal.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

For Design for Certificate.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

If any Competitors wish to submit a Model in Clay, Plaster, Wax, etc., as a Design for Medal instead of a Drawing, they are at liberty to do so.

Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

Prize Competition.
Medal (or Certificate, as the case may be.)

A Motto must be affixed to each Drawing, and the name and address of the sender enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted to three competent judges, who will select those that are considered most worthy of prizes.

The Prize Drawings will become the property of Messrs. CASSELL & COMPANY, Limited, who will return all Designs made by unsuccessful competitors to their respective owners carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced in WORK in due course.

For further particulars, all intending competitors should apply to the Secretary, "WORK" Exhibition, CASSELL & COMPANY, Limited, as above.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, ,, ...	3s. 3d.
12 months, ,, ...	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

Fretwork, Carving and Repoussé Work.—Catalogue of all requisites, 700 illustrations, 6d. each—HARGER BROS., Settle, Yorks. [13 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [14 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [1 S

Splendid Safety Bicycle for disposal; brand new; perfect condition; this year's make; ball bearings; usual parts beautifully plated. Must sell; cash wanted. Cannot fail to give satisfaction. Sacrifice for £6 to immediate buyer. Rare bargain.—CYCLIST, 34, Hill St., Ipswich. [2 S

Designs.—100 Fretwork (speciality), 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Rd., Bournemouth. [3S

Grandfather Clock.—Works; no case; complete except weights. Brass face; fair going order, 30s.—KING, 248, Goldhawk Road, London, W. [4 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, ***EAST DEREHAM, NORFOLK.***

Kindly mention this paper when ordering.

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.

SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

PRICE. TALBOT & CO., LIMITED,

LATE DALE & Co.,

26, LUDGATE HILL, LONDON, E.C.

Cloth, *3s. 6d.*

The Art of Cooking by Gas.

By MARIE JENNY SUGG.

Illustrated.

CASSELL & COMPANY, Limited, *Ludgate Hill, London.*

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises**, etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

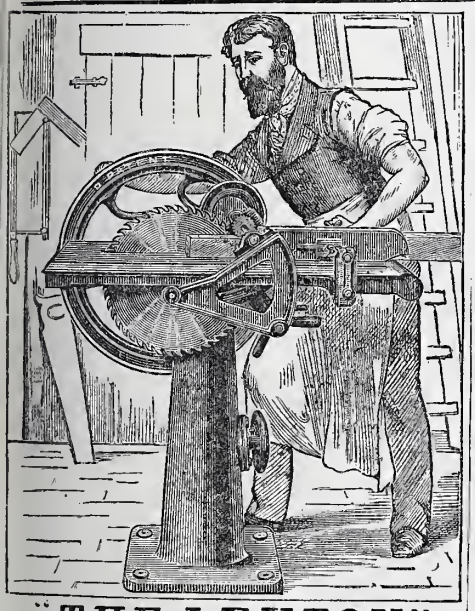
One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.



"THE LEYTON"

New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood inches thick with ease

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

TOOLS TOOLS
MOSELEY & SON
323 HIGH HOLBORN
200 PAGE CATALOGUE
BY POST 6P
ORDERS OF 10/- CARRIAGE PAID

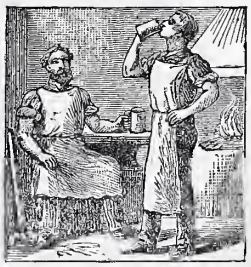
New Books for the Season, 1890-91.

A List of MESSRS. CASSELL & COMPANY'S *forthcoming Volumes will be sent post free on application to*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

SAVED! The following Photo.'s illustrate once again the Marvellous Effect produced by

MELLIN'S FOOD

WILLIAM GALLANT. Age 12 Months. Weight 9 lbs.

And indicate the value of a proper Natural Substitute for Mother's Milk.

Letters from Mrs. ROBERTSON, Gloster House, Harders Road, Peckham, London, and the Rev. WALTER SCOTT, Peckham, London, which may be seen at the Marlboro' Works, verify the above.

WILLIAM GALLANT. Age 18 Months. Weight 18 lbs.

Samples, Pamphlet, and Prospectus Post Free on Application to

G. MELLIN, Marlboro' Works, PECKHAM, S.E.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

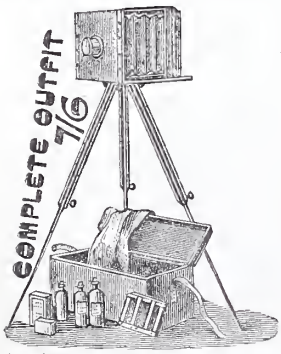
Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

AMATEUR PHOTOGRAPHY.—**J. H. SKINNER & CO.,** *W Department, East Dereham, Norfolk.*



J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description.

CHEAP SETS FOR BEGINNERS.

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6

Including Polished Mahogany Camera, with Folding Tail-board, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at **20 per cent. to 50 per cent. discount** to clear. Send post card for Sale List.

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic **WEAKNESS** speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place).

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 78.] SATURDAY, SEPTEMBER 13, 1890. [PRICE ONE PENNY.

AN ARMCHAIR: HOW TO MAKE THE FRAME AND UPHOLSTER IT.

BY DAVID ADAMSON.

THE FRAME: ITS CONSTRUCTION AND DIMENSIONS.

THE "great chairs of ease" to which Shakespeare alludes in his *Timon of Athens* are as popular at the present time in civilised—or shall I say luxurious?—communities as ever they were. Not that it must be supposed they bore the slightest resemblance to what we now regard as easy chairs, for it must not be forgotten that upholstery as we understand it is quite of recent invention, and was not dreamt of in the days of Queen Elizabeth. Even then there was a rude attempt at upholstery, but the probability is that Shakespeare had in his mind more what we should call an armchair than a lounge or easy chair. No doubt, if we could see those which he calls chairs of ease, we should consider them anything but easy. In all likelihood they were with wooden seats and high straight backs, such as are typical of the period. The chair about to be described may not inaptly be regarded as a modern rendering of these uncomfortable and stately seats. Although it may be upholstered with springs if we will, it is not to be regarded as an easy chair in the ordinary sense of the word. It is neither low enough in the seat, nor has it the high back to entitle it to that name. Nevertheless, it is a comfortable chair, and those who dislike the low puffy "easy," with its yielding springs and large low seat, may cavil at the objections urged against this designation. To them I only say it is not what in this country and age would be recognised as an easy chair. It is an armchair, certainly, wherein "portliness and pomp may sit enthroned" and enjoy all necessary comfort without being suspected of indulging in superfluous luxury. For an ordinary drawing-room such a chair would be out of place, with its straight lines and general appearance of rigidity and massiveness; but in the dining-room, at the head of the table, these very qualities recommend it. In the smoke-room this seems naturally to follow the dining-room use: such a chair is not to be despised by those who like to blow a cloud; while in the library or study what can be more appropriate? There is nothing frivolous about it, nothing paltry. It seems the sort of seat one would choose to sit in to peruse a classic author or a ponderous theological discourse, and when tired of the weighty thoughts aroused, its back invites to contemplation with the eyes shut.

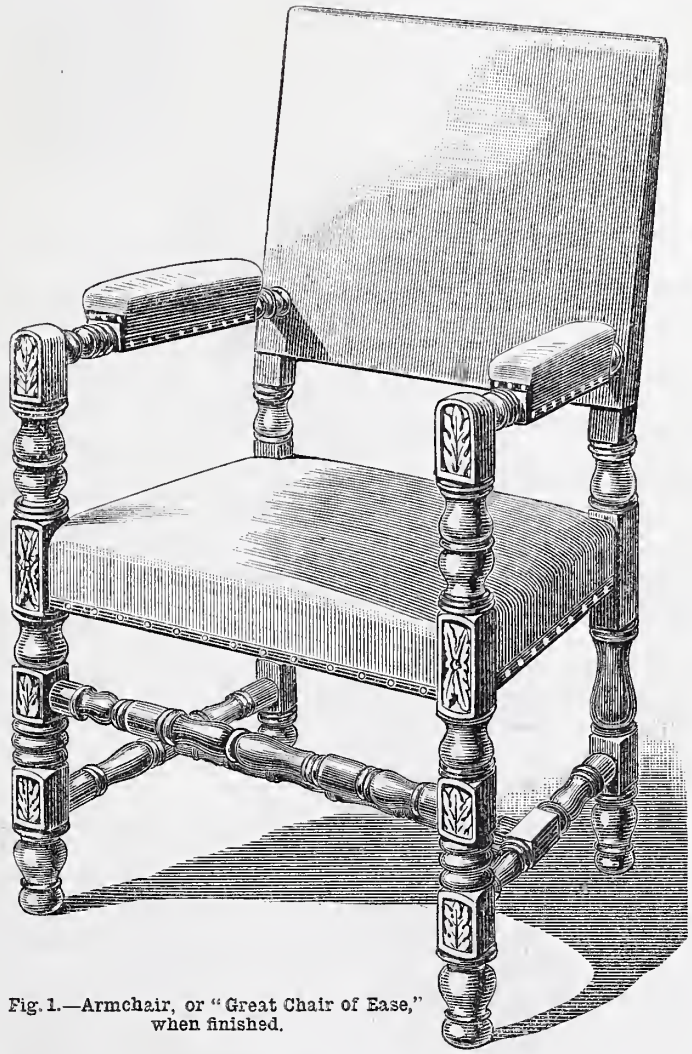


Fig. 1.—Armchair, or "Great Chair of Ease," when finished.

Who, however, would think of reading a "shilling startler" in it. No; the man who owns and habitually sits in such a chair could never be suspected of any weakness for light literature or anything of that kind. Nor could Clericus choose a more suitable chair when wishing to write a sermon of more than usually soporific tendency. Oh, don't fear, good readers, that I am sitting in such a chair while I write, although I am a bit prosy and long winded. But (it is hoped the explanation will be deemed sufficient) I am sitting in a transmogrified church chair, and associations will cling to old furniture, you know, etc. etc. Writers on art tell us we are all influenced by our surroundings, so, gentle reader, for any prolixity blame the chair, not the writer, who is particularly susceptible to the "aura" emanating from old furniture.

I almost feel inclined to say that our subject, the great chair of ease, naturally divides itself into three parts, though, as a matter of fact, it does not, unless we look on the woodwork, the upholstery, and the polishing as three separate branches, each of which, moreover, is capable of sub-division to an almost unlimited extent.

After all, I do not know that we can do better than adhere to these heads for consideration, for in the ordinary course of work the frame-maker, the upholsterer, and the polisher all have a hand in making the completed chair. For our present purpose it will, however, be more convenient to presume that the work of these three craftsmen is to be put in operation by one individual, who may also combine in his own person the draughtsman, the turner, the carver, and the—no not the needlewoman, for he had better get the sewing done by some adept in working the pricking steel.

Before going any farther, let me give a few hints to this individual in his multiple capacity when making any chair.

First of all, the sizes must be well considered. I do not refer so much now to the substance of the wood—though this is important to a certain extent—as to height of back and seat, size of the latter, and similar points. The dimensions given are generally suitable, but there is no reason whatever why they should not be modified to suit the user. The novice must, however, be reminded that an inch or two make all the difference, especially in the height of the seat from the ground. This is given as about 18 in., or the height of an ordinary dining-room chair.

When sizes have been determined, the next thing is to make careful full-sized drawings of all parts, and moulds or templates of the rails, in order that the right degree at which to bevel them off at the

ends may be ascertained and marked off on the wood with accuracy.

These may seem trivial matters to mention, but it must not be forgotten that the intention is to show novices in chair-making—skilful wood workers, perhaps, but not accustomed to chair work—how to proceed. This, I trust, will be done in the following remarks; and in making them, I shall assume that I am not addressing complete tyros either in joinery, upholstery, or polishing. It will, for instance, be presumed that the worker knows how to plane and clean up wood, how to turn it, carve it, and so on, as well as to make ordinary joints.

This will reduce the amount of labour very considerably. The drawings, of course, will not look so nice, but appearance need not be of the first consideration in a working drawing, and I fancy few employers would appreciate time spent merely on ornamental details on such. Decorative treatment is not necessary; and if a working drawing is comprehensive enough to enable the worker to construct from it, that is all that can reasonably be required from it. The plan of the seat has been referred to, and it is most important that this should be carefully prepared.

In practice it would, no doubt, generally

possible to scale, but to prevent any mistake the principal dimensions are given in inches. From these it will be seen that the chair is a fairly large one, so that when necessary similar chairs may be made considerably smaller. I am not, however, so much describing how any chair may be made as this particular one whose dimensions are given, so that, for the present at any rate, alterations must be at the discretion of the reader, unless—happy thought—he cares to have an opinion in "Shop" before cutting up the stuff, or setting out a chair to other measurements. This may be an assistance to some, though proportions

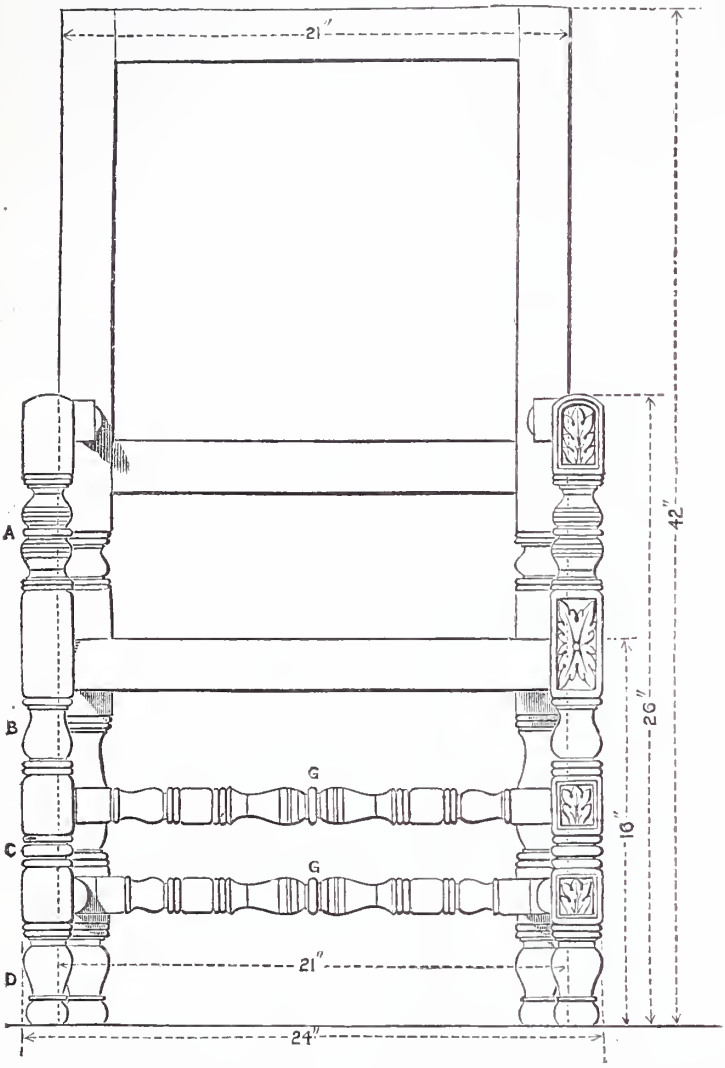


Fig. 2.—Front Elevation.

Fig. 5.—Joint in Back Legs.

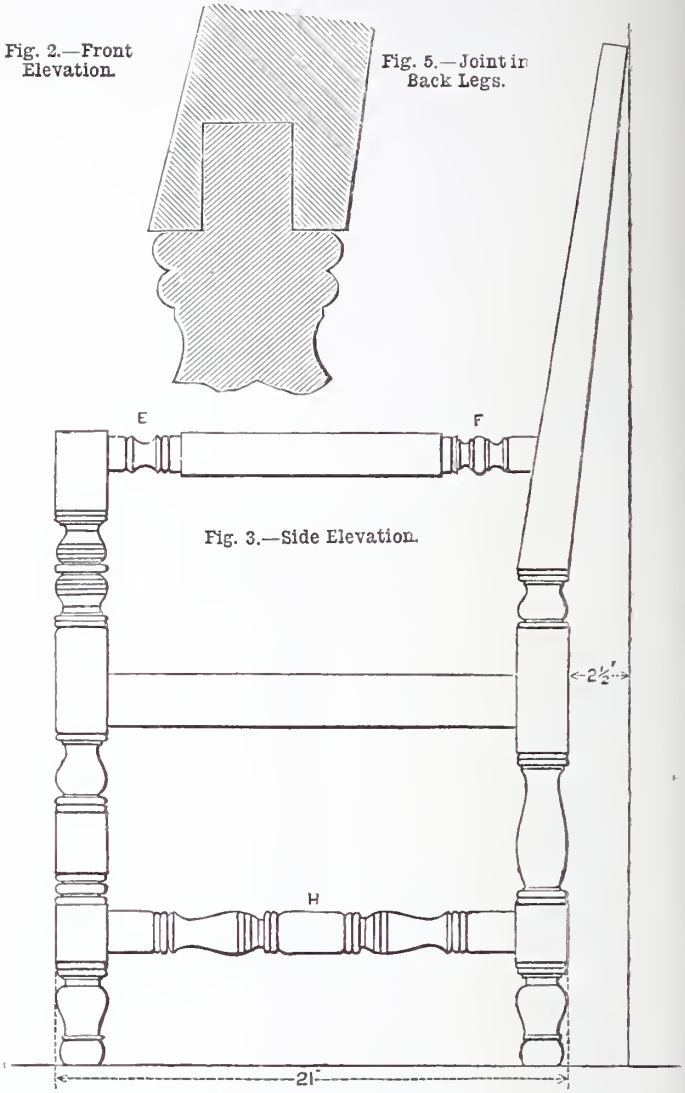


Fig. 3.—Side Elevation.

It may as well be said that this chair is a very suitable one for the novice to construct, as it presents few of the difficulties which those unaccustomed to frame-making might be apt to meet with. Its construction is of the simplest; there are no curves to perplex him, and with a very small amount of care he cannot help making a successful job of it. With the illustration (Fig. 1) showing the completed chair to guide them, many chair-makers would dispense with any drawing, except a plan of the seat, but it will be better to make as well one each of the front and side elevation, as Figs. 2 and 3, but, of course, in full size. To simplify them as much as possible, the turning need not be shown *in extenso*, as it will be quite sufficient to draw each part of the pattern once and refer to it by letter or number wherever it is repeated.

be sufficient to set out the side rails, as, with the elevations, it would be easy to make the chair; but to prevent any misunderstanding, the diagrams are given in full, even at the risk of seeming to experts superfluous. To prevent any mistake which might possibly be made about these drawings, it may be said that the upholstery is not shown. They refer to the frame only—as the whole of the wooden or structural part on which the upholstery is afterwards laid is technically called. Well, reverting to the plan of the seat—which, by-the-bye, is Fig. 4—it will be seen that the ends of the side rails are bevelled off, and without dilating on them at present, let it be said that the ends of the arms and the rails connecting the back and front legs are at exactly the same angle.

The drawings are made as nearly as

of chairs are a good deal a matter of opinion and fashion.

With the exception of the seat rails, all the wood is 2 in. square "down," *i.e.*, when cleaned and finished off. The natural wood for such a chair as this is oak, but walnut or any other may be used, if preferred. For the seat rails and those in the back, as they are covered over, beech may be used with economy. It does not, however, much matter what the wood for these parts is, but a soft one such as pine is not to be recommended, it not being strong enough to hold the tacks safely.

The back legs, by which is understood the upright parts above the seat as well as below it, are the only pieces which may present a difficulty, owing to the slight rake. This is necessary not only for comfort, but for appearance. Owing to the

length of these pieces, it is extremely unlikely that the amateur, at any rate, will have a lathe long enough to turn them in, so a construction which will allow of this being managed must be contrived, and with ordinary care it will be found quite as serviceable as, and not to be recognised by its appearance from, the method which would be perhaps adopted and advocated were the chairs to be made in quantities, or in a workshop provided with every requisite for chair-making. The plan I would recommend is simply to make each back leg in two parts: one to include the whole of the turned portion, and the other the square above it. The former should finish off with a good stout pin, say not less than 1 in. thick, and a couple of inches long. This, of course, will fit into a corresponding hole in the other piece, which by being cut on the bevel can be made to assume any reasonable amount of slope. Fig. 5 shows this mode of fitting on an enlarged and also somewhat exaggerated scale so far as the slope is concerned, in order that it may be clearly seen that the turned portion is perpendicular, and that the spring only begins at the square part above it. This joint may be regarded as a source of weakness, and I can almost imagine some of my readers shaking their heads with horror at the bare suggestion of it, perhaps contemplating indignant letters to the editor — aye, or possibly even sending them. Well, do so: it will be good for the revenue of the P.O.; but even at the risk of this not being benefited, let me say that a chair made in this way—a chair, in fact, from which this description is written—has been in constant use for the last ten years, and that its general occupant is a man of some eighteen stone weight. It is, therefore, quite strong enough for light and sylph-like creatures up to that, but others who are really ponderous should be careful. The back might give way under the severe strain of, say, twenty-five stone, but on the whole I think it may be considered reasonably strong, which is all that is required.

The square part of the back legs is further tapered from 2 in. at the bottom to about 1¼ in. at the top, the taper being clearly indicated in Fig. 3.

Now, those who do not care, notwithstanding what has been said, to form each back leg of two pieces joined end-ways, may adopt another method, and make them without the necessity of having the pin joint, which, in theory at any rate, is objectionable. Two pieces will, however, still be required. Fig. 6 shows this alternative form of construction, where the continuation of the lower part of the leg is shown by the dotted lines. The front of this, after the turning has been done, is tapered off, and behind it another piece of equal width is firmly fixed with glue and screw nails. As this second piece is, to a certain extent, fitted with its end grain against the other, in order to render the glue as effective as possible, the grain should be stopped by sizing it with thin glue before making the joint, the size, of course, being allowed to dry. Three or four screws should then be quite sufficient to make the back legs as substantial as if they were formed from one piece of wood.

If any reader wishes to make a quantity of these chairs, or at any rate, chairs of a similar construction, as a matter of business, and desires to avoid the necessity for any jointing, the best way will be to set the back legs out on 2 in. stuff, and get as many as are required cut at a saw-mill. To turn the legs in the lathe, screw temporarily a piece on the sloping front. As all the legs will be the same size, one piece, of course, will do for the lot.

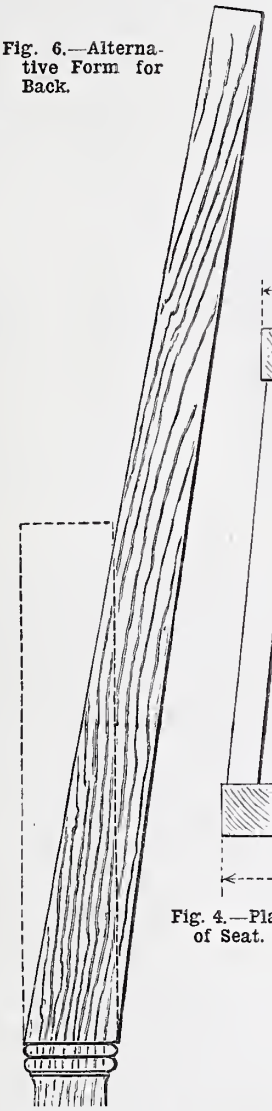


Fig. 6.—Alternative Form for Back.

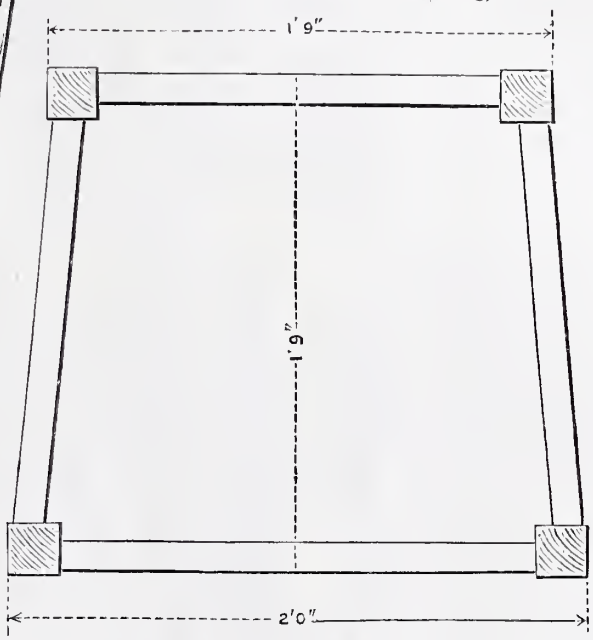


Fig. 4.—Plan of Seat.

SIGNALLING IN COMPASS STEERING.

BY J. C. KING.

Mr. Frank M. Purinton, of Providence Island, New Jersey, has perfected a system and code of fog-whistles which may be aptly termed "Compass signals," as any point of the compass may be indicated and understood in an instant by anyone who has had one or two readings of the code. Exchange of signals from ship to ship will at once convey the exact compass-point they are steering to—thus a possible collision may be prevented. The same from a lifeboat station, lighthouse, or any place near enough to be heard.

The system may be described in so few words that it claims notice for its simplicity, and for its obvious service to imperilled humanity exposed to the dangers of the deep in storms, at night, or in fogs.

For steering north, by a ship, one long whistle is sounded; for south, a short whistle; for the west, two short whistles; for the east, two long whistles. Here are four points of the compass so simple to learn, that no one can mistake them. The long signals are of three seconds duration, and the short signals of one second duration. A compass chart, if marked with a long dash to N., and a short dash to S., two short dashes to W., and two long dashes to E., gives to the vision the simple text of this code comprehensible by any one.

Now for other bearing points of the compass. The code is built up on these four short and long sounds. To signal N.E., the signals of N. and E. are both sounded, producing three long sounds or whistles marked on the index compass chart by three long dashes; S.W., three short whistles, by three short dashes; N.W., a long whistle and two short ones, or a long dash and two short ones; S.E., a short whistle and two long ones, *i.e.*, a short dash and two long ones on compass chart.

Thus eight points of the compass are marked, the long and short signals meaning always opposite directions. The composite signals of long and short make their identity obvious, N. and E. combinations being all long, and S. and E. combinations all made up of short and long signals. The S.W. are made up of short signals. The N.W. are made up of long and short combination signals.

In working the code, the general course of the vessel is first announced, and, after a pause, the special direction told by the whistle. Of course, so simple a system admits of visual as well as oral application, by night or day; by lights or flags visible at intervals corresponding to the length of the whistle sounds and interpauses.

BURNISHING AND BURNISHERS.

BY G. EDWINSON BONNEY.

Burnishing.—An electro-deposited coat of silver of moderate thickness always presents a dead white surface as it leaves the plating solution, unless this has been made to deposit bright silver by using a brightening solution. This surface is entirely devoid of lustre, and appears, when viewed through a powerful magnifying-glass, to be made up of a fine network of silver grains cemented together. In this condition they absorb the light, and cause the deposit to assume a dull surface, designated "matt" silver. It closely resembles frosted silver, and has a pleasing appearance when freshly deposited, rinsed in clean hot water, and quickly dried in a room free from dust. When this "matt" surface is scratch-brushed, it loses, to a certain extent, its peculiar dead whiteness, but no amount of scratch-brushing and polishing will give it the beautiful mirror-like surface so much admired and desired in silver plate. To get a highly polished, reflecting surface on electro-plated goods, they are subjected to a process known as burnishing, after they have been well washed, scratch-brushed, and dried. In factories where a trade is done in electro-plating, the process of burnishing is regarded as a distinct branch, and the work

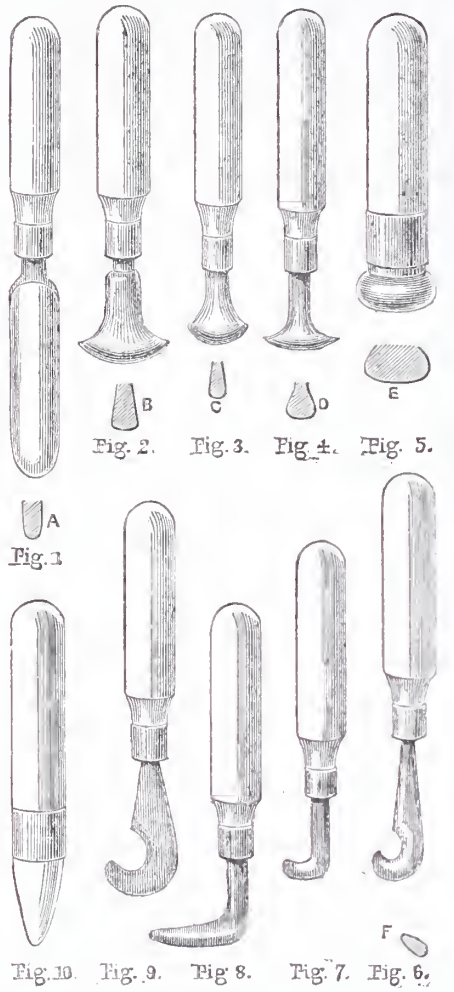
is done by females, who finish the goods after they leave the hands of the electro-plater.

As amateur electro-platers, and workmen in a small way of business, cannot employ a finisher, but have to finish the goods themselves, a few words on burnishing will be acceptable to them. It is most important that the work to be burnished should be properly prepared for plating, as on the perfection of its preparation will depend to a great extent the perfection of the finished surface when burnished. In the first place, all scratches, lines, indentations, and corroded pits must be removed by filing, rubbing down with water of Ayr stone, polishing, and burnishing, before the article is pickled and quicked with mercury preparatory to being placed in the plating vat. The slight roughness imparted to the surface by the action of the acid pickle is not in any way detrimental, but should a stain be left on the brass or German silver surface, or should the operator leave his finger-marks thereon, these will be distinctly traceable in the surface of the finished article if the spot does not strip under the burnisher. The utmost cleanness must be observed in the preparation of the articles to be burnished, and care must be taken to put the quicking coat of mercury on evenly, or the silver will be apt to strip from slightly soiled spots, as also from those where thick blotches of mercury have been left on the surface. Articles made of pewter, Britannia metal, and similar soft alloys, are usually difficult to burnish, because they are softer than the overlying coat of silver, but they are made worse by lack of care in their preparation. Such goods as these should be transferred at once from a clean potash dip to the plating solution (after being properly cleaned and prepared) without any intervening rinsing, because such alloys are readily tarnished when exposed to the air whilst wet. Potash dissolves the tarnish on such metals.

Silver will strip under the burnisher when it is deposited too fast or too slow, since its hardness is greatly affected by its rate of deposition. The plater should, therefore, find out by trial the best rate at which to deposit a coat for burnishing on the several metals, or alloys likely to be employed. Silver will also strip when a plating bath has been made up by dissolving chloride of silver in a solution of cyanide of potassium, or when chloride of silver has been used in building or faking up a plating solution. A similar result will follow on the use of too much brightening solution in the plating bath. Plating solutions thus ruined should be set aside for the most common work, and allowed to work out, then treated for recovery of silver.

When the requisite amount of silver has been deposited on the article to be burnished, detach it from the battery or machine, and swill to and fro in the plating solution for a few moments to dissolve off any sub-cyanide of silver adhering to the deposit, which, if left on, might discolour the pure white coat on exposure to daylight. Next rinse in clean hot water to remove all traces of the plating solution, and dry off quickly in hot boxwood sawdust. This sawdust is obtainable from boxwood block makers and engravers on wood, and it should be perfectly clean, else it will soil the silver. For the same reason the dust of other woods is unsuitable, because in all, or nearly all, except box, there is found some trace of acetic or of tannic acid, or of some resinous substance. The dust is best made and kept hot over a water bath or in a steam heated chamber, to prevent charring of its particles.

After the articles have been dried, they are next scratch-brushed, or else scoured with very fine sand in soap-suds applied with a soft cotton brush, then rinsed in hot water, and transferred to the burnishing bench, where they should be laid on a clean soft pad of rag, on which they will be held whilst being burnished. If now the operator attempted to burnish them whilst surface and burnisher are dry, the tool would heat and drag off the silver in the form of fine dust. A lubricant is, therefore, essential, and this is effectually furnished by weak



Figs. 1-10.—Some Forms of Burnishers used in finishing Electro-Plated Surfaces. Reference Letters show Sections of the Blades.

linseed tea, or a decoction of marsh mallows will do equally well, as both these are of a slippery nature, and are harmless when applied to silver. Soap-suds are used by some persons, and these form a fair substitute when freshly made, but they should never be set aside for use a second time, as they are apt to undergo changes whilst standing exposed to the air, which result in the formation of acids injurious to the silver coating.

The burnisher must first be polished to a dead black lustre, by rubbing its edge or face briskly along a groove worn in a polishing buff charged with jeweller's rouge. A thin burnisher is first selected to ground the work, and this is afterwards gone over with one having a broader surface, finally finishing off with a broad bloodstone burnisher. The tool is held in the right hand, the lower part of the handle resting on the outside of the little finger, and the upper part resting against the inside of the three other fingers, with the ball of the thumb on the top of the handle. In this position great pressure can be brought to bear upon the tool, if required.

The strokes of the burnisher should always be given in one direction, since cross strokes will spoil the appearance of the burnished surface. Each stroke must be applied with some pressure, and the burnisher must be kept supplied freely with the lubricant, to prevent heating. Each succeeding stroke should slightly overlap that of its predecessor, so as to leave no unburnished metal between the strokes, and a clear, mirror-like surface behind. As the surface or the edge of the burnisher gets dull by use, polish it up on a polishing pad, made for the purpose out of buff hide (such as soldiers' belts are made from), mounted on a piece of wood like a large razor strop, and charged with rouge or with the finest putty powder. Very pleasing effects on ornamental goods are sometimes obtained by burnishing certain parts, such as bands and raised parts, whilst others are left matt. Gold-plated articles are treated in a similar manner to those of silver, but it is not usual to burnish nickel, since this metal is somewhat hard and intractable under the burnisher. When articles have been burnished, the finishing polish is put on by hand with soft rags charged with a suitable plate powder, or on a dolly of soft linen revolving in a lathe. Some of the forms of burnishers used in this process are described and shown in the following paragraph.

Burnishers. — Silver-plated and gold-plated articles have a finished lustre imparted to their surfaces by tools named burnishers. In their least expensive form, these are made of steel blades varying in form, and fixed in wooden handles by a tang running into the wood. Straight burnishers, shaped as shown at Fig. 1, and in section at Fig. 1 A, are used for burnishing stems of spoons and forks, and plane surfaces generally. Curved burnishers, such as those shown at Figs. 2 to 6, and in section at B, C, D, E, and F, are used for burnishing the insides of the bowls of spoons and for hollow curves. Burnishers made of chips of agate, and of bloodstone or hæmatite, set in brass ferrules and mounted on wood, are more costly than those made of steel, and they also impart to the goods a more finished surface. Some of the forms in everyday use are shown at Figs. 5 and 10.

Burning the Work.—When the current of electricity supplied to a plating bath is too strong, the solution deposits its metal in the form of a dirty grey loose powder, or a coat having the appearance of pewter. This is named in the trade "burning the work." When gold is deposited under similar conditions, the deposit may vary in appearance between a loose brown powder to a foxy red, and from this to a dark bronze, resembling in colour that of a dirty penny. Brown deposits of gold may be improved by a judicious use of colouring mixtures, but those of a foxy red and bronze tint are usually intractable, and the workman will find that they can only be restored by freshly cleaning and re-gilding the article. As "burning" is caused by too great a density of current delivered at a high E.M.F., it may be avoided by using a resistance board in circuit with the vat, and throwing in sufficient resistance to stop back the excess volume of current.

SHEET METAL WORK.

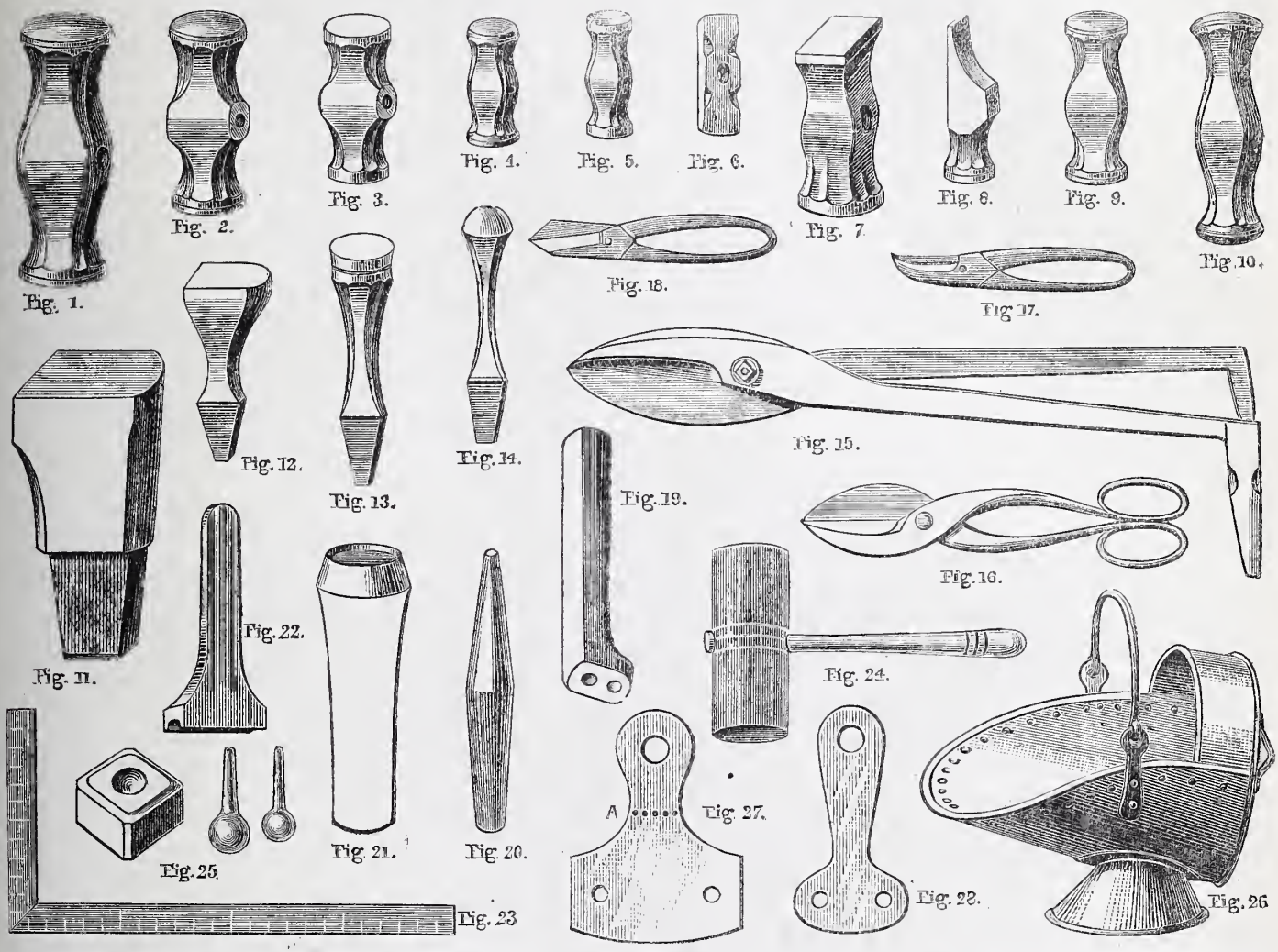
BY R. ALEXANDER.

DESCRIPTION OF TOOLS:—HAND TOOLS, HAMMERS, GRAVERS, RIVET SETS, PUNCHES, ETC.—PRICES OF TOOLS—REPAIRING.

RESUMING the subject of tools, Figs. 1 to 10 show the various kinds of hammers in use. Fig. 11 is the tinman's anvil, very different, you observe, from the blacksmith's tool of the same name: it is steel-faced, highly polished, and perfectly flat; it is usually fixed in a block, but sometimes a large hole is cut for it in the bench; on this tool is done the planishing of plain surfaces in tin, brass, or copper. Fig. 12 is the anvil stake—a similar tool, but smaller. Fig. 13 is a round bottom stake, useful for rivetting patches on bottoms of stewpans and many other purposes. Two or three sizes are required. Fig. 14 is a pepper- or flour-box and teapot-top head. Fig. 15, the stock shears for cutting out new work in quantities. Fig. 16, Scotch shears, used mostly for sheet-iron work. Fig. 17 is the bent snips used for cutting out kettle tops, etc. Fig. 18, straight snips. Fig. 19 is a rivet set. Three or four of these are required for the various sized rivets. There are about sixteen sizes made, but there is no need to have one for every size rivet. I have but five myself, and manage very well. Figs. 20 and 21 are solid and hollow punches. The solid punches run from $\frac{1}{16}$ in. to $\frac{7}{16}$ in., in about ten sizes, and the hollow from $\frac{3}{8}$ in. to $2\frac{1}{2}$ in. Fig. 22 is a groove punch, or groover, as most people call it: it is for laying the seams of articles together. Fig. 23 is the tinman's square for marking out, squaring-up sheet, etc.: it is figured on both sides. It is made in three sizes: 18 in. × 12 in., 24 in. × 12 in., and 24 in. × 18 in. The 24 in. × 12 in., known to the craft as the "two-foot square," is the one mostly used. Fig. 24 shows the tinman's mallet: this is, or should be, made in boxwood in several sizes, from 2 in. to 3 in. in diameter. $2\frac{1}{4}$ in. and $2\frac{3}{4}$ in. are very useful sizes, the small one for light work, and the heavier one for strong stuff and stove-pipe work. There will also be required cold chisels, cutting pliers, round-nosed ditto, and other sundries, which will be mentioned as required. Although I have mentioned a great many machines and tools, the number is not yet exhausted, and some will probably be described in the more advanced stages of these papers.

Prices.—I have already given the prices of the machines; and the stakes, hand tools, hammers, etc., are sold by weight as follows:

		s.	d.
Anvils,	per lb.	1	4
Anvil stakes,	,,	1	3
Bick-irons, wrought iron		1	1
,,	over 20 lbs. weight	1	0
,,	cast iron	0	4½
Crease-irons,	per lb.	1	5
Extinguisher stakes,	,,	1	3
Funnel stakes,	,,	1	0
,,	cast iron, ,,	0	4½
Tea-kettle heads,	,,	1	6
Pepper- or flour-box ditto,	,,	1	5
Half-moon stakes,	,,	0	11
Hatchet stakes,	,,	0	11
Block hammers,	,,	1	5
Hollowing hammers,	,,	1	2
Planishing hammers	,,	1	6
Rnd. and square-faced do.	,,	2	6
Paning hammers, each		1	8
Creasing ,,	,,	1	9



Figs. 1, 2.—Block Hammers. Fig. 3.—Planishing Hammer. Fig. 4.—Convex Hammer. Fig. 5.—Concave Hammer. Fig. 6.—Creasing Hammer. Fig. 7.—Square-faced Hammer. Fig. 8.—Rivetting Hammer. Fig. 9.—Block Hammer. Fig. 10.—Hollowing Hammer. Fig. 11.—Tinman's Anvil. Fig. 12.—Anvil Stake. Fig. 13.—Round Bottom Stake. Fig. 14.—Pepper-box Head. Fig. 15.—Stock Shears. Fig. 16.—Scotch Shears. Fig. 17.—Bent Snips. Fig. 18.—Straight Snips. Fig. 19.—Rivet Set. Fig. 20.—Solid Punch. Fig. 21.—Hollow Punch. Fig. 22.—Groove Punch or Groover. Fig. 23.—Tinman's Square. Fig. 24.—Tinman's Mallet. Fig. 25.—Stud Boss and Punches. Fig. 26.—Mode of re-lining Coal Scuttle. Fig. 27.—Stamped Ear. Fig. 28.—Forged Ear.

		s.	d.
Hollow punches, per set of 13, from ¾ in. to 2 in.		35	0
Solid punches, each		0	10
Bottom stakes, per lb.		1	4
Rivet sets, each	from 1s. 9d. to	4	0
Stock shears,	per lb.	1	3
Tinman's horse,	,,	0	9
Pipe stakes, wrought iron,	,,	0	11
,, cast iron,	,,	0	4½
Side stakes, wrought iron,	,,	0	10
,, cast iron,	,,	0	4½
Stud bars and punches, per set		12	6
Scotch shears	14 in., 8s.; 17 in.,	10	6
Straight snips	10 in., 3s.; 12 in.,	4	0
Bent snips	9 in., 3s. 9d.; 10 in.,	4	0
Groove punches	from 1s. 9d. to	3	6

The reader will observe a great difference between the price of wrought-iron and cast-iron tools. Cast iron will do very well for some of the tools, if expense is an object;

but the hatchet stake, side stake, crease-iron, and bick-irons should, at any rate, be of wrought iron.

These tools must be disposed of in the handiest way possible in the workshop: the heavy stakes on the floor, somewhere out of the way, and yet where they can be conveniently got at; and the lighter ones hung on the wall between two stout nails. Punches, rivet sets, groovers, and small tools in trays on a window-ledge in front of you, where they can be easily reached and put back. Have, as far as possible, a place for everything. Keep all bright tools and hammers well greased when not in use, and keep spirits of salts and sal-ammoniac as far away from them as you can.

We will now return to our muttons, as the French say—viz., to the consideration of the saucepan that is presumed to be waiting for a new bottom to be put on it. The bottom will be cut off in a similar manner to the coffee pot, and an edge thrown off. Before throwing off the edge, a portion of the seam or seams must be cut off with a chisel, or it will be too thick to pass the wheels in the jenny. It must next be scraped for soldering. This may be done either inside or out: much depends on the state of the saucepan. For instance, it is frequently the case that a saucepan is furred and dirty on the inside, and quite bright and clean on the outside. In this case, it is best to solder outside, as the scraping required is almost *nil*, whereas the inside would want a file applied, and take much longer to get it sufficiently clean to solder. It may, however, be considered a general rule that all kitchen utensils, such as saucepans, boilers, fish-kettles, and the like, should, where practicable, be soldered inside. Having prepared the saucepan, strike out the bottom with the compasses, leaving a proper allowance for a turn-up. Turn up the bottom as previously described, slip it on, and pane down. Then put up the hatchet stake, and holding the saucepan with the body of it close to the stem of the tool, and the edge of the saucepan over the edge of the tool, go round it with the flat side of the mallet. This turns the edge a little, and prepares for the next process, which is "knocking-up." This is done as follows:—

Put up the pipe, or side stake, on the bench: let it point to the front of the bench, then turn your back to the bench so that the tool will be on your right hand as you then stand; place the article on the tool, hold it with the left hand with the fingers spread over the bottom and thumb on the body; commence to knock up the bottom with the mallet, and be careful not to hit your thumb; as you strike the blows, turn the saucepan with the hand that is holding it on the tool. This will seem rather awkward at first, but you soon get accustomed to it. Put the blows close together, and only move the article a little at a time. Turn it from you, and give the mallet a kind of drawing motion. After having been once round it with the mallet, take a hammer and go round again, giving quicker, lighter, and closer blows. Be careful to keep the bottom close to the tool, or the turn-up will be bruised and unequal. Solder round, and the job is completed. If soldered inside, use the bottoming iron, illustrated in Vol. I., page 257; but if outside, use the ordinary pointed iron. This last-mentioned method of putting on bottoms is, of course, the strongest and best of the three ways I have described; but in many cases articles are not worth the trouble, and then either of the other ways are adopted.

Many workmen put all their toilet-can bottoms on by the slipping-on method, while others will not hear of it. I always knock them up, but all this is a matter of custom, personal choice, and convenience.

I think this is all there is to be said on the subject of re-bottoming, except that water-pots, toilet cans, and boiler fillers have what are termed studs soldered on the bottoms to protect them. It is usual to put four on oval cans and three on round ones: they are punched out with a large hollow punch on a lead piece, which is a block of lead about 1½ in. thick, and from 8 in. to 12 in. square; they are then hollowed up with a small hollowing hammer, called a stud hammer, in a hollow made in the lead piece, or with a stud boss and punch (Fig. 25).

Re-lining Coal Scuttle (Fig. 26).—This is a different style of job to the previous ones, and will bring into use different tools. It is a frequent job in most shops. They generally wear out in the bottom between the foot and the back, and then require a piece of iron or zinc riveted in. This is the way to set about it: Measure the scuttle from back to the front edge, then bend a narrow strip of zinc round the inside of the body; let it come within ¼ in. of each side, just where the ears are riveted on. These two measurements are the right size to cut out the piece of stuff for the lining of the bottom: 22-gauge will be about the right thickness to use; and after cutting, bend it to the shape of the scuttle, either in the rollers or over the pipe stake. Having done this, place it in the scuttle, and with a slate pencil mark round to the shape; remove it, and cut about ¼ in. within the line: this can be done without flattening the lining: replace it, and see that it touches the back all round; if not, trim with the snips till it does. Place the scuttle and bottom on the pipe stake, have ready to hand some rivets (No. 6 or 8 will do, tinned or black), rivet set, and hammer. Hold the scuttle and bottom together, draw them a little way off the tool, and place a rivet on it; draw the scuttle on again till the rivet is ¼ in. from the edge of the lining; take the hammer, and give a tap where you think the rivet is; you will, if you hit on the rivet, see a mark appear on the outside of the scuttle; place the part of the rivet set with the hole in it just over this mark, and strike the set with the hammer: this will draw the rivet through; give a blow or two before removing the set to draw the rivet quite close to the stuff, hammer the rivet to a head, and with the "button" or countersunk side of the rivet set put the finishing touch on the rivet. Then work round the scuttle in the same way, putting one on each side alternately: not all on one side first, or the lining will "draw," and not lay close on the other side.

The rivets should be 2 in. or 2½ in. apart on the front, and 4 in. along the sides; when finished, paint with Brunswick black.

New Back and Foot to Scuttle.—It frequently is the case that the back is worn as well as the bottom. There are then two ways open of repairing it: one is to knock off the old back, take the back handle off, cut out a new back in the same way as for the bottom of a saucepan, re-rivet the back handle on, and put on the back and pane down. But the method most generally adopted is to put a piece in the back. In this case the bottom should be lined with zinc or galvanised iron, and then the back can be soldered to the lining as far as it goes. The back cannot very well be marked out on the stuff from the scuttle because of the back handle, but this is the way I get at it: cut a piece of brown paper large enough to match the back, cut out a hole for the handle to go through, place the paper on the back, and rub round the edge with the hand, holding the paper so that it will not shift: this will mark the paper sufficiently to enable you to cut it. You will see, of course, that it will be just as much too large to go in as the width of the edge of the scuttle; cut the pattern that much smaller all round, then dip it in a pail of water for a minute, and dab it on to the piece of zinc you are going to cut the back from; it will not be so likely to move then as if you simply held it with your fingers and marked it round with a scoring-awl; in this way you will not need to mark it: simply cut round quite close on the paper. It is then slipped into the scuttle and soldered round, and two rivets put in at the top part, using a bottom stake to rivet on.

New Foot.—A new foot is required when the old one has come off, and the flange is too much broke about to allow of its being riveted on again.

The old foot is generally available to flatten out and use as a pattern, which should be kept for future use; and I may here say that whenever you take the trouble to make a pattern for anything, always keep it: it is almost sure to come in again some day. These scuttle feet are generally made in two pieces: this is for economy in stuff and to use up odd pieces; but if so wished, they can be made in one piece, by marking it from the old one without taking the two pieces apart. Only one seam will then be required: this can be riveted together. Let one side lay over the other about ½ in., and put three rivets in; then throw off the edge for the wire: this may require a little explanation. We will suppose that it is a large foot being made, and for that we must use No. 11 wire. Take the compasses, and set them the size of two wires, and make a line round the foot with the compasses: this is the width of the edge to be thrown off. Put up the side stake, and holding the foot against the square edge of it, lay off a flange as far as the mark made by the compasses, using a thick pane hammer, and letting the heaviest portion of the blows go to the outside edge: this stretches the material and helps it to flow. The tyro will perhaps be surprised to find his round foot going into an oval; but do not try to alter it, as the next process will bring it back to its shape again to a great extent, and when wired it can easily be put into shape. When you have thrown the edge back as far as possible on the side stake, take the half-moon stake and finish turning the edge on that, then cut off a piece of wire long enough to make a ring the size required for the foot; place one end of it an inch or two to the right of the seam, and holding it in position with the thumb of the left hand, commence to knock the edge down over it with a mallet, using the round part of the side stake to work upon; this operation is called "wiring," though all wiring is not done in the same way. As you knock the edge down over the wire give the mallet a kind of drawing motion: this brings the stuff over the wire better; but when the fold or edge is too large, strike the blows straight down, or with a slight drawback motion: by this means any slight error of judgment can be, to some extent, corrected. Having wired it, take out the puckers by letting the wired edge rest on the square part of the stake, and going round it with a mallet, shape up, and then throw off the flange for rivetting it to the body; this will be done in the same way as described for wiring, except that it will not

want to be thrown back so far; try on the scuttle till it fits nicely. To rivet it on, the holes for the rivets must be punched, as it would be very awkward to hold the foot on and draw the rivets through the same as in the case of the lining; the holes must be made in the foot first, three each side, and then the foot placed on the scuttle, and the holes marked with a piece of slate pencil or a brass scriber (a piece of brass wire pointed with an eye the other end); be careful to put the foot the right way about when you mark it: that is, so that the mouth of the scuttle cants upwards. I have seen them put on the other way, and not noticed till the scuttle was placed on the floor, when it presented a comical appearance, you may be sure. After punching the holes in the body, put in one rivet each side first, then the remainder, and paint with Brunswick black, as before.

Fitting New Ears and Handles to Articles—This is another frequently recurring job, especially in a dairy district. There are several kinds of ears used for pails and cans. Figs. 27 and 28 show two of the most used. Fig. 27 is a stamped ear, and Fig. 28 a forged ear. The forged ear is much the strongest, and does not break so frequently as the stamped one; but the stamped, being a deal cheaper, are much used for the commoner class of pails, and always for camp kettles, yeast cans, etc. These ears frequently break across at the place indicated by the dotted line A in Fig. 27, when a new ear must be put in. The broken part of the old ear must be got off first; to do this, place the article on the pipe or side stake, and with a sharp chisel cut off that part of the rivet that is burred over the hole in the ear: hold the chisel upright for this, and the little pieces will fly off; then take a nut with a hole in it slighty larger than the head of the rivet, and place the nut on the stake and the article on the nut, so that the rivet head comes over the hole, then with a hammer and small punch knock out the old rivets. On offering the new ear against the pail, or whatever it may be, it sometimes—indeed, often—happens that the holes do not exactly correspond in position. In this case rivet through one hole, and then draw the other through where it comes. End handles of boilers, slop pail ears, etc., are done in the same way. It is often the case that after punching the old rivets out the holes are too large to make a good job by putting the new in the same holes; when this is so, a piece of tin must be soldered or riveted on, of sufficient size to well cover the holes, and the ear or handle riveted to that; it also makes a better job to solder over all rivet heads.

A SIMPLE METHOD OF ETCHING ON STEEL OR IRON.

BY R. G. NAISH.

We often see in many of the leading journals, under the heading of "Answers to Correspondents," an answer to an inquirer respecting how to etch on steel. This answer being characterised by a conglomeration of chemical formula, or a redundancy of process, must, I aver, dishearten the anxious inquirer, and result in the incapability of rendering practicable the instructions given. To overcome this difficulty is my intention, and, as far as I am able, to put in the simplest manner instructions by which almost any one may etch on steel or iron, and have good results, even in a first attempt. My method must be looked at purely from a mechanic's point of view, and not for the production of elaborate or artistic work. I can answer for my method, having used it for years with success.

The mechanic's name, for instance, on certain tools he may possess is almost indispensable. It is the only security. He may leave them in a place where only such would secure their return. Carpenters, and other similar trades who use tools with handles composed of wood, generally resort to punching their name in this soft material; but, of course, this may be easily obliterated; whereas if the name is etched in the steel blade of the tool, erasure is not so easily effected, and I doubt whether such would ever be attempted; so much trouble would be involved, and probably in the end all efforts prove futile in attaining the desired aim.

First of all you may be inclined to advance the usual interrogation, "What will it cost?" knowing that something will have to be purchased to carry out the process. Well, I don't think you will be discouraged by learning that about sixpence will supply ample materials for dozens of operations. So the process is comparatively inexpensive, considering the results obtained.

The first thing to get is one pennyworth of nitric acid from the chemist. It is very cheap. Dilute this about one half with clean water; be very careful in using it, for it will burn almost anything it is dropped on. It is well to look after the fingers in this respect.

The next thing is the "ground" to resist the corrosive action of the acid. Various grounds are often tried in the shape of soap, wax, grease, etc., but these are far from being up to the mark, and often play a trick with the article to be etched; there is no security in their use, being inadequate to the corrosive properties of the acid. Something better is needed; therefore, purchase three pennyworth of Japan black. It may be obtained at any paint stores. Have the best. It is not quantity you will want. As a ground for ordinary purposes, I don't think this black can be beaten. There is no need of altering the temper of your tool by heating it, as is the case with some grounds which require manipulating in this manner (and this is of great import to a mechanic), neither is it expensive, as a very small quantity will go a long way, and it is easily procurable.

Also get one pennyworth of spirit of turpentine to clean off the ground after the etching is completed. If turps is not handy, paraffin will answer the purpose just as well. Get a bit of sponge, and a piece of wood about the size of a camel's-hair brush—a brush handle would do—and cover the top with black. This may be employed in dropping the acid on the article to be etched, or spreading some on any particular place under the agency of capillary attraction. With all this, and a careful following out of instructions, you will rarely have to complain of failures.

Having the materials we will now proceed to business. Take a wood chisel, for instance, a tool which most workmen possess, and say you wish to etch your name on the steel blade; see that it is clean, and if not, rub a bit of fine emery cloth over it. This will soon give it a bright appearance. Now for laying on your ground. Tip the bottle containing the black, and, placing your finger to the place usually occupied by the cork, obtain a small quantity. Some may be inclined to use a brush, but I always use the finger. Now spread your black backward and forward. Endeavour to keep it as even as possible, and be on the look-out for bright streaks, which sometimes occur when a bit of grit has mingled with your black. Don't have it too thin for a start; if you did not put on enough the first time, put on some more; but you must do this quickly, for it is very rapid in drying. For first trial it is better to have it too thick than too thin; and a few trials will soon acquaint you of the right consistency.

Having done this, you place your chisel by, and let it remain for about twenty-four hours; so if you purpose doing two or three articles, you might "ground" them all at the same time. The time is not particular to an hour or two, but I take twenty-four as an average. The ground having then become firm and yet not brittle, will admit of your name (or anything else) being drawn upon its surface with the aid of a point—and so expose the steel—with ease and sharpness.

You might do your name in ordinary script, or if you are any good at letters, Old English characters should be essayed, as a certain amount of elasticity may be exercised in their construction without altering their general appearance. Block letters also look well, though a little care is necessary to give them a nice, upright, square appearance. However, I will leave you to your own ideas as to what letters you use; some fellows have not the time for elegancy, the roughest answering their purpose just as well.

To work nice and smooth with your point don't have it too sharp; there is no necessity for scratching the metal, but simply to remove the ground, exposing the steel that the acid may act freely upon it. To brush away the detached ground, a camel's-hair brush or something stiffer may be used. There is no need to fear using it, as the ground will stand a moderate amount of rough usage. After your letters are done, it is always best to have a good look to see if any bits of ground require dislodging. Some may have been neglected, and these appear as a bright spot after biting, through the action of the acid being retarded.

"Biting in" the letters is the next process. The name, having been inscribed, must be subjected to the action of the dilute nitric acid, to eat away the exposed steel to a certain depth. A little care is necessary to carry this out properly, and on it depends the success of your enterprise.

Have your chisel on a level place, and drop a few drops of acid on the letters, spread well over, taking care not to allow your acid to go beyond the ground. Your object should be to cover the letters with as much acid as is reasonable, spreading to any particular place with the japanned stick.

At once the bright surface of the steel turns black, and bubbles will rise to the surface of the acid, and burst incessantly over the letters marked. This will continue for a few minutes, after which the acid will become thick and turbid. When the bubbling has subsided, absorb it off with your sponge, swilling same in clean water at once. About two of these bitings will be sufficient for ordinary work; but should you want the letters in very deep, you have only to repeat the "biting in." But it is well to remember that the more the letters are exposed to the acid, the coarser they are liable to get, as one may well understand. The acid, having eaten to a certain depth, will undermine the edges of the letters, and eat away the metal under the ground; and, though scarcely perceptible in most

instances, at times, if the biting is overdone, the letters will appear very much coarser than desired.

After you have finished biting, remove the ground with the spirit of turpentine or paraffin, and your letters will appear of a nice, dark colour, clear and sharp; but, if you have been etching on iron, the letters will be bright.

One or two words in conclusion. Don't begin working on the black if it is "tacky." Better let it stay and dry a little longer. It should work nice and sharp; not as though you were scratching at wet paint. Always get your letters as clear of ground as possible. Don't have your acid too strong. Better have it a little weak, and take a little longer to do, than spoil the job. Be careful and cover the blade *well* with black. When the acid is in a state of ebullition, the bursting of the bubbles produces a kind of spray, which would discolour any unprotected part it may happen to fall on. Or you may happen to tip over your article, and in doing so the acid would run down the sides, and play havoc if the metal was not protected. Of course, all this will be unnecessary after a few trials. One soon overcomes all the trivial difficulties which beset a beginner, and obstacles at first, are overcome another time by the suggestions of a little experience.

The utility of the process described above must be sufficiently obvious to all, as the process affords the means of affixing the initials or name of the possessor of any article of iron or steel to the article itself in a manner that is practically indelible and indestructible. And that it is the best manner of claiming and determining the ownership of any article that is thus marked may be considered as being beyond dispute, chiefly on account of the impossibility of effacing the inscription without seriously injuring the tool itself in every way. Its neatness, also, will commend it to all who desire to mark their tools as being incomparably superior to the plan of branding with initials by means of a heated iron stamp the handle of any tool, which causes great disfigurement by the depth of the letters thus burnt in.

ELECTRIC CONNECTION FOR ALARUM CLOCK.

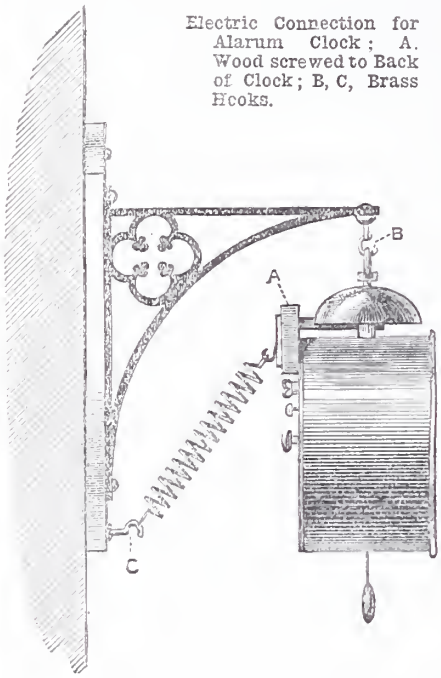
BY L. PENDRED.

Perhaps the following description of an electric alarum connection for an American clock may be serviceable to some. I have fitted my "Peep o' Day" alarum thus, and it works very satisfactorily.

I removed the back of my clock, and near the top of it punched two holes in such a position that I could screw on (from the inside, of course) a piece of wood about 2 in. by ¾ in. by ½ in., marked A in the illustration. One end of this piece, it will be seen by the sketch, stands up over the top of the clock, and to its further side is screwed a piece of flat thin brass spring of sufficient length, and in such a position that its extreme end, which should have a small platinum point soldered to it, touches the hammer of the alarum. To the other end of this spring, which is bent round the wood, is soldered a small hook, from which hangs a brass spiral spring. I should mention that the wooden piece is fixed diagonally in a certain position, which must be ascertained by trial. It is necessary to have it placed thus to avoid touching one of the set screws at the back of the clock.

A piece of silk cord is attached to the hammer of the clock by one end, and a small wooden weight hangs from the other.

The brass bracket shown in the sketch is screwed to a velvet-covered wooden shield, which is nailed firmly to the wall of my room. A small brass hook (B) is soldered to the end of the bracket, and a similar hook (C) is screwed into the shield. This hook is connected to one wire of the battery, and the bracket to the other, a bell and switch being in the circuit. When the clock is hung from the top hook, and the spiral spring hooked to the bottom hook, if the flat spring touches the hammer, contact will be made. Now you will notice, if you try, that when the clock is wound up the hammer is held by a spring in the mechanism in a certain position. The flat brass spring is set so that it *just* does *not* touch the hammer head when the clock is wound. When, however, the clock has "gone off," the wooden weight pulls the released hammer head against the spring, and contact is made, and the bell rings till



Electric Connection for Alarum Clock; A. Wood screwed to Back of Clock; B, C, Brass Hooks.

I get up and stop it. The wooden weight is not too heavy to prevent the clock alarming properly. I should mention that I removed the silencing switch attached to the clock, and raised the gong about ⅛ in. higher than it was originally. This, it will be found, leaves a little more space for the spring.

A MANTELPIECE WITH ITALIAN RENAISSANCE CARVINGS.

BY ALEXANDER MARTIN.

Carvings of Mouldings, etc.—Alternative Treatment of Mantelpiece.

The remaining illustrations show the carvings for the different portions of mouldings, etc., already mentioned. The central portion of frieze is given half full size in Fig. 17. It would take up too much space to give it in full length; but the left-hand vase and fruit may be used at both ends. The other vase may be used for the two centre vases, but reversing the spiral, or twisted fluting in vase, and rearranging the apples, plums, etc., on top. The upright leafage in Fig. 17 in centre of frieze, and the arrangement in Fig. 18, may be used at the two other intervals between the vases. The dotted curved line at the left-hand end of Fig. 17 represents the position of the adjoining piece of frieze which butts against this, and which consequently must be left clear of carving for that purpose, of course retaining the same curve as the rest of the ground has. This ground should be taken down to a bare eighth of an inch at each side, as shown by dotted line in Fig. 41 (page 370), which is a section of the wood as left by the cabinet-maker. This allows ⅛ in. of wood for carving, which is enough for the purpose. The little piece of frieze at each side of carved pilaster is shown in Fig. 19, and the piece round break of jamb in Fig. 20. The outside gable (Fig. 5, page 369) is carved similar to Fig. 19, but the scrolls, etc., are extended to fill up the larger space.

The moulding E, which is carved above pilasters, is shown in Fig. 21 drawn full size. There being four semicircles of carving above each pilaster, the two end ones may be as the left-hand pattern in Fig. 21, while the right-hand pattern is shown with two arrangements—that on one side being for one of the inner semicircles, and that on the other for the other inner one. The base of pilasters is carved as in Fig. 22; this is very simple work on account of its position. If much cutting were put on this base, lying as it does it would constantly be catching dust. What dust does lie on this moulding will easily be swept off the pattern of carving employed.

The remaining illustration (Fig. 23) is a detail—full size—of the dentils in clamp on shelf. (See Fig. 16, page 370.) They are cut in the plain band, which is carried uninterruptedly all the way along. Ordinary dentils consist of little square blocks separated by a narrow space; but here, in Fig. 23, we have a much richer dentilling. Three patterns are given; these should be cut in groups of three—three of the first design, then three of the second, then three of the third, after which a triplet of the second and then the first design, and so on.

The polishing of this article should receive very careful attention. The carvings should have no polish on them at all, so that the cutting may always have the crispness and sharpness with which it leaves the tool. The other parts may be polished and dulled with pumice-stone, to take the glaze off. If the mantel be made of mahogany, the wood should be stained a dark colour—commonly called "Chippendale" colour, on account of that maker's furniture being universally of the rich dark shade that mahogany assumes through age.

As an alternative treatment of this design, it may be mentioned how the profuse carving might have some simpler decoration substituted for it. First of all, the frieze might be treated as shown in Fig. 24—this being a section half full size of the wood, ready for fixing in its place. The beads carried right along and round the mitres of framing of jamb would be rather pretty. Then the carved pilasters might be framed together, as in Fig. 25, forming one long panel, which would be relieved by the various mouldings on either side of it. A section of such moulding is shown full size in Fig. 26. The carving in base and bed-mouldings would also be omitted, and the ordinary dentilling substituted for the carved dentils in the clamp to the mantelshelf. With these alterations, a simple yet chaste and effective mantelpiece would be the result.

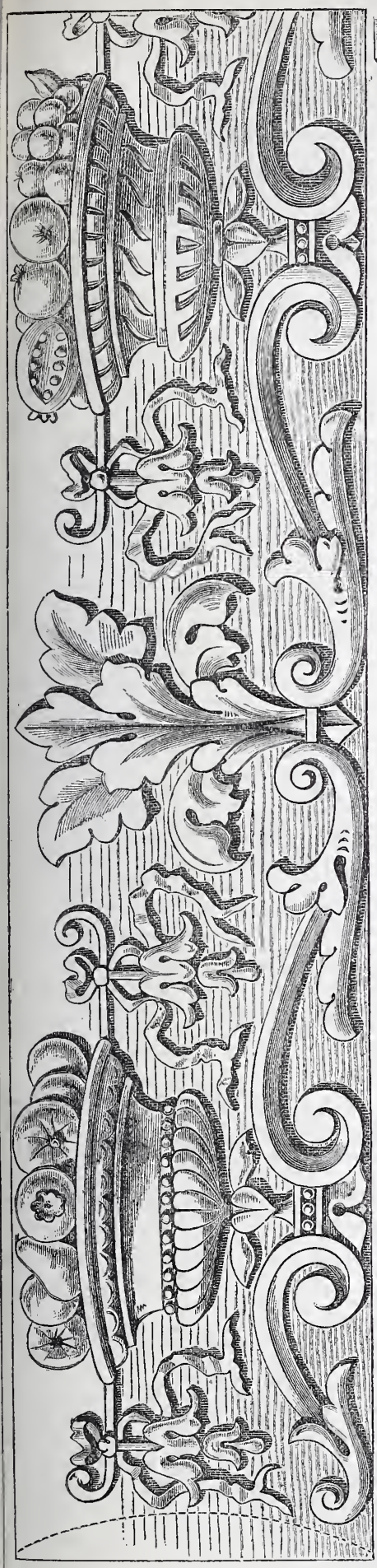


Fig. 17.—Central Portion of Frieze (half full size).

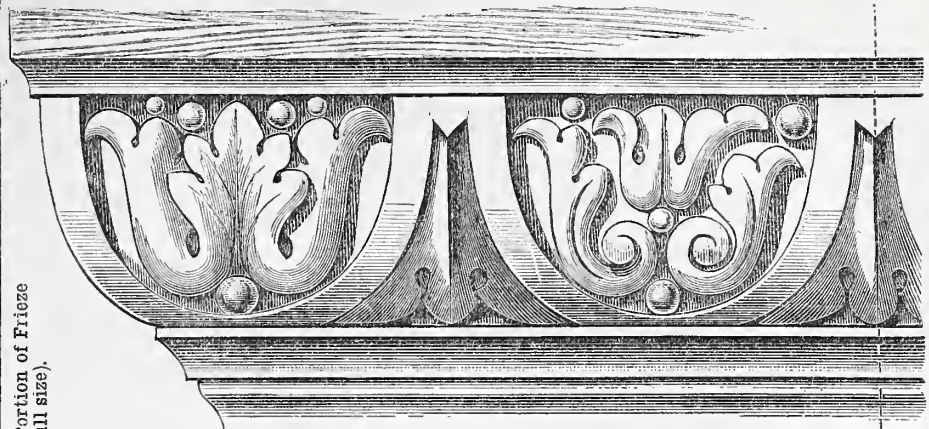


Fig. 21.—Carved Work on Moulding (E, Fig. 5) above Pilasters.

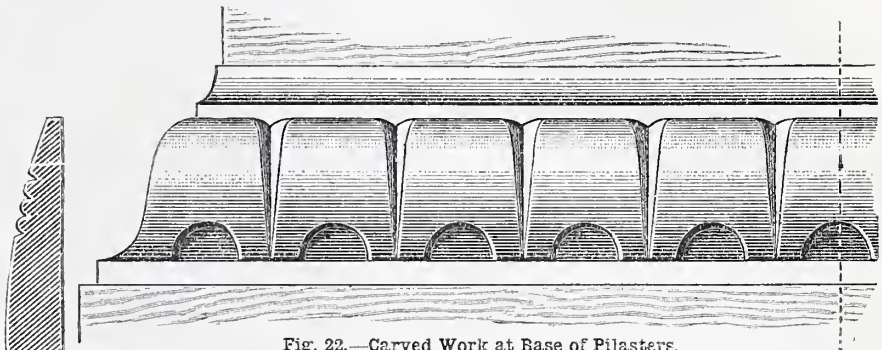


Fig. 22.—Carved Work at Base of Pilasters.

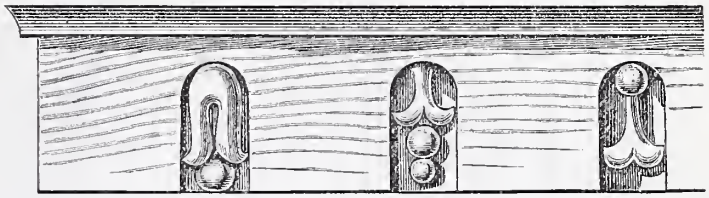


Fig. 23.—Details of Dentils in Clamp on Shelf (full size).

Fig. 24.—Section of Substitute for Frieze.

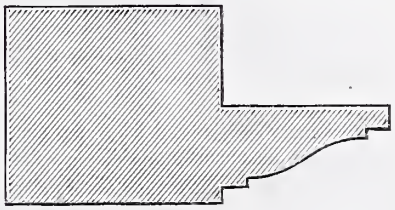


Fig. 26.—Moulding round Panel (full size).

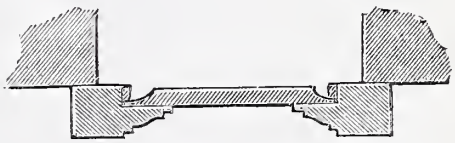


Fig. 25.—Section of Panelled Pilaster.

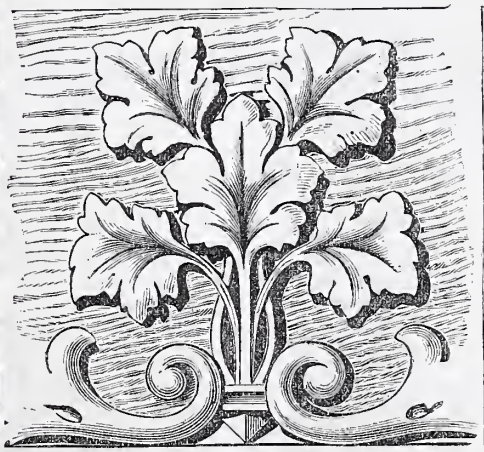


Fig. 18.—Foliage for Intervals between Vase on either Side of Frieze.

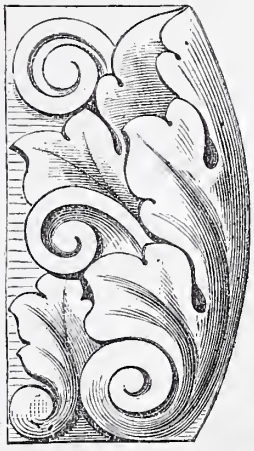


Fig. 19.—Carved Work on each Side of Pilaster at Top.

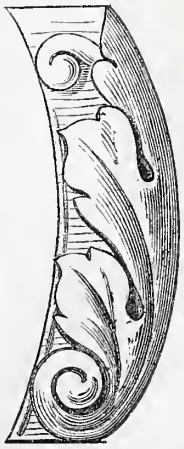


Fig. 20.—Piece round Break of Jamb.

"WORK" EXHIBITION, 1890-91.

CLASSIFICATION of Exhibits for which it is intended to offer Prizes, Medals, and other awards, to readers of WORK (the illustrated magazine of theory and practice for all workmen, professional and amateur), to be held at the Polytechnic Institute, Regent Street, from December 29th, 1890, to January 10th, 1891, inclusive.

Group I.—WORK in Wood.

Furniture, Cabinet Work, Carving, Fretwork, Pattern-making, Turning, Carriage and Cart Building, Wheel-making, Pulley-block-making, Carpentry, Marquetry, Parquetry.

Group II.—WORK in Metals.

Casting, Forging, Stamping, Die-sinking, Medal-striking, Finishing, Turning, Screw-cutting, Repoussé Work, Arms (Guns, Rifles, Pistols, Swords, Bayonets, Lances, Armour), Armour Plating, Iron Ship-building, Amalgams, Mixed Metals.

Group III.—Tools for WORK.

Hand Tools, Machine Tools, Tools for Sharpening Tools, Photo-micro and Electric Apparatus (except Lighting and Telegraphy), as Cameras, Magic Lanterns, Slides, Microscopes, Surgical Instruments, Mathematical and Drawing Instruments, etc.

Group IV.—WORK in Design only. *Exhibits to take the Form of Drawings or Models.*

Designs for Decorative Purposes (including Stained Glass). For Architecture (including Ventilation). For Mechanical Purposes, such as Boilers, Engines, Machines. For Engineering, Forts, Ships, Roads, Bridges, Canals, Sewers, Railways, Trams, Balloons, Parachutes, Ambulances, Tents, etc.

Group V.—WORK in Printing.

Letterpress, Type Founding, Press-work, Machine-work, Lithography, Drawings on Transfer Paper, on Stone, on Wood, on Zinc; Engraving on Steel, Copper, and Wood; Colour Work, Photography on Stone, on Wood, Photographic Printing, Bookbinding, Music Printing, Transferring, Stereotyping, Electrotyping.

Group VI.—WORK in Domestic Appliances.

For Decorative Purposes. For Cooking (Hardware, Glass, Pottery, Faïence), Heating, Washing, Drying, Lighting, Cleaning, Sewing, Bathing, Teaching; Home Recreation, Games, Gymnastics; Hygiene; Toys, Dolls, Wax-work (Figures, Fruit, and Flowers); Telegraphy, Telephones; Watches, etc.; Basket-work.

Group VII.—WORK in Wearing Apparel.

In Tailoring, Hat-making, Boot and Shoe-making, Mantua-making, Millinery, Beading, Dress-making, Baby Linen, Lace-making, Knitting (Machine or Hand), Needle-work (Machine or Hand), Button, Cotton, Silk, and Thread-making, Hose, Gloves, Wigs, Theatrical Costumes, Court-Dresses, Uniforms, Liveries, Belts, Buckles, Fans, Feathers, Artificial Limbs, Eyes, Teeth, etc., Abdominal Belts, Trusses, Surgical Bandages and Appliances, Electric Belts and Bandages, Jewellery, Hair-dressing.

Group VIII.—WORK in Painting and Decorating.

House Painting; Decorative Painting in Oil, Distemper, Flatting and Fresco; Gilding, Graining, Marbling, Sign and Facia Writing, China Painting, Carriage Painting, Heraldic Painting, Scene Painting, Stained and Painted Glass and Imitation ditto, Plaques, Panels, Appliances for Painting and Decorating.

Group IX.—WORK in Textile Fabrics and Leather.

Curtains, Carpets, Blinds, Rugs, Upholstery Screens, Brackets, Frames, Harness, Saddlery (Civil and Military), Bags, Trunks, Portmanteaux, Travelling Bags and Trunks, Dress Baskets, etc.

Group X.—WORK in Musical Instruments and Music.

1. Organs, Pianofortes, Harps, Violins, Banjos, Mandolins, Guitars, Cornets, Trombones, Clarinets, Oboes, Drums, Flageolets, Flutes, Piccolos, Fifes, Bagpipes, Triangles, Cymbals, Metronomes, etc. 2. Musical Compositions, Systems of Teaching, Appliances for Learning.

Group XI.—WORK in Watches, Clocks, Alarm Bells, etc.

1. Design of any of the above (including Musical Boxes and Mechanical Contrivances). 2. Actual Models or Finished Working Specimens, Clockwork for Lighthouses, Burglar Alarms, Electric Signals.

Group XII.—WORK in Building Appliances and Material for Building.

Bricks, Tiles for Floors and Mural Decoration, Stone Masonry and Carving, Terra-cotta Chimney-tops, Drain Tiles and Pipes, Sanitary Stoneware and Pottery, Mosaics, Hot and Cold Water Appliances, Baths and W.-C.'s.

Group XIII.—WORK in Chemical Processes and Products.

Stains, Dyes, Colours, Inks, Varnishes, Soaps, Cleansers, Disinfectants, Food Compounds, Drinks, Igniters, Fuels, Explosives, Manures, Detergents, Antiseptics, Anodynes, Electric Lighting, etc.

Group XIV.—WORK in the Utilisation of Waste (Novel and Original Feature).

Utilising Waste Space in crowded Cities and Towns.
" " " in Agricultural Districts.
" " Heat.
" " Water.
" " Sewage.
" " Products hitherto unused.
" " Labour, manual and mental.
" " Time.
" " Capital (including legacies not applied for by claimants).
" " Charity Funds, which have exceeded testators' expectations.
" " Power, of Combination for legal purposes, Purchasing power, Co-operation, Power of oppression by sweating.

Exhibits in this Group to take the form of Essays, Plans, Précis of Experiments, and even Suggestions.

There will be three classes of Exhibitors, viz.:—

1. **Workmen** or Workwomen actually employed and gaining their livelihood in and by the craft under whose name they exhibit.
2. **Apprentices**, *bonâ fide*, serving an apprenticeship to the craft or calling under whose name they exhibit (whether indentured or otherwise).
3. **Amateurs** or connoisseurs who either do not practise any craft as a means of subsistence, or who exhibit in any group other than their own craft.

The Exhibits will be judged in accordance with the above classification of Exhibitors.

The Jurors will judge all Exhibits in Groups I., II., III., X., according to workmanship alone, irrespective of design, which may be new or old.

The Jurors will judge all Exhibits in Groups V., VI., VII., VIII., IX., XI., XII., according to merit in design associated with meritorious *workmanship*.

The Jurors will judge Exhibits in Groups IV., XIII., and XIV., solely as to novelty, originality, and improvement upon known and existing forms, formulæ, and processes, designs, or inventions, irrespective of workmanship in their execution.

The Jurors will be practical and competent experts.

Exhibitors may declare their Exhibits as not in competition.

CONDITIONS AND REGULATIONS.

1. Any *bonâ-fide* subscriber to WORK shall be eligible to exhibit on the Conditions and under the Regulations stated below.

2. All intending Exhibitors must make the prescribed entries upon the printed form to be obtained of the Secretary (see foot of page), and sign the same in the presence of a reliable witness, who shall also sign and give his address and occupation. N.B.—Any false or fraudulent statement will disqualify.

3. Every Exhibitor is to pay the carriage of his Exhibit to and from the Exhibition. The Proprietors of WORK will supply printed labels for attaching to packages. It must, however, be distinctly understood that the Exhibit will be entirely at Exhibitor's risk. No package will be received unless it bears the official label, and is packed.

4. Every Exhibitor must fill in, on the Application Form, the value or price he places upon his Exhibit, and of any separate portion thereof, so that in case of sale and for insurance purposes, no dispute may arise.

5. The Secretary will advise, on printed forms, the receipt of an acceptance of all Application Forms which are correctly filled up, and will return any for correction which are not filled up correctly. All correspondence must be addressed prepaid to the Secretary, "WORK" EXHIBITION, LA BELLE SAUVAGE, LUDGATE HILL, E.C. *All letters requiring an answer must be accompanied by a stamped and addressed envelope.*

6. The Awards of the Jurors shall be final and binding without appeal.

7. The Proprietors of WORK reserve the right to decline any Exhibit which they may deem unsuitable or unworthy, and the Secretary will advise the Exhibitor of such decision.

8. All Exhibits must be forwarded so as to arrive on the 19th or 20th December, and not before. Applications for space must be filled in and forwarded AT LATEST BY THE 30TH DAY OF OCTOBER, after which date they cannot be received, and no labels for carriage will be thereafter issued. It is intended to open the Exhibition on Monday, December 29th, 1890, and to keep it open till Saturday, January 10th, 1891.

9. Every Exhibitor will be entitled to a free Admission Ticket, not transferable, available during the Exhibition. Exhibitors at a distance unable to come to London, may have such ticket transferred to a London friend on nomination by previous arrangement with the Secretary. Applications for Free Tickets for Attendants should reach the Secretary not later than the 10th of November.

10. No articles must be removed till the close of the Exhibition.

11. The Proprietors of WORK reserve the right to remove the Exhibit of any one who does not conform to the regulations, and also the right to alter, add to, or cancel, any of these Rules.

12. Awards, Medals, Prizes, etc., will be forwarded, post free, to all Exhibitors who do not present themselves at the Distribution of Prizes, the date of which will be duly announced in WORK.

PRIZE LIST.

Group Prizes.—GOLD MEDALS.—A Gold Medal will be given for the best Exhibit in the whole Exhibition, together with a First Class Certificate (except Group XIV.). A Gold Medal will be awarded with a First Class certificate to the best Exhibit in Group XIV.

SILVER MEDALS.—A Silver Medal, a Money Prize of One Guinea and a First Class Certificate, will be awarded to the best Exhibit in each of the Groups as classified above, except Group XIV., where a Gold Medal will be awarded.

Class Prizes.—BRONZE MEDALS.—A Bronze Medal, a Book Prize of Half-a-Guinea, and a Second Class Certificate, will be awarded by the Jurors to the best Exhibit in each Class or Sub-Division of Groups.

Special Prizes.—Special Prizes, of which details will be announced later on, will be given to the best Exhibits from actual Working Drawings published in "WORK."

Certificates of Merit.—A First Class Certificate and Book Prize of One Guinea will be awarded (1) To the Second Best Exhibit in the Exhibition, (2) To the Second Best Exhibit in Group XIV.; and if recommended by the Jurors, a special extra SILVER MEDAL will in either case be given. A Second Class Certificate will be awarded (1) To the Third Best Exhibit in the Exhibition, (2) To the Third Best Exhibit in Group XIV. N.B.—The Proprietors of WORK reserve to themselves the right of

Forms of Application for Space will be sent, post free, upon writing to The Secretary, "Work" Exhibition, Messrs. Cassell & Company, Limited, La Belle Sauvage, London, E.C.

publishing in the pages of that Magazine any Essay or Suggestion for which a Prize shall have been awarded.

SECOND CLASS CERTIFICATES will be awarded to the Second Best Exhibit in each Class or Sub-Division of Groups.

THIRD CLASS CERTIFICATES will be awarded to the Third Best Exhibit in each Class or Sub-Division of Groups, and if specially recommended by Jurors, Second Equal Awards in case of Ties of Merit.

Imitation.—It shall, however, be understood that the highest Prize Medal only shall be given, in lieu of minor honours; but all honours obtained shall be recorded upon the Certificate in each case. *No Prize will be awarded except on the Jurors' recommendation as to merit.*

Exhibitor's Certificate. — Every Exhibitor, whether a Prize Winner or not, will be entitled to a separate Certificate that he has exhibited.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Cutting Mitres.—F. H. (*Streatham*) writes to POST OFFICE BOX (*Richmond, Va. U.S.A.*) (see page 323, Vol. II.):—"You have not been badly advised, but both with a 'shooting board' and a mitre-cutting machine great care is required to cut gilt moulding without it chipping off. I have used both, and my experience is that a mitre-cutting machine is far better than a shooting board, as the knife cuts from the top downwards, and can be cut more gently; whereas with a plane it requires a sharp thrust. I have one of Booth Brothers' mitre-cutting machines, and find it answers fairly well. In the one that I have there is one fault: the set screws bad round heads, so that moulding that did not come up to the centre of the screw would be out of truth. But this has been remedied by having flat-headed screws instead of round ones. It is the opinion of old practised hands that there is nothing to beat the mitre shooting board: but that I take as jealousy against simplifying machinery."

A Useful Vehicle.—H. A. H. (*Manitoba*) writes:—"I send you a diagram of a most useful vehicle used out here. The diagram speaks for itself, and I have given dimensions of parts. The shafts are attached to the front axle as near the wheels as

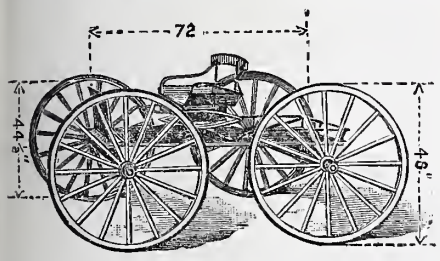


Fig. 1.

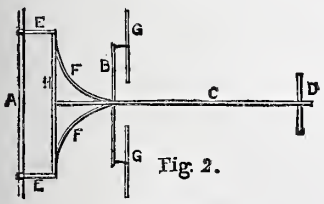


Fig. 2.

A Useful Vehicle.

possible, say about 4 or 6 in. The pole is also attached, as shown, to the axle. For farmers and others carrying small parcels at the back, the backboard is comfortable and convenient. I have used one for over four years over the prairie. In front, below the seat, the lathes are covered with thin boards."

Oval Drawing.—F. C. (*Leytonstone, E.*) writes:—"I think the answer of J. W. H. to A. B. in the 'Shop' supplement to WORK, No. 66, is very misleading. The point I allude to reads as follows:—'Further, all ellipses so drawn, either inside or outside this ellipse, where the proportion of major to minor diameter is the same, irrespective of size, will and must be parallel to the first.' Now this is not correct. No two ellipses can be parallel, because a line parallel to an ellipse is not an ellipse. My sketch, Fig. 1, will clearly demonstrate

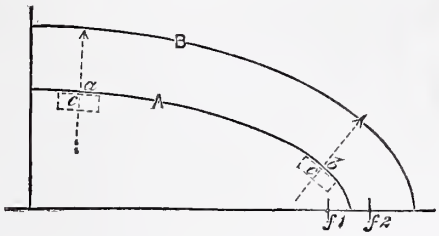


Fig. 1.

this. A and B are the curves of two ellipses, struck by the thread and pin method, f 1 and f 2 being respectively a focus of each. It will be found on measuring that although the proportion of major to minor axis is the same, the lines are not parallel. Fig. 2 shows the method of drawing a parallel to an ellipse. The inner curve is an ellipse: f 1 and f 2 being the foci. To obtain the outer curve, take a number of points, a, a, a, join these to f 1 and f 2; bisect the angle f 1 a, f 2, this gives the line a b, which is normal to the ellipse; on this, set off the distance of the required parallel as b, b, b, then trace the curve through the points b, b, b. To find the foci, take the length D E, and from the point G set it off on the line C E. The method sometimes adopted in practice is:—First, to cut out the inner curve, then gauge from this

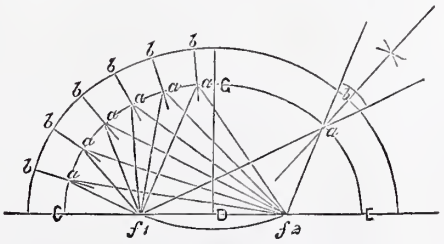


Fig. 2.

the distance of the required parallel with an ordinary marking gauge. The accuracy of this method depends upon the eye of the workman, for if the gauge is not kept normal to the ellipse the lines cannot be parallel. There are one or two other questionable points brought forward by J. W. H., but, as they are not of practical importance, it is not worth while to mention them."

J. W. H. writes in reply to F. C. (*Leytonstone, E.*) that he admits that ovals parallel to ellipses are not mathematically true ellipses, but as A. B. asked for a method of drawing ovals, and the heading was "Oval Drawing," there need be nothing "misleading." F. C.'s Fig. 1 is not as he says, however, an example of the same proportion between major and minor axis. His major in smaller ellipse is $5\frac{3}{16}$ in. to 2 in. minor, and in the larger one $6\frac{3}{4}$ in. to $3\frac{1}{4}$ in., or $\frac{85}{16}$ to $\frac{32}{16}$ in one case, and $\frac{105}{16}$ to $\frac{48}{16}$ in the other, so that the one major $= 2\frac{1}{3}$ to 1, and the other major $= 2\frac{1}{4}$ to 1. Simpler than F. C.'s method of drawing an oval parallel to an ellipse is to keep the pins in my Fig. 3 (page 230 WORK, supplement to No. 66) at G and H as before, and lengthen the thread to any desired distance outside the ellipse, and then proceed to describe the larger orbit, which though not, strictly speaking, an ellipse, is usually called so. As to describing an oval by means of a working gauge, F. C. ought to know that it is impracticable, as the head of the gauge would bear off at the quick part of the curve, not only shortening the arm by the distance at c b as compared with c a in the lines I have dotted to represent the head of gauge on F. C.'s Fig. 1, but the normal could not be maintained.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Incubation.—J. W. (*Holloway*).—Chicks break out themselves if all goes well. Sometimes a chick may need assistance, which may be given if the egg is "starred" (chipped), and no progress made after the twenty-one days are fully up. The egg should be taken out and aired in the cool air of the room for fifteen minutes each day, and turned over completely when replaced in the machine.—L. W.

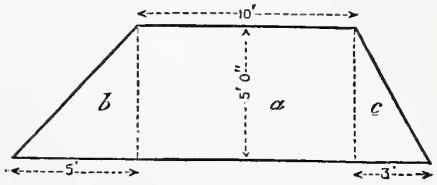
Hot Water Apparatus.—E. D. C. (*Leytonstone*).—I think "Hot Water Fitting and Steam Cooking Apparatus," by F Dye, would suit your requirements. It is published by Messrs. Spon, 125, Strand. The price is 1s. or 1s. 3d. You might also get much useful information by watching "Shop" columns of WORK.—T. W.

Glass Silvering.—W. K. (*Cardiff*).—Neither the old mercurial nor the newer chemical process is suitable for amateur work. The latter requires a thorough knowledge of the chemistry connected with it. To give you the formula would therefore be only calculated to induce you to lose money instead of helping you to economise. Probably the recipes you refer to have been correct, and failure is rather owing to want of skill than to inaccuracy on the part of the writers. Many chemical processes and experiments require the most delicate manipulation.—D. D.

Canada Balsam Cement.—E. H. W. (*Highbury*).—Why not give your information through "Shop" for the benefit of all readers?—ED.

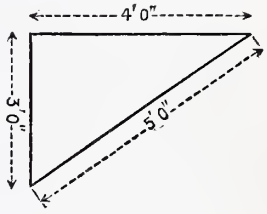
Overmantel. — PLUMBER. — It appears to me almost impossible to answer your question about colours for overmantel satisfactorily as I do not know the colour which prevails in the room, but I cannot recommend you to paint the outside in two, and the inside another colour, as you would then have three colours to consider. Unless very carefully considered, such a combination would probably result in a gaudy, vulgar-looking piece of furniture which would be more of an eyesore than an ornament in your room. Instead of using three colours you will find it better to stick to one, and use it in three shades. I am, however, averse almost to even this, and prefer to advise you to use only two shades, if you are not satisfied with one. Let the inside of course be the lighter shade, as it will show up the bronze ornaments better. If you were to put pieces of looking-glass at the back of the recesses holding the bronzes it will be an improvement. Before painting, look over an enamel paint card of tints and select the one you like best. If the wood of the overmantel is nice, clean, sound stuff, would it not suit your purpose to stain it to match the rest of the furniture and finish it by polishing?—D. A.

Slating.—F. M. (*Ayrshire*). — The mould generally used for ornamental slating is a wooden one, which is laid on the slates and marked round; the slates are then cut in the usual manner. A simple way of measuring irregular forms of roofs is to divide the area up into as many squares as possible, and treat the remaining triangles as squares, and halve them.



a.—10 in. by 5 in.	.. ..	= 50 in.
b.—5 in. by 5 in. = 25 in. ÷ 2		= $12\frac{1}{2}$ in.
c.—3 in. by 5 in. = 15 in. ÷ 2		= $7\frac{1}{2}$ in.
The whole		70 sq. ft.

The height (or width) would be measured flat on the slates from eaves to ridge: that is to say, that if a roof was 4 ft. high, and one half of the span was 3 ft. wide, the height (or width) from the ridge to eaves would be 5 ft.



The rest of your queries being couched in Scotch technical terms, I am in doubt as to what is meant, but if you will translate or make them clearer to me by sketches, I shall be only too happy to assist you. You will find Beaton's "Builders' and Surveyors' Technical Guide," published by Crosby Lockwood & Co., London, very handy in measuring.—E. D.

Prices and Patterns. — J. A. P. (*Preston*). — I cannot exercise any control over prices asked by firms for tools and appliances—a fact which goes without saying, as the phrase runs. Your hope that amateurs may be able to obtain good and reliable castings of engines, machines, etc., will, I trust, be realised at no distant date. I have had the question of supply of things of this kind on my mind for some time.—ED.

Mail Cart.—AN AMATEUR.—An article on the above subject giving all details as to construction appeared in No. 30 of WORK.

Bicycle Seats.—T. K. M. (*Whitehaven*).—I have tried riding with the seat well back and all the intermediate positions up to that with the nose of the saddle about ½ in. behind the centre of the crank shaft, and I find that this latter position is the easiest; and as I have had some years' experience in going about the country, I can recommend it. And I am glad your experience is the same, as the positions of cyclists when cycling are getting frightful. The reason that you cannot adjust your machine to suit you is that it is badly designed. You say that you are short legged. Therefore, when ordering a new machine, you should be measured for it. When I say, in article, that the seat and handle bar should be level when both are in the centre of

their vertical adjustment, I don't intend the handles to remain there. If the man is a short armed one, then the handles must be raised; and if he is long armed, then they must be lowered; so that when sitting upright he can just grasp the handles comfortably with the arms extended. The reason I suggest that they be level is that men's arms, when properly proportioned to the body and slightly extended to grasp the handles, would be just level with the seat. The model machine shown in my sketch, Fig. 3, was taken from a Humber machine, Beeston make, which I possess, and this firm are considered the best designers; and I think you cannot do better than go to them for a new one, as their workmanship is also good.—P. B. H.

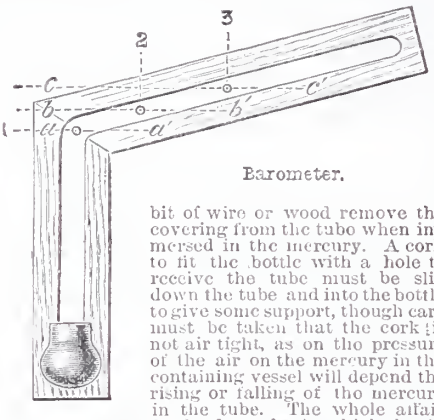
Patenting an Idea.—A. B. (*Northampton*).—If the invention in question will do away with those ugly pauses, which, in the absence of it, are so annoying, we should say that (provided it is simple and not too costly in production) it will have a reasonable chance of success. A. B. cannot, he says, himself make a model, but surely he can make such drawings as will explain the principle and construction of his apparatus. How rough these may be will not greatly matter. These he might place in the hands of Mr. W. Cook, "Inventors' Model Maker," Headless Cross, Redditch, who will "lick the idea into shape" if any one can. If the model is found to answer A. B.'s expectations, he should then procure provisional protection; and to negotiate the sale or working of his plan, he should have the assistance of one of the agents who undertake such matters. He might try Mr. Clarence S. Newton, Royal Court Chambers, Chancery Lane, London, E.C., who is a patentees' agent.—C. C. C.

Jet Black Ink.—W. T. S. (*Padiham*).—Owing to the extreme pressure on the columns of "Shop," the reply you allude to has been crowded out. If I mistake not, the initials then were P. B. L. (*Padiham*). Before this appears W. T. S. will have seen that reply, or if he should overlook it, I may just say that good writing ink with a little white sugar added to it will have the appearance when dry that he desires, and is used by ticket writers.—J. W. H.

Cigarettes.—F. A. W. (*Handsworth*).—I do not know where my correspondent can procure "solid" ends for cigarettes; but I can tell him a very easy way to make them for himself. It is, however, a misnomer to call them "solid." They are simply spiral coils of thick paper with the outer layers gummed or glued together. I never use them, although I smoke half a pound of cigarettes a week on an average, often more; neither do I ever use a machine, rolling them as the senoritas do in Spain, in my fingers; alas, not so pretty and taper as theirs, for mine are deformed with "work." Take a sheet of cartridge paper and rub your thumb nail along one edge, and with your palm roll it into a coil until it is thick enough for your size of cigarette, when with a penknife you can cut it off and commence the next long roll, and so on. These rolls may be gummed, pasted, or glued just at the edge of the last lap of the spiral if desired; but if, after cutting into lengths of about ½ in., they are squeezed and sprung into the cigarette covering, they would better answer their purpose and be more cleanly than if glued or pasted. One sheet of paper would, I compute, make more than 1,000 mouthpieces; and if placed along with the tobacco in most of the ordinary cigarette machines would keep in place.—J. W. H.

Sanitary Inspectors' Duties.—R. A. (*Liverpool*).—A reply to R. A. hardly appears to me to come within the scope of WORK at all, but I will this time advise my correspondent, firstly, to get an introduction to some duly appointed inspector; secondly, to diligently search the free library catalogues for any book that bears on the subject; not to be afraid of learning too much, and to write more carefully, both as to spelling, and more particularly in the arrangement and expression, clearly and concisely, of his ideas, than his letter exhibits. I do not wish to discourage R. A. in the least; I would help him in his efforts to improve his position, and in this connection I am candid enough to say to him, "First improve yourself and your position will soon follow suit."—J. W. H.

Barometer.—CHEMIST asks for directions to make a barometer, and says, "I work in a chemical laboratory; I have glass tubing, etc., at my hand." CHEMIST does not say for what purpose he wants to make a barometer, nor of what type; I therefore shall assume he is a youngster fond of trying experiments. CHEMIST must be aware that putting the question in the open way he has, it becomes a very wide one; too large, I am afraid, to get into "Shop." I shall, therefore, narrow down my remarks as much as possible. First, the patterns which lend themselves best to an amateur. The simplest will be a straight tube, the lower end open and dipping into a vessel of mercury. The next, the syphon, in which the short leg is left open and serves the purpose of the vessel in the previous form. And third, a modification of the first, but instead of the tube being upright, it is bent nearly at right angles, about one third of its length from the trough. This, for a reason hereafter shown, is very sensitive though somewhat unsightly. *Tubing.*—For either kind glass tubing must be procured of, say, ¼ in. internal diameter, and 30 in. long. Care must be taken in selecting the tube, that it be of the same diameter throughout, else a reliable barometer will be impossible. Next see that the bore is chemically clean. Wash it with strong soda to remove any trace of grease, then with acid to remove all trace of soda, and finally with a plentiful supply of clean water. One end must now be melted and sealed, which CHEMIST, I presume, well knows how to do. *Mercury.*—It is absolutely necessary that the mercury should be chemically pure, for if impure, not only is its density altered, but it will cling to the glass and the thing will become useless. It can be purified by squeezing through clean chamois leather, or by passing it through a funnel of writing paper folded as a filter paper with a pin hole in the bottom; this should be repeated until no dross or impurity is left on the paper, though the best way would be to distil it. When perfectly pure see that it is dry. Line a vessel with absorbent paper, and roll the mercury in it, so that any moisture may be taken up. Some recommend placing it in a warm oven, but that, in my opinion, is not a good plan. *To fill the tube.*—Make a paper funnel with a pin hole and place it in the tube; gently knock the tube if it becomes choked. When full, gently heat the tube so as to expand any air bubbles in it and force them to rise to the top. With a hand glass examine the column of mercury to see if any minute bubbles are imprisoned; if so, they must be expelled by heating and gently knocking. When the tube is full, dip the open end in a vessel of mercury, when a portion of the column will fall out, leaving a perfect vacuum at the upper end. To test whether the vacuum is perfect, close the end of the tube with the finger and turn the tube upside down; if the vacuum is perfect the mercury will fall with a distinct click. If air or moisture is present there will be a dull thud, as the air or moisture will form a cushion. Replace the tube in the vessel of mercury as before, and whilst immersed tie a piece of skin or leather over the open end. Take a wide mouth bottle and fill it with mercury and place the tube in it; with a



Barometer.

bit of wire or wood remove the covering from the tube when immersed in the mercury. A cork to fit the bottle with a hole to receive the tube must be slid down the tube and into the bottle to give some support, though care must be taken that the cork is not air tight, as on the pressure of the air on the mercury in the containing vessel will depend the rising or falling of the mercury in the tube. The whole affair must now be firmly fixed to a back, which should be marked off in inches and ⅛ in. This is the simplest form, and will be subject to errors which the space at my command forbids to explain, further than to say that the larger the area of the vessel, as compared with the bore of the tube, the smaller will be the error. In the second form the tube is sealed at one end whilst the other is bent like a syphon; this plan is adopted in what are called the wheel barometers, where a pointer travels round a circular face. It has to be filled the same as in the other case. No containing vessel with mercury is needed in this as in the other, as the atmosphere will act on the open end of the tube and balance the mercury. In the third type mentioned the glass tube is bent as shown in the diagram. I have never seen but one of this kind; it is not at all ornamental, but is exceedingly sensitive. It will be understood that according to the pressure so the mercury rises perpendicularly. Now it is clear if the mercury rises perpendicularly one inch, and the tube lies at an angle with the perpendicular, then it must travel much more than an inch in the tube to reach an inch perpendicular, and the nearer the bent tube is to a right angle the farther must it travel. By this means it is possible to graduate the scale much smaller. In the figure, if the mercury rises one inch from *a a*' to *b b*' it will have travelled in the inclined tube to the dot 2 lying between them, which is much more than an inch from *a*. When it rises to *c c*' perpendicularly it will have travelled in the inclined tube to the dot 3. By this means much more minute variations can be read off. I have not the exact measurements of this instrument by me, but will procure them if asked for.—O. B.

Cheap Water Filters.—J. S. (*Bullocksmithy*).—The subject of filtering water for drinking purposes is of such paramount importance that a full book of 250 or 300 pages would scarcely suffice for its consideration, much less a condensed reply to a "Shop" correspondent. Firstly, filtration ought (although hitherto it has never been able to) deprive water of all impurities. Water is impregnated, *chemically*, by the strata through which it passes after its fall in the shape of rain, dew, or snow from the clouds as well as *mechanically*, as it rushes in streams, rivulets, and even torrents to fill the artificial reservoirs constructed by man for storage purposes. Dead dogs, cats, rats, etc., must not be left out of the calculation, nor the pollution of rivers poisoning even the poor fish! The simplest form of filter is some porous medium through which the water may percolate to rob it of all impurities in the shape of vegetable matter, such as moss, grass, water plants, and other vegetation, growing either in the bed or on the borders of the tributary stream, which form the source of, or acts as the channel of, conveyance for the water supply. This vegetation—especially when the water supply consists of the great drainage of moors, uplands, and hills, such as those of Lancashire, at Rivington, in your immediate neighbourhood, and the watershed on the Lancashire side of Derbyshire and Yorkshire, at Woodhead and Dunford Bridge and their neighbourhood, into reservoirs of great extent with double filtration (first through gravel and afterwards beds of sand and stone) from one reservoir into another—is almost all eliminated, as analysis of the Manchester water supply proves; it is the purest in England by far. Liverpool comes next, and when the works for Manchester deriving the supply from the Cumberland and Westmoreland lakes are complete there will be no need of filters for the district supplied. And all this expense, it is worthy of notice to remark, came, not as in London, out of the ratepayers' pockets, but out of the profits (over £30,000 per annum) earned by the gasworks, also a Corporation property, which supplied gas at a lower price than any other gas company, and still yielding a profit enabling the Corporation to construct the finest water works in the world, and to supply the purest water on the largest scale ever known and by its purity and plenty and constant supply to reduce the death-rate of an abnormally unhealthy city to a favourable percentage. Where water is derived, not from the drainage of moorland, where vegetable matter is almost the only impurity, and where the excess of ozone in the atmosphere is sufficient to impregnate the so-called surface water but from springs having their origin in strata, such as iron-ore, gypsum (as in Paris), or carbonates of lime, medicinal springs (such as Malvern), or other sources chemically tainted, mechanical filtration is no longer effectual. Hitherto all household filters have failed to purify water chemically impregnated. They prevent all insoluble particles from passing, all vegetable and animal matter is arrested; but chemicals in solution can only be got out by chemical means, such as precipitation. As water becomes chemically impregnated by the soil through which the water passes as a rivulet, a stream, or river, the strata through which it percolates through the earth as it forms a spring, or the pipes or conduits through which the supply is disseminated to dwellers in towns or cities, or again, in villages and hamlets, by drainings from cemeteries or burial grounds (which our ancestors placed invariably around their beloved parish church on the highest ground they could find in the said parish), seeking their natural escape into wells and springs, it is evident that a perfect filter cannot be designed without first obtaining an analysis of the local water supply. A filter that can render pure the water impregnated by iron salts would be of no use, but positively harmful where lead ore was a component of the soil in contact with the water, or where carbonates of lime or lithia formed the beds of streams and rivulets. Copper, even tin, and other minerals such as sulphur, barytes, alum, alumina, and other bodies, influence by their partially dissolving in the water flowing over them, the water itself primarily and the health of those who drink water (which by-the-bye, I *never* do), as is evidenced by what the Swiss call "goitre," and Matlock people "Derbyshire neck" (a vast and unsightly swelling of that part of the neck between the jaw and the clavicle) attributable solely to the impregnation of the water in both districts by the same chemical salts of lime, which produce also in both Switzerland and the caverns of the Peak of Derbyshire, stalactites and petrifaction. Filtration has no power over water chemically impregnated, unless as a first process other chemical re-agents are introduced which are beforehand known to precipitate such impregnations in an insoluble form. Hence the distinction between chemical and mechanical filtration. Ordinary filtration consists in sieving water and stopping all particles grosser than water from passing through. Chemical filtration means making every soluble, invisible particle passing through unnoticed, even the finest filter known, declare itself in the form of a precipitate which cannot pass. To construct a cheap and really effective filter is very simple. Take a large flower pot, and cement into the bottom hole, either with Portland cement or red lead, a pipe of gutta percha so that it is water-tight when dry. Into this pot with cement set another about the same size which will only descend about half-way down. Half fill this second pot with sand or gravel well washed in salt and water first and afterwards in pure water. Then fit in, likewise in cement, a third flower pot, which half fill with wood charcoal, and then put into it a fourth flower pot, cemented as before, into No. 3, in the bottom of which place a circular piece of felt, or screw a bit of sponge into the hole in the bottom. This is the complete form of mechanical filter; nay, more, the carbon (charcoal) will eliminate as a disinfectant, any surface impregnation otherwise derived from the atmosphere, and disinfect passing water from all germs of disease. To make this cheap and effective mechanical filter into a chemical filter also, first analyse the water you have to contend with, and having done so, ascertain what other re-agent will precipitate as an insoluble powder, or precipitate the chemical you desire to get rid of. Add this re-agent in the fourth or upper pot and add the water as required. The action will be: firstly, the re-agent will precipitate the obnoxious salt; secondly, the precipitate will not pass the felt or sponge; thirdly

animal and vegetable molecules will be left ind in the fourth pot. The charcoal in the third will deprive the water passing through it of all ns of disease, microbes, etc. In the second pot have placed sand or gravel as a filter to arrest animal and vegetable matter which may have ded first and second filtration. In the fourth you have provided a reservoir into which the ter, having undergone all the ordeals you have vided in the cause of health, may drip as it colates through to be drawn off as required m the gutta-percha pipe fixed to the hole in the tom of it; by placing the lower pot upon two cks laid side by side, with room for the tube ween them, this simple filter is completed, a k or wooden spigot closing the pipe when reired. It is necessary to take out the sponge or t every two or three weeks, and wash both it and inside of the upper pot, then replacing. It uld be better to add the chemical re-agent to the ter in a separate vessel, leaving it to precipitate fore putting it into the filter; and the proportion ist be very accurately ascertained, or the remedy y be worse than the evil itself. In many cases ses, such as carbonic anhydride, passed through e water will effect the precipitation without ving any taste in the water, especially as the rbon deodorises it and deprives it of taste. Do t paint your flower pots either inside or out, and not use glazed vessels, as the percolation of ater through them "sweating," as it is termed, eps the water deliciously cool; and do not use the tered water for a few days, until it loses the ightly earthy taste it will naturally have at first. he cement should be broken away and both avel and charcoal cleaned and washed about very six months, or oftener if the water is very pure, and re-cemented. Such a filter ought not cost more than fourteen or fifteen pence.—. W. H.

Door of Greenhouse.—A. X. E. (*Nottingham*) rites:—"On page 812, Vol. I., *re* 'Door of Greenouse,' described by G. LE B., there is an illustraion given of part of belt rail and diminished tile of above. I think if the illustration had een the other way upwards it would have been nore easily understood, narrow part at top, as hen hung. Is that so, or am I mistaken?"—You re quite right in your conjecture that the narrow nd of the stile should have been uppermost. The rinter inadvertently turned the illustration upside lown, and this has, no doubt, been the cause of ogging the brains of others besides yourself, for s it appears you would either have to stand on our head or turn the paper upside down to enable ou to grasp the meaning of the thing. See reply n same subject to PHI, in "Shop" column of No. 71. —G. LE B.

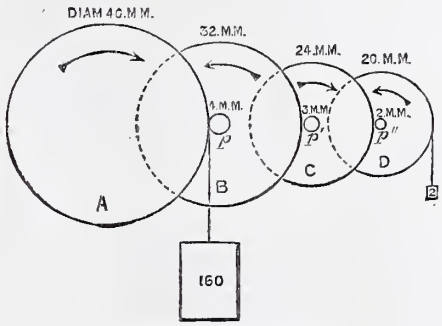
Pebbles.—NOVICE.—I am always glad to read such letters as yours, as I am a thorough believer in "hobbies;" I know every one is happier for having something to take an interest in and devote his spare time to, and not only does it add to his enjoyment, but enlarges his mind, and many of the highest authorities, in their different branches, began the study as a leisure time amusement. As an example in your own particular hobby, Professor Geikie says he "began to learn his geological lessons when a schoolboy; but it was not from books that he learnt them. The mere accident of finding some fossils during a half-holiday excursion turned his thoughts towards such subjects, which soon became the chief employment of his leisure. He can look back upon these country rambles in search of fossils and rocks, not only as among the happiest hours of his life, but as having been of the utmost importance ever since." I hope this may induce you to take up the study of geology. I do not know of any books solely upon pebbles, but why confine yourself to these? Your specimens are in no way extraordinary, and I feel sure you would derive more advantage from the study of the whole than of a small part—that is, of course, if your taste lies in that direction. Get one of the "Science Primers," price 1s., Macmillan & Co.: that upon geology by Professor Geikie; you can afterwards turn to larger works. You will find some excellent lessons upon the subject in "Cassell's Popular Educator." Instructions for forming a collection must stand over just for the present, as I have answered you so fully upon the other parts of your letter; in the meantime, visit a good museum, and that, perhaps, will teach you better than several letters. As for the best means of preparing them, I hardly know what you mean; geological specimens require little or no preparation, but I observe some of your pebbles are partly polished, is that (the polishing) what you require information upon? If so, write again, and I will explain the process.—W. E. D. JR.

Steel Straightedge.—MEUX QUE CA.—Any engineer, or almost any working fitter at home, would do this job for you. Perhaps your best course would be to go to Hindley, of Bourton, being near your home, and ask his price for planing the steel edge. I should get a thoroughly dry bit of stuff, say an old straightedge, screw my strip of steel on it, and then have it *planed in place*—not plane it first and screw it afterwards. Insert screws at distances of every 2 or 2½ in.—J.

Spring for Model.—A. E. W. (*Birmingham*).—A watch and clock maker can supply you with such a spring for a shilling or two.—J.

Ornamental Ironwork.—G. R. (*Dorchester*).—You can work thin sheet iron upon a pitch bed with hammer and punches. A good deal would be also done in the vice, using pliers and hammers; for repetition work, moulds and formers would be prepared; grooves and veinings would be done with sets, hollows, and depressions, with round fullers. For large work, the earthen floor scooped out roughly to shape would form a mould or bed into which the sheet metal would be hammered. Each workman would to a large extent invent his own methods.—J.

Pendulum for Clock.—CLOCK.—I have not a back number of WORK to refer to, but I believe you wanted to put a shorter pendulum to a clock to go in a smaller case. Upon calculating the present train, I find it has a 9·11 in. pendulum, and you require a 5·75; here is the method of calculating:—Present train is 84, 70, 36 wheels, and the pinions are both 7. Now $84 \times 70 \times (36 \times 2) \div 7 \times 7 = 8{,}640$ vibrations per hour, which divided by 60 (minutes per hour) gives 124 per minute. A seconds pendulum gives 3,600 vibrations per hour, which multiplied by the length, 39·2 in. = 141,120. Now divide this by $124^2 = 9{\cdot}11$ in.—the length of present pendulum. A shorter way to write it is:—$84 \times 70 \times (36 \times 2) \div 7 \times 7 \div 60 = 124$; $141{,}120{\cdot}0 \div 124^2 = 9{\cdot}11$ in. Now to find a train suitable for a 4·7 pendulum, for the length is calculated to the centre of bob, or near enough for all practical purposes. I think by taking off the third wheel of 70, and putting one the same size of 84, then turning the 'scape wheel pinion down a little to suit, you will find a pendulum of 4·7 in. will keep time. To prove it so, calculate thus:—$84 \times 84 \times (36 \times 2)$ (that is twice the number of 'scape teeth) $\div 7 \times 7 = 10{,}368 \div 60 = 172{\cdot}8$; now $141{,}120{\cdot}0 \div 172{\cdot}8^2 = 4{\cdot}7$ in. from centre of pendulum spring to centre of ball; let your ball be about 1·5 in. in diameter, and that will suit you, I think, very well; I prefer a heavy to a light ball; the size of the pinion



Pendulum for Clock.

should be 3 full teeth of the wheel, but a little larger or smaller will not hurt, providing it does not butt or bind. Now to calculate the weight required to drive a clock. The following I take from Sauveur, page 600. "In a train of wheels and pinions the *power is to the resistance as the product of the radii of the pinions is to the product of the radii of the wheels*, if we neglect friction; and the approximate *ratio of the power to the resistance, ignoring friction, may be found by measuring the space traversed by the two forces; these forces are to each other inversely as the spaces.*" Let A, B, C, D be a train of wheels; assume a weight of 160 to be suspended to the circumference of A; the radius of B is four times that of its pinion *p*. Thus the force transmitted by B if reduced by ¾ becomes 40; the radii of C and D are 4 or 5 times the radii of their pinions; the force transmitted by C is then only ¼ of 40, or 10, and that by D is ⅛ of 10, or 2; if then a weight of 2 be suspended from D, it will balance a weight of 160 at A: the power is to the resistance :: 1 : 80. By calculating we should have had—Product of radii of wheels $16 \times 12 \times 10 = 1{,}920$; product of radii of pinions $4 \times 3 \times 2 = 24$. Hence P : R :: 24 : 1,920 and we have 24 : 1,920 :: 1 : x = 80. On calculating the velocities of the wheels, we see that D makes 160 revolutions while A makes 1. To determine the space traversed by a point on the circumference of A in the one revolution, we have $40 \times 3{\cdot}14 \times 1 = 125{\cdot}6$, and for a point on the circumference of D during the 160 revolutions $20 \times 3{\cdot}14 \times 160 = 10{,}048$. But 125·6 : 10,048 :: 1 : 80. The result, then, is the same as above. I trust from the foregoing you will be able to calculate your train and weight. To get a wheel, take off the one next the 'scape wheel, send it to Grimshaw & Co., 35, Goswell Road, Clerkenwell, or Haswell & Sons, 49, Spencer Street, Clerkenwell, and ask them to cut one exactly the same, but 84 teeth instead of 70; then fix it on an old collet and your job is done. That will save altering or making new pallets, which you would have to do if you put a new 'scape wheel. The wheel would cost about 1s. 6d or 2s.; to take it to a clockmaker they would probably charge you from 6s. to 7s., or more if a striking clock, but that would include cleaning, etc. I trust you will be able to do the job yourself, and should be pleased to hear the result, or to advise further.—A. B. C.

Electric Time Alarum.—W. J. W. (*Sussex*).—The simple contrivance for an electric time alarum sent by you is very creditable, but your description and diagrams are not sufficiently clear to insert in "Shop."—ED.

Varnish Stain out of Drawing.—This can be done only by an expert; it is impossible to take the varnish stain out without the use of spirit, and with the greatest care the sepia drawing would be so impaired as to require restoring. The best man I can recommend in your district is Tom Wood, printseller, Darlington.—F. B.

McLeod's Practical Hints for Draughtsmen.—W. L. V. (*Penge*).—I never heard of the book you inquire about. Write, however, to Messrs. Lockwood & Co., Stationers' Hall Court, London, E.C., who publish Weale's technical books, and they might obtain it for you.—J. W. H.

Soldering Fountain.—E. H. B. (*Stoke Newington, N.*).—If you are "easily able to make a joint where the two pieces are of one metal," you will have no difficulty in soldering diverse metals, as there is no material difference in the process, except in the fluxing—that is to say, for brass you must use "killed" spirits of salts, while for zinc you use raw spirits of salts. You will not need to dip the legs of fountain at all. Mark the position of the joint, and tin a ring of solder at that point; then just touch the surface of the zinc with the raw spirits, and solder up together.—C. M. W.

Fountain.—F. R. H. (*Andover*).—The cost of the self-acting fountain described in No. 69 of WORK would depend upon the kind of workman employed; the materials would cost about 7s. 6d., exclusive of ferns. I am unable to give you the name of any one in these columns who would make one.—C. M. W.

Tent Making.—LONDON.—The easiest tent to make and use, on the whole, is what is termed a "canopy" tent, and while presenting an attractive appearance is sufficiently substantial for garden purposes. It is square in plan, tapering to a square shoulder and thence to a point. Striped canvas forms a suitable material, and is shower proof. For three or four persons, a convenient size would be 6 ft. each way at base, 3 ft. each way at shoulder; height from base to shoulder, 6 ft. 6 in.; height from shoulder to point, 2 ft. 6 in.; the centre pole 9 ft. 9 in., allowing 6 in. to go into the ground and 3 in. projecting through the top. One side of the canvas is detached up to the shoulder, and is held up open by two poles to required height, forming a canopy in front of tent. The canvas at base should be made fast to equal size lengths of wood on the inside, and provision made for pegging down the same. No outside lines are required. Of course, this is intended as a fine weather tent, and not to stand much wind, and is easily put up or taken down, the shoulder frame being hinged to the pole; thus when opened it assumes its proper shape, by being bulged out at that point.—C. M. W.

Work on Bricks and Tiles.—T. H. W. (*Leytonstone*).—You should get the following books:—"Manufacture of Bricks, Tiles, Terra-cotta, etc." by C. T. Davis, 8vo, 25s. (LOW); "Bricks and Tiles: Rudimentary Treatise," by E. Dobson, 3s. (Lockwood).

Photo-zinco Blocks.—AMATEUR (*Dover*).—I should advise AMATEUR, if he wants a fairly good zinco block, to send to Mr. John Swain, Farringdon Street, or to Hare & Co., Limited, Bride Lane, Fleet Street, his photo of shop front. If he prefers to try this process himself, he will have to undergo a long series of experiments before he succeeds at all. Any description of it, to be of any value at all to AMATEUR, would be too long and intricate for "Shop," but he will find it carefully and minutely described in one of Wyman's "Technical Series," "Zincography," by Josef Bock, 2s 6d., of any bookseller, or by post from 65, Chancery Lane.—J. W. H.

Heliographs.—W. C. Y. C. (*Walthamstow*).—A paper on this subject is in preparation, and as not only it would "rob its sails of the wind," but would also involve far too long a description for the space in "Shop" at my disposal to give it now, please wait as patiently as you can.—J. W. H.

Parcel Labels.—C. Y. H. O. (*Birmingham*).—Apply for prices, etc., to any large firm of wholesale stationers in your town, or write to Waterlow and Sons, London Wall, E.C.—J. W. H.

Telephone.—B. S. (*Reading*).—It was quite a pleasure to receive your letter. I am glad you have succeeded in making your telephones from the instructions given in No. 28 of WORK. If you will turn up that article again you will find that two such instruments were simply joined together, and that no battery was used, and that by applying one of them to the ear a feeble imitation of the distant speaker's voice was heard, providing, of course, that some one was speaking at the other end. Try joining up your telephones in this way and note the effects. In telephone practice, however, the case is quite different, for the sound emitted by the receiver is much too feeble to be of any practical use. A transmitter, generally of carbon, a modification of Professor Hughes's instrument given in the telephone article, is used for intensifying the sound, and with this arrangement a battery is required. See recent numbers for telephone transmitters, especially No. 55, page 45. These, with the receivers, are generally mounted on a switch-board, which has also a call bell included for convenience. An article containing instructions for this part of the subject is in the Editor's hands, and will, no doubt, be a help to you. By the way, however, you will be infringing upon the rights of the Bell Telephone Company by using the combination referred to for business purposes.—W. D.

Cells for Electric Bells.—A. B. (*Battersea*).—In calculating the number of cells needed to ring a certain number of bells in a house, it is necessary to take into consideration the total resistance of the circuit together with the volume of current required to ring the bells. A great variation exists in electric bells; some will ring well with 0·25 ampère, others take 0·50 or even 0·75 ampère of current to ring them. Much of this depends upon the size and length of wire used on the magnets. We must, therefore, place enough cells in series to furnish sufficient pushing power to force the requisite volume of current through the resistances of line, fittings, and bells. First find the total resistance of the circuit in ohms, and add to this the resistance of each cell in the proposed battery; divide the total sum by 1·50, and thus find the approximate number of cells. Next multiply 1·50 by the number of cells to be used, and divide the sum by the total resistances. The result will give the volume of current in ampères, and we shall then know whether we have enough to ring the bell or not. If not, we must add more cells in series. When a large number of bells are to be fixed in a house, as in the examples given in your letter, it is only necessary to estimate the total resistance of the circuit for the most distant bell, or that offering the most resistance. As all the others will be branches of the main lines their resistances may be disregarded. If it is supposed that several bells will be rung at one and the same time we must employ a battery with large cells, or couple the cells in parallel to furnish the necessary volume of current. The largest size Leclanché cells should be used where a number of bells are employed. A battery of three or four cells in series is usually enough for all purposes, but any number may be used in parallel if it is desired to build up a strong battery to meet the demand for a large volume of current.—G. E. B.

Electrotyping Bath.—A. H. O. (*Lewisham*).—An electrotyping bath gets out of order from standing idle, because the sulphate of copper solution has a greater density than the free acid and water in the bath. The solution settles down into stratas of different density, with too much free acid near the surface. The remedy is to well stir up the bath with a clean stick two or three times before commencing the work, allowing the sediment to settle down between each operation. If it has lost some of its bulk by evaporation, add enough rain water to make it up to its original bulk.—G. E. B.

Bicycle Gearing Method.—A WELL-WISHER.—The rule to find the gearing up or down of a safety bicycle or tricycle is a very simple arithmetical one. Take the diameter of the driving wheel, say 30 in., multiply this by the number of teeth on the chain wheel, that is the bottom bracket chain wheel, then divide the sum thus obtained by the number of teeth on the driving hub cog; the result will give the geared up diameter. Example 1—

Driving wheel	30 in.
Lower chain wheel teeth	18
	240
	30
Hub cog teeth	9)540
Result	60 in., or geared double.

Example 2—

Driving wheel	30 in.
Lower chain wheel teeth	15
	150
	30
Hub cog teeth	9)450
Result	50 in.

Example 3—

Driving wheel	32 in.
Lower chain wheel teeth	16
	192
	32
Hub cog teeth	8)512
Result	64 in.

A. S. P.

Work Index and Covers.—A. J. T. (*Holborn*).—These are and will be issued by Messrs. Cassell & Co., Limited, on the completion of each volume, and are obtainable from the publishers or of any bookseller.

Machine Book.—F. G. H. (*Erith*).—I do not think there is such a book. May I suggest that possibly one of the following is in your mind:—"The Complete Practical Machinist," by Joshua Rose, price 2 dollars 50 cents. "The Modern Practice of American Machinists and Engineers," price 2 dollars 50 cents. These can be obtained through Trübner of Ludgate Hill, E.C. "The Mechanician and Constructor," by C. Knight, price 18s., published by Spon.—J.

Glass Silvering.—C. H. G. (*Liverpool*).—You ask for directions to silver glass, but do not say if you want to do it upon a large scale, such as for trade purposes, or only as an amateur; I conclude the latter, but if I am not right, kindly let me know through "Shop," explaining fully what size pieces you wish to do, and whether plate, crown, or window glass. The following is a cheap and simple method of silvering small pieces of glass for common purposes:—Take a piece of glass the size wanted (window glass will do if only a small size is required), wash and clean thoroughly, as every dirty spot will show only too plainly when finished. Take a piece of tin-foil; cut it a little larger than the glass, say ½ in. or 1 in. larger each way; smooth all the creases out, and lay upon a flat board or table; cover it all over with mercury (quicksilver); now cover it with a piece of clean paper, then lay the glass on the paper, and, holding it firm with one hand, draw the paper out with the other, when it will bring away the greater part of the mercury, together with the air bubbles and dirt; weight it down, and let it lay until the next day; then lean it against the wall with a piece of foil underneath, to draw all the mercury out, and let it be a little longer to set. Cheap glasses are also silvered with chemicals, but I do not think you would succeed so well; but if you wish to try I will give you a recipe if you write again.—W. E. D., JR.

Cutting Patterns.—TINNER.—I will endeavour to meet your requirements at some period of the articles now appearing on sheet metal work, but cannot state precisely when it will appear.—R. A.

Guitar Making.—C. R.—I will give instructions how to make a guitar as soon as possible; I must polish off the banjo article first. You might get some information if you read the article on mandoline making in WORK No. 66, page 229. The information will apply to the guitar in nearly everything excepting shape.—J. G. W.

Silver for Banjo.—W. H. B. (*Leicester*).—You can purchase sheet German silver from Mr. Hillcocks, 20, Endell Street, Long Acre, London, W.C. You had better write to him for prices, which I have no doubt he will be pleased to give you. The harp is not in my line.—J. G. W.

Antimonial Lead.—JAY DEE.—One part of antimony to four to eight parts of lead will suit your purpose. Guettier's "Practical Guide for the Manufacture of Metallic Alloys," published by Sampson, Low & Marston, London, is perhaps the best practical book on the subject. I do not know the price of it: probably about 3s. 6d. Another good book is Bloxam's "Metals; their Properties and Treatment," published by Longmans, Green, & Co., London, price 3s. 6d. A large and complete book on the subject is Phillips' "Elements of Metallurgy," published by Charles Griffin & Co., Exeter Street, Strand, London, at 36s. Write to Cassell & Co., London, E.C., who will send you a catalogue of their books post free.—F. B. C.

Gas Meter.—H. E. (*Clapham*).—The top dial as a rule only indicates single feet, that is to say, that when the hand has gone from 1 to 2 the meter has registered one foot of gas, and so on. It is useful for testing an escape, as you surmise, in this way. If it is feared that there is an escape or leakage, see that there are no lights burning, and then examine the top dial, and if the hand moves you may be sure there is something wrong somewhere. A simple way for you to test what I say would be to light a burner that you know the number of -for instance, one that has 5 rings turned on the brass just below the earthenware shows that it is supposed to burn 5 ft. per hour, and so on, but the burners are mostly marked with a figure instead. After lighting the gas, take the state of the top dial of the meter, letting the gas burn for half an hour, and if at the end of half an hour the hand is somewhere between 2 and 3, you can take it that there is nothing much amiss—that is, if you have used a No. 5 burner.—E. D.

Toy Balloons.—R. K. (*Burnley*).—The toy balloons require the very thinnest paper and nice work in the making. I do not know why yours failed; according to your account you were very nearly successful, so I can only recommend you to try again, bearing the above remarks well in mind.—OPIFEX.

Advertisements in WORK.—G. H. M. (*Lower Clapton*).—Thanks for your long letter. At present the question of arrangement of the pages of WORK as regards advertisements must be left with the publishers.

Brass Castings.—C. W. J. (*Clapham Common*).—Articles on brass castings will form a portion of a series on "Moulding" to be taken up at some future time. The only book I can confidently recommend is Spretson's "Casting and Founding," published by Spon, 18s., but brass work occupies a small portion only of the work. There are others, but not of much value.—J.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. R. (*Chelmsford*); G. F. R. (*Barking*); G. G. H. R. (*Norfolk*); G. M. (*Duffield*); H. D. B. (*Enfield*); J. C. M. (*Exeter*); T. H. (*Tooting*); W. L. T. (*Leeds*); A. E. T. (*London, E.C.*); A. L. (*York*); S. B. E.; STEREOTYPE; J. M. J. (*Edinburgh*); J. S. (*Ilminster*); J. K. (*London, E.*); H. P. C. (*Blackrock*); READER OF "WORK"; W. N. (*London, N.*); A. M. (*London, W.*); H. F. (*London, W.*); T. J. O. (*London, W.*); F. G. (*Essex*); E. A. W. (*London, W.*); S. P. (*Middlesboro'*); J. McL. (*Govan*); N. H. (*Manchester*); C. E. S. (*Shipley*); J. E. N. B. (*Keighley*); T. C. (*Yeovil*); A. G. (*Plaistow*); F. H. (*Streatham Hill*); R. A. (*Islington*); R. B. (*Hertford*); T. A. W. (*Kilburn*); A. C. (*Peterboro'*); F. D. (*Dartmouth*); SOUTH STAFFORDSHIRE; J. M. E. (*Openshaw*); F. A. (*Peckham*); H. H. (*London, E.C.*); G. A. DE R. (*Forest Gate*); H. E. (*London, S.W.*); J. H. H. (*Manchester*; J. R. H. (*Carnforth*); SIDE LEVER; J. L. (*New Wigan*); HURO; ENGINEER, AQUA; J. B. (*Darlington*); G. C. (*Salford*); AMATEUR; CONSTANT READER; G. A. D. (*Bradford*); E. W. M. (*Kentish Town*); W. B. (*Hull*); R. V. (*Bow*); A. S. B. (*Corstorphine*); R. A. (*Islington*); R. H. P. (*Redruth*); W. C. C. (*Finsbury Park*); G. H. (*London, E.C.*); C. H. L. (*Bradford*); ELECTRO; R. J. W. (*Fulham*); H. S. GREENFIELD; FISHPONDS; STUDENT; ENGINEER; F. J. P. (*West Bromwich*); CARINO; G. A. B. (*Stoninydale*); J. P. (*Byker-on-Tyne*); "AB UNO DISCE OMNES"; BLACKSMITH; A. H. F. (*Cheltenham*); TELEPHONE; A. S. (*Musselburgh*); W. V. (*Birmingham*).

"WORK" EXHIBITION.

(1890-91).

For Classification, Prize List, etc., see WORK Nos. 70 and 78.

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in pages 290 and 418 of this Magazine:—

For Design for Medal.

FIRST PRIZE	Two Guineas.
SECOND PRIZE	One Guinea.
THIRD PRIZE	Half-a-Guinea.

For Design for Certificate.

FIRST PRIZE	Two Guineas.
SECOND PRIZE	One Guinea.
THIRD PRIZE	Half-a-Guinea.

If any Competitors wish to submit a Model in Clay, Plaster, Wax, etc., as a Design for Medal instead of a Drawing, they are at liberty to do so.

Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

Prize Competition.
Medal (or Certificate, as the case may be.)

A Motto must be affixed to each Drawing, and the name and address of the sender enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted to three competent judges, who will select those that are considered most worthy of prizes.

The Prize Drawings will become the property of Messrs. CASSELL & COMPANY, Limited, who will return all Designs made by unsuccessful competitors to their respective owners carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced in WORK in due course.

For further particulars, all intending competitors should apply to the Secretary, "WORK" Exhibition, CASSELL & COMPANY, Limited, as above, stating which competition they intend to contest.

N.B.—Any Competitor, whether successful or not, is at liberty to exhibit his designs at the forthcoming WORK Exhibition, on filling in the proper application form for space; and success in this Competition will be held to be no bar to his receiving honours if awarded by the Jurors in addition to the above Prizes, but such forms must be filled in and forwarded previous to the 30th of Sept. to the Secretary, WORK Exhibition, as above.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL AND COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

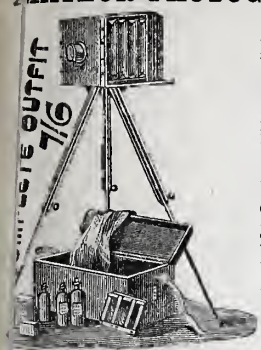
Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [14 R

Christmas Presents.—Locket Miniatures on Ivory: plain, 2s.; beautifully coloured, 3s. 6d.; send photo with postal order and size of locket; money returned in full if not perfectly satisfactory.—ETHELBERT HENRY, Alvaston, Derby. [1 S

Water Motors! Castings, list 2d.—P. PITMAN & Co., Aubrey Road, Withington, Manchester. [2 S

Buyers of Lathes and other Tools send 3d. for list of Second-hand Tools.—BRITANNIA WORKS, Colchester; or inspect largest stock in London, 100, Houndsditch. [16 R

AMATEUR PHOTOGRAPHY.—**J. H. SKINNER & CO.,** *W Department, East Dereham, Norfolk.*



J. H. S. & Co., have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every descr ption.

CHEAP SETS FOR BEGINNERS.

3/6 The Eclipse Camera Set. 3/6
Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a g od Photogr ph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6
Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring dack, Se sitised Albuminised Paper, Gold Toning Solution, Fi ing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6
Including Polished Mahogany Camera, with Folding Tail-ird, Brass Sid Bar, and Double Dark Slide in hardwood box, with leather strap, in all other pects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to 00. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of eipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., 20 per cent. to 50 per cent. discount to clear. Send post card for Sale List.

SPRING CLEANING.

SEND 3d. IN STAMPS
FOR LIST OF
SECOND-HAND ENGINES
(Gas or Steam),
AMATEUR TOOLS, &c.
Cash or Easy Terms.

FULL CATALOGUE, 6d.

BRITANNIA CO., 100, Houndsditch, London.
All letters—BRITANNIA WORKS, COLCHESTER.

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets, containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,
TOOL MAKERS,
DUBLIN.

ESTABLISHED 1851.

BIRKBECK BANK.
Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

NOTICE.—With Nos. 365 and 366 of **CASSELL'S SATURDAY JOURNAL,** price ONE PENNY each, published on SEPT. 24 and OCT. 1 respectively, and forming the commencement of a New Volume, will be

GIVEN AWAY

the Celebrated Sensational Copyright Novel, entitled

"DEAD MAN'S ROCK,"

By Q. Author of "The Splendid Spur," etc.

Each of these Numbers will consist of **48 Pages,** and the Novel will thus be given in addition to the usual contents of the Journal.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

KING'S COLLEGE, LONDON.
WOOD CARVING.
DEPARTMENT OF TECHNICAL INSTRUCTION.

CLASSES for instruction in Wood Carving will be held during the ensuing Autumn (beginning October 6) at King's College, in the Strand, under the joint direction of the Carpenters' Company and the Council of King's College.

For particulars apply to J. W. CUNNINGHAM, ESQ., King's College, London; or to S. W. PRESTON, ESQ., Carpenters' Hall, London Wall.

DEPARTMENT OF TECHNICAL INSTRUCTION.
KING'S COLLEGE, LONDON.
BUILDING CONSTRUCTION and ARCHITECTURE, DRAWING CLASSES, an CLASSES of DESIGN.

LECTURES and CLASSES for these subjects will be held during the ensuing Autumn (beginning October 6) at King's College, in the Strand, under the joint direction of the Carpenters' Company and the Council of King's College.

For particulars apply to J. W. CUNNINGHAM, ESQ., King's College, London; or to S. W. PRESTON, ESQ., Carpenters' Hall, London Wall.

"A work which satisfies a real want."—*Standard.*

In Monthly Parts, price ***1s.*** each,

The Rivers of Great Britain

Descriptive, Historical, Pictorial.

With Several Hundred Original Illustrations.

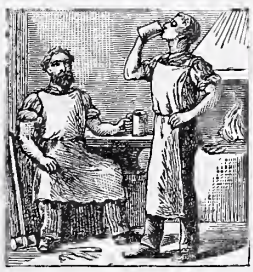
Part 1 ready SEPT. 25.

Prospectuses now ready at all Booksellers'.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

DELICIOUS

TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer. Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

☞ ***CHEAP EDITION,*** *in Monthly Parts, price* ***3d.***

HEROES of BRITAIN in PEACE and WAR.

WITH 300 ILLUSTRATIONS.

Part 1 ready SEPT. 25.

"An intensely interesting work for young and old."—*Broad Arrow.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Bovril

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6d. OR FOR 7 STAMPS.
BIRMINGHAM. [33

London Warehouse: 124, NEWGATE STREET.

HENRY MILNES,

MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic **WEAKNESS** speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,

President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS

Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

Sufferers should call without delay, and inspect the *Thousands of Testimonials* received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,

52, OXFORD ST., LONDON, W.

(Corner of Rathbone Place),

All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

A Four Page Supplement is issued Gratis with this Number.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

Vol. II.—No. 79.] SATURDAY, SEPTEMBER 20, 1890. [Price One Penny.

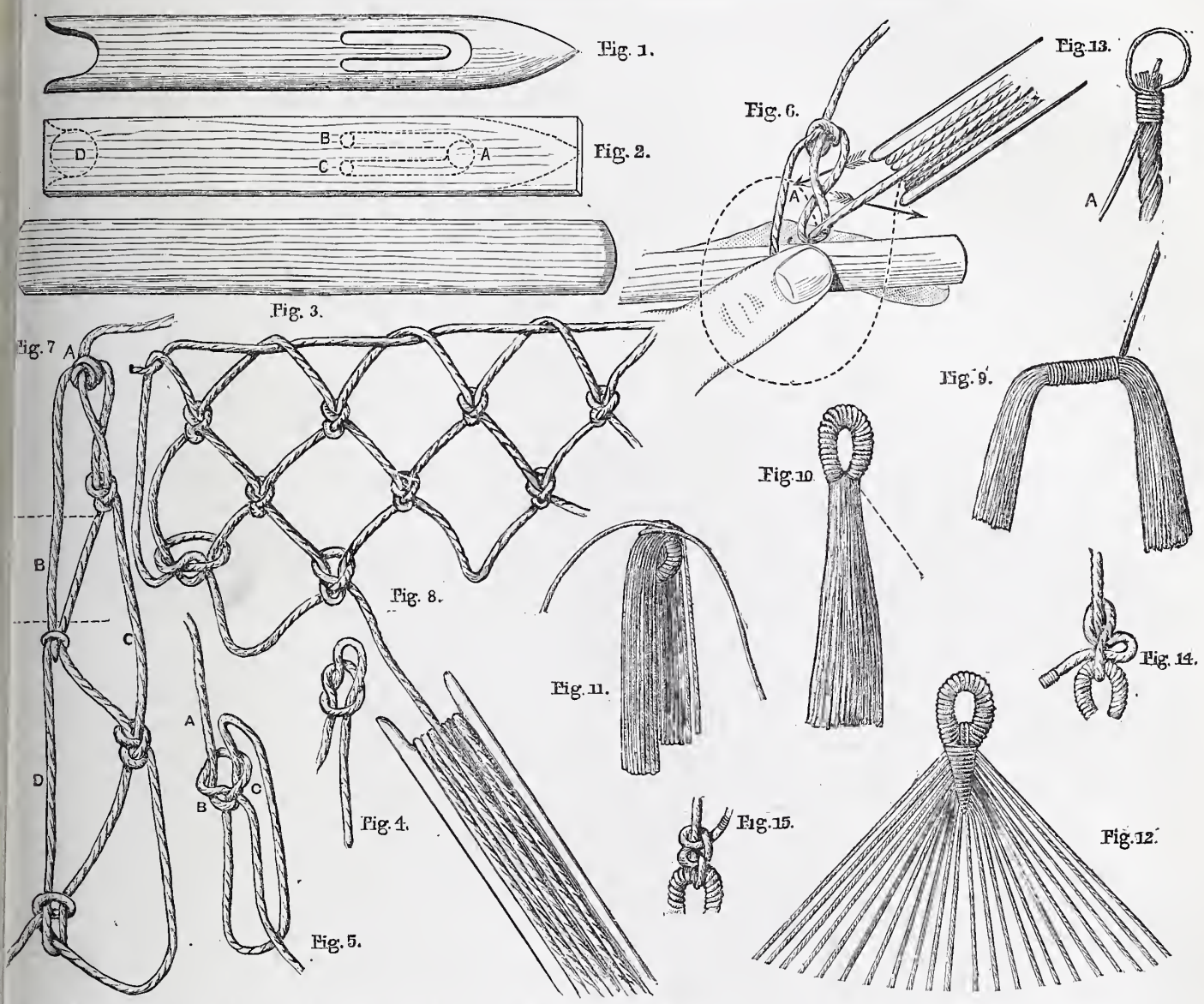


Fig. 1.—Netting Needle finished. Fig. 2.—Needle marked out on Wood. Fig. 3.—Mesh-stick. Fig. 4.—Noose to go over Tongue of Needle. Fig. 5.—Becket Stitch to start First Mesh. Fig. 6.—How to make the Mesh. Fig. 7.—First Chain of Meshes. Fig. 8.—How to make Second Row of Meshes. Fig. 9.—Bundle of Nettle Cords to form Clew. Fig. 10.—Bound Bundle of Cords turned to form Eye of Clew. Fig. 11.—How to form Head of Clew. Fig. 12.—Hammock Clew complete. Fig. 13.—How to whip Ends of Cords. Fig. 14.—Looped Half-Hitch. Fig. 15.—Anchor Bend Hitch.

HOW TO NET A GARDEN HAMMOCK.

BY G. E. BONNEY.

In netting a garden hammock, two sources of pleasure are opened up to the worker. First he has a pleasant occupation for long winter evenings in netting the hammock by his own fireside, and, whilst doing so, can look forward with pleasurable anticipation to the time when he will be able to enjoy the fruits of his labours. Then will come the long summer evenings, when, reclining at ease in his airy couch, slung between two trees in his garden, he can enjoy the shady coolness of the arboreal retreat, and read, or smoke, or doze away the time whilst taking a well-earned rest.

The tools required in the occupation of netting (of which this is one example) are very few, of simple construction, easily made at home, and of low cost. They consist of (1) a netting needle and (2) a mesh-stick. The materials also cost very little, since they are simply some stout twine and a few yards of fine cord. Almost any stout twine may be used, providing it is strong enough to bear a person's weight when made into a net. Whip-cord is a very good strong material, but it is rather costly. Macramè cord is also very good, but this is too costly for the purpose, as it would take several sixpenny balls to make a hammock. If whip-cord

is chosen, it will be best to buy it in quantity by the pound, since it can be got at less price than when bought in balls. One of the best and cheapest materials is that of soft three-cord packing-twine of smooth and even texture throughout. The stiff, rough, and lumpy varieties are altogether unsuitable. A good soft three-cord twine for the purpose will cost about 3s. per lb. Those who can afford it will find the macramè cord a most superior article, as it is soft, strong, and very durable.

The Netting Needle.—This tool, shown in Fig. 1, may be bought at any shop where fishing-tackle is sold, or it may be easily made at home out of a strip of thin oak, holly, hornbeam, ash, or other tough close-grained wood. Lancewood is one of the best materials. The length and width of the needle may vary from 5 in. by ½ in. for small meshes, to one measuring 10 in. by 1 in. for use with such large meshes as those generally adopted in making garden hammocks. First rough out the wood to the required length, width, and thickness. The thickness of the needle should not exceed $\frac{3}{16}$ in. Bore a ¼ in. hole with a centre-bit at A in Fig. 2, a $\frac{3}{16}$ in. hole at B, and another at C. Also bore a ½ in. hole with the same tool at D. Next cut out the pieces enclosed by the dotted lines. This may be done with a fret saw, but I have done it with a good pocket-knife, and with the same handy tool have smoothed and trimmed the various parts to shape, as shown in Fig. 1. The slots in the head and at the tail of the needle are receptacles for the netting-twine, and must be cut to a length proportionate to the size of the needle. The head-slot should be 2¾ in. for a 10-in. needle. Persons accustomed to the use of the chisel, or a small smoothing-plane, may use either of these tools in trimming the needle to its proper shape. It should then be made quite smooth with glass-paper.

The Mesh-stick.—This is the tool for forming the mesh of the netting, and is made to the shape shown at Fig. 3 out of any strip of hard wood, such as that used in making the needle; or it may be of bone, whalebone, or ivory. About 8 in. will be found a convenient length for this tool. Its width must be determined by the width of the mesh to be made, the rule being to have the width of the stick nearly half the length of the mesh. That is, supposing we wish to make a mesh 2 in. in length when stretched out, or measuring 1 in. across when in diamond form, we should use a mesh-stick only ⅞ in. in width.

How to fill the Needle.—To fill the needle with netting-twine, we must first make a running knot and loop or noose in one end of the twine, as shown at Fig. 4, pass this over the tang in the head-slot of the needle, and draw it tight. Pass the twine down one side of the needle, over the tail-slot, up the other side, and over the tang in the head-slot; then back again down the same side of the needle, over the tail-slot, and up the other side. Thus proceed, first one side, then the other, alternately, passing the twine over the tang in the head-slot each time, and laying it carefully side by side, and tight, along the needle until the slot will hold no more. Wind it regularly and tight, so as to get as much twine as possible on the needle without making it bulge out with twine at the sides when the head-slot is full, because a bulky needleful is not so easy to get through the meshes as one neatly wound. When the needle is full, cut the twine off from the ball.

How to make the Mesh.—Take from 4 to 5 in. of the end of the netting-twine and, at 4 in. from the end, make a bend as shown at A, Fig. 5. Pinch this between the tips of the thumb and forefinger of the left hand to form a loop, pass the needle with the right hand through this loop at B, and draw the twine through until another loop is formed large enough for the first mesh. Then grip the bend at B between the finger and thumb of the left hand, to hold the twine in its proper position, pass the needle around the back of the bend B, and bring its head out through the loop C. This will form the knot, as shown in the figure, which must then be drawn tight, when it will assume the appearance shown in Fig. 7, and the first mesh is made. Next tie the free end of the twine to a nail or hook, or get some one to hold it whilst the next few meshes are made. Take the mesh-stick in the left hand, and lay it against the twine in the position shown at Fig. 7. The mesh-stick should lie easily in the crotch of the left hand, between the forefinger and the thumb, which should hold the twine against the mesh-stick, as shown in Fig. 6, the loop of the first mesh being also under the command of the finger and thumb. This will give the right size to the mesh, as it will then be in length twice the width of the stick. Whilst held in this position, the slack of the twine is to be dextrously thrown over the knuckle of the left thumb by a backward movement of the right hand holding the needle. The head of the needle is passed through the mesh at A, Fig. 6, passed behind the slack of the twine, and then drawn tight, whilst the left hand maintains its hold of the mesh-stick, and the finger and thumb of the left hand its grip on the bend of the first loop. At first this movement is not easily performed, for the left hand must not be allowed to relax its grip on the mesh-stick and mesh, the needle being altogether manipulated by the fingers of the right hand, much in the same way as an ordinary needle is used in sewing; the head of the needle being gripped between the thumb and forefinger, whilst the tail is held between the tips of the third and fourth fingers. A little practice, will, however, secure to the workman the needed dexterity. As a further aid, I have marked the several positions of the needle by arrows in Fig. 6. The first position is that shown by the direction of the needle after passing through the loop. The loop must now be pinched between the thumb and finger of the left hand, and the slack of the twine thrown back around the joint of the thumb, as shown by the dotted line. The point of the needle is now turned to the left, and made to pass out through the opening A. This done, it is turned to the right in the direction shown by the arrow, and the loop drawn tight to form the knot. I have purposely left some knots loose in Figs. 7 and 8, to show how they are made.

Having made the first mesh in the chain shown in Fig. 7, turn the chain over, place the mesh-stick on the part marked C, and knot the twine into the lower loop of the mesh B; this finished, turn the chain over again, place the mesh-stick on D, and knot the twine into the lower loop of C; proceed in a similar manner with the next mesh and all succeeding ones, until a chain of meshes have been made long enough to form the head of the hammock. The length of this must not be taken with the meshes stretched out as shown in Fig. 7, but must be estimated when the meshes are elongated in the other direction, as shown in Fig. 8. I cannot give the exact length—that is, the extreme width of the hammock—as this must be made to suit the occupant. As a guide to obtaining the width, I may say that it may be repre sented by the measurement from elbow t elbow around the back of the occupant. Thi for myself would be about 36 in.

When the end of the chain has bee reached, take a 3-ft. length of stout cord pass it in and out the meshes as shown i Fig. 8, and tie the two ends together t form a ring, to act as a convenient holdfas whilst netting the remainder of the ham mock. This ring is placed over the ben knee of the workman whilst sitting down and connected to his foot by a looped piec of cord. As the hammock gets longer, th ring itself is passed over the foot, and th netting brought up over the knee. Whe the chain has been thus strung on the rin of cord, and the meshes stretched out t their proper shape, it will assume the ap pearance shown in Fig. 8. The chain mu now be turned over, to bring the last mes with its needle on the left-hand side, an then we proceed to put on another row o meshes, as shown in the figure, workin from left to right along the whole width o the hammock. When the other end reached, turn the netting over, and agai work from left to right. Thus go on, addin row to row until the required length ha been obtained, which must be, of cours that of the intended occupant, with a fe spare inches over. Just a few words c caution will not be out of place here. B careful to suit the size of mesh to the siz of twine selected for the netting. A fine size twine should have a fine mesh, to ensur the necessary strength. A three-cord twin will wear much longer than a twofold twin of the same size. Make the meshes of equa size throughout the whole hammock, or i will bag in some parts, and the bagged part will be the first to break, because of unequa strain on the meshes. Draw each kno tight as the mesh is made, and so secure i as the work proceeds. When one needlef of twine is used, join on the end of the nex needleful by a knot, made as shown i Fig. 6, or what is known as a becke hitch.

How to sling the Hammock.—A garde hammock is slung, by means of suitabl attachments at head and foot, between tw trees in the garden, or between two boughs c a large tree, or to the supports of the roof c a verandah, or between two tripods (one a head and the other at foot) secured by stou cords and tent-pegs. The body of the han mock having been netted, we must nex consider how we are to attach the nettin to the ropes by which it is to be slung Several methods of doing this may be sug gested:—(1) A ring of stout cord may b threaded in the meshes at head and foo as shown in Fig. 8, and the ends of this rin spliced together to form what sailors call grummet. To this the supporting rope may be fastened. (2) A short stout piece c rope may be passed through the meshes a head and foot, then turned to form an ey and spliced. A smaller eye may then b spliced at the other end to receive a hook or the end of a supporting rope. (3) A piec of stout ash or oak stick may be lashed t the meshes at head and foot of the ham mock, and a stout rope tied securely t each corner to form a support. This woul spread out the hammock, and would b perhaps, preferred by an invalid or a timi person to the others herein mentioned. (4 The usual and most approved metho however, of slinging a hammock is b means of attachments named "clews" a head and foot, and made as now describe Procure for each clew, twenty-two 40-i

lengths of cord, about the size of the stem of a clay pipe. Lay them all equally together to form a bundle, and prepare to bind them, as shown in Fig. 9. First take about 5 yards of netting-twine, and tie one end to a nail or hook driven in a post. Next take the bundle of cords in the left hand, and at a spot 3½ in. to the left of the middle of the bundle, lay about 3 in. of the netting-twine in among the cords, holding it firmly with the thumb of the left hand in this position. Draw the twine tight, and commence turning the bundle of cords so as to wind the twine closely around the bundle, as shown in Fig. 9, for a distance of 7 in. The first end of the twine will be held firmly under its coils; the other end must now be fastened off. Bend the part of the bundle so wound into the form of an eye, as shown in Fig. 10, with the free end of the whipping-twine to the right of the eye, as shown by the dotted lines. Pass the end through the eye, around the left side of the eye at the back, then through the eye again from the front, and bring it down sharp in the crotch of the eye. This will bring the two sides close together at the bottom. Pass the end once more through the eye from the front, and again pull it tight; then fasten off by taking a couple of turns around one of its own coils in under the crotch of the eye, out of sight among the down-hanging cords. The cords—or nettles, as they are named—must now be plaited, to assume the form shown in Fig. 12. To do this, take the bundle by the eye firmly in the left hand, and part the nettles equally in a transverse direction, as shown in Fig. 11, throwing eleven nettles over the back of the hand, and allowing eleven to hang in front. Next take the outside one of each group (that is, one to the left, and the other to the right), cross them both in the middle, as shown in the figure, and pull them down tight. Then proceed to cross all the others over these alternately, passing first one from the inside group over to the outside group, then one from the outside group over to the inside, until all the twenty have been made to change places. Next take the two outside ones of this twenty, cross them in the middle as at first, and pass the remaining eighteen from side to side alternately, pulling each down firmly with the right hand as they are crossed over. From these, select two more to cross in the middle, and throw the remaining sixteen across alternately as at first. Thus proceed with all the nettles, leaving two behind at each time, until all have been worked in; then tie the two remaining ones together twice, and the plaiting is complete. Each end of the nettle cords should now be whipped with sailmaker's twine, to prevent the strands from fraying out. To do this, take about a foot of sailmaker's twine in the right hand, and the end of the nettle in the left hand. Lay one end of the twine upward in among the strands at the end of the nettle, and bring it down straight for an inch or so, then grip it there with the thumb of the left hand. Take the other end of the twine, and lay it in downwards from the top, and grip this also with the thumb. Then proceed to wind on the twine over the end of the nettle, each coil close to the other, until the loop of twine, shown in Fig. 13, is too small to admit of being passed again over the end of the nettle. Then pull the end A down sharp, and so draw the loop tight around the end of the nettle, and cut off all loose ends close.

The nettles are secured to the hammock by a becket hitch into one or two or more meshes, and the clews, when thus attached and spread out, present the appearance shown in Fig. 12. The head and foot lines of the hammock—that is, the ropes which are employed to suspend it—are run through the eyes of the clews, and tied with a looped half-hitch, as shown in Fig. 14. When thus slung, the knot can be easily undone by pulling out the loop. Or it may be fastened by an anchor bend, as shown in Fig. 15.

If the owner of the hammock wishes to strengthen the sides, this may be done by running a stout cord through the meshes, as shown in Fig. 8, and lashing each mesh to the cord with sailmaker's twine. The hammock will be further strengthened if this cord is made to pass around the head and foot as well, as then the head and foot meshes will be relieved from strain. Experienced netters may be frequently seen working without a mesh-stick, using the fingers of the left hand to act as gauges to the size of the mesh; but I advise the novice to make for himself a stick, and use that in preference. In conclusion, I may just add that, having learned how to mesh a hammock, the workman may go on making other nets, only varying the size of tools and size of twine to his requirements.

BRICKLAYERS' WORK.

BY MUNIO.

Arches (*continued*).

The Elliptic Arch.

Draw the springing line A B (Fig. 41), and divide it into three equal parts at the points C, D, then with the radii C A, D B, and the centres C, D, describe the arcs A G, B F, making the chords A G and B F equal to C A and D B; draw F D and produce it to E, also draw G C, and produce it to E, then with the radius E G and the centre E draw the arc G F, set off the depth of the arch H A, and from the centres C, D, and E draw the outer arc; draw K I at right angles to A B, and set off on each side of I, half the thickness of the key, and draw lines radiating to E between the two curves; then divide the remainder of the outer curve into equal spaces the size of the key, and draw lines between the two curves, radiating to the centres from which the arch is struck; these divisions will be the moulds for the arch bricks. It will be evident that the intrados of the bricks in the lower part of the arch will be narrower than those in the upper part, and this is sometimes objected to, and the whole of the joints are made to radiate to the centre K, but when so done, the labour of cutting is very much increased and the strength of the arch decreased; when thus drawn, the soffit bevels may be taken in the same manner as those of the camber arch.

The Elliptic Gothic Arch.

Draw the springing line A B (Fig. 42), and divide it into four equal parts, at C, D, E, then with the radii C A, E B, and from the centres C and E, draw the curves A G, B H, making the chords A G and B H equal to C A and E B; draw D F perpendicular to A B, and make D F equal to the rise of the arch, then from the points H, F and G, F, with a radius equal to or longer than the springing line, draw curves intersecting each other in the points I and K, and from the points I and K, with the same radius, draw the remainder of the arch; set off the depth of the arch A L, and from the same centres draw the outer curves; set off half the width of key on each side of F M, drawing lines radiating to the centres, divide the remainder of the outer curve into equal spaces the size of the key, and from these points draw lines between the two curves radiating to the different centres. The same remarks as to the size of the intrados in the lower portion of the elliptic arch will apply to this arch, and sometimes the joints are all drawn to radiate to the centre D; but when so drawn the soffit bevels in a portion of the arch are very acute, and difficult to cut.

Setting.

In setting plain arches, the courses should be marked on the boards of the centre, to keep the courses parallel with the line of abutments, or the last course may be wider at one end than the other; the courses should be well bonded, and set with joints of one uniform thickness; the head or face of arch is set to a line strung between the abutments, or a line may be marked on the centre, and the work set to it; after one course is closed, it should be plastered over with a thin coat of mortar for the next course to rest on.

Rubbed and gauged work is set with fine putty; the bricks are dipped in the putty, which must be mixed to a proper consistency, and as soon as sufficient adheres, they are set; care must be used so as not to stain the face or soffit; any surplus putty which squeezes out of the joint in setting, must be left till it stiffens, when it can be cut off clean; the faces of the bricks are set to a line stretched along the wall, and the joints must be set to radiate to the centre, by having a cord fixed to a pin or nail at the centre from which it is struck. When this is inconvenient, a templet to lay on the centre (Fig. 43) can be used; the courses should also be marked on the centre, to prevent them gaining or losing.

Cut or axed arches are not dipped; the mortar is spread on the bricks by means of the trowel, and they are set in a similar manner to gauged arches; sometimes Portland cement is mixed with the putty.

Moulded Bricks.

Cornices, strings, and other ornamental work are cut by the bricklayer; the mould is marked on each side or edge of the brick after it is squared and gauged, and the mould is cut: but if a great number are to be cut, a box with open end is used, into which several bricks are fixed, and the whole cut at one operation; in cutting from one brick to another, great care must be used so as not to chip the edges of the bricks; the chisel should be used as much as possible in the direction of the length of the brick. When arches are moulded, if the bricks are cut before being reduced to the wedge shape, both beds of the brick will require cutting down, or the mould will not fit; when moulded, after being made wedge-shaped, much care must be exercised so as not to break the brick at the narrow end.

A great number of moulded bricks both for cornices and arches are now made by various manufacturers, which are cut or moulded before being burnt, and these, when carefully set, although not so perfectly accurate as hand-cut bricks, make very good work; good setting is quite as important as good cutting. Figs. 44, 45, and 46A represent some moulded bricks made by Messrs. Lawrence & Son, of Bracknell, Berkshire, which are moulded before being burnt. This firm also manufactures excellent cutters and rubbers, which harden by

exposure to the weather, and, owing to the nature of the clay, carry the same colour throughout. Many other firms manufacture moulded bricks.

Paving.

Paving is laid with brick flat, brick on edge, and paving squares or quarries, from 9 in. to 12 in. square. They are all laid in the same manner. The floor should be filled up with hard, dry material, and well rammed down. It is a good plan to level it up as the building is going on; it then gets well trampled down. It should be levelled to within one inch of the under side of the bricks or squares, and covered with fine sand; then fix at each side of the room a strip of wood, the upper edge of which is straight, and fixed level to the floor line; then stretch a line between the two strips and lay the bricks in parallel courses, bedding them down solid, and keeping them level to the line. The bricks should be bonded, and when the whole floor is laid, take up the strips, and piece each course out to the wall. It will be most convenient to lay the first course parallel and in line with the outer edge of the hearth flag. The whole of the cutting is then thrown against the walls, where it will not be so much seen.

After the floor is finished, it is covered with dry sand, which is well brushed into the joints till they are full. Sometimes the floor is grouted with liquid mortar, which must be run into the joints till they are full, and the floor is washed clean. The floors are sometimes laid diagonally, or in herring-bone bond.

Staffordshire Tile Laying.

Staffordshire tiles are very extensively used for flooring. They are made 6 in. square and 1 in. thick, and sometimes in octagons 6 in. in diameter, with small squares. Fig. 47 represents Staffordshire tiles. They are made in various colours—red, blue, buff, black, etc. They are laid in the following manner. Level up and ram the foundation within 6 in. of the finished surface, and cover the floor with three inches of broken stones to pass through a 2 in. ring. Upon this lay a bed of cement concrete 1½ in. thick, finished level, then nail down at opposite sides of the floor strips of wood, the tops of which are level with the finished surface of the floor; then, when this is set, spread a bed of Portland cement on the concrete, and lay the tiles level to a line stretched between the strips of wood, trying them occasionally with straightedge. When all is laid up to the strips, take them up, and finish each course up to the wall. When the cement has set, grout the whole of the joints with liquid cement, till the whole of the joints are full, and clean off the surface before the cement sets, as it is almost impossible to get it off if allowed to set on the tiles.

These tiles are sometimes laid diagonally in various patterns, a proportion of the tiles being nicked before being burnt, to facilitate cutting, which is necessary at times when it happens that halves or quarters of tiles are required to fill in.

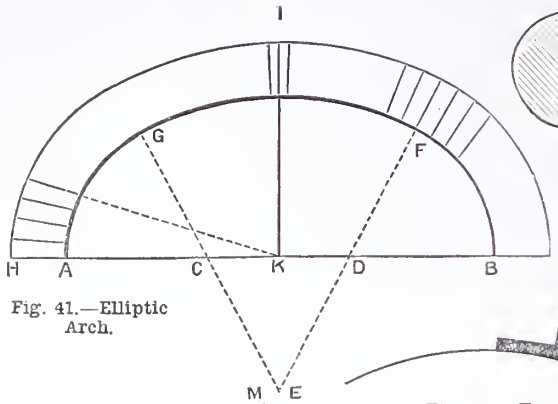


Fig. 41.—Elliptic Arch.

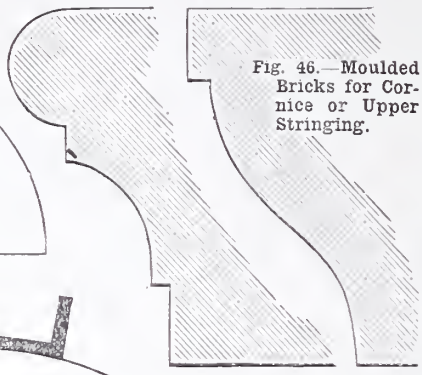


Fig. 46.—Moulded Bricks for Cornice or Upper Stringing.

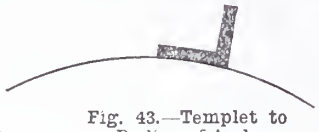


Fig. 43.—Templet to Radius of Arch.

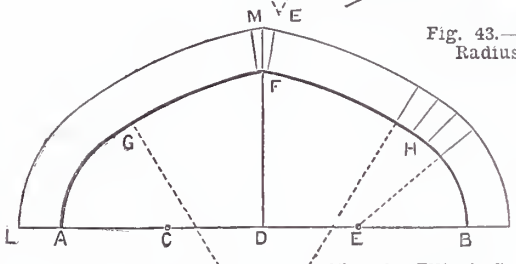


Fig. 42.—Elliptic Gothic Arch.

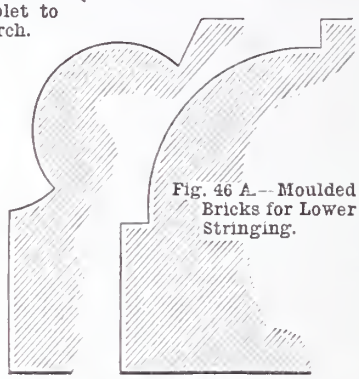


Fig. 46 A.—Moulded Bricks for Lower Stringing.

Fig. 47.—Staffordshire Tiles.

Fig. 49.—Mode of laying Geometrical Tiles.

Fig. 44.—Moulded Bricks.

Fig. 50.—Screeder for levelling Bed of Tiles.

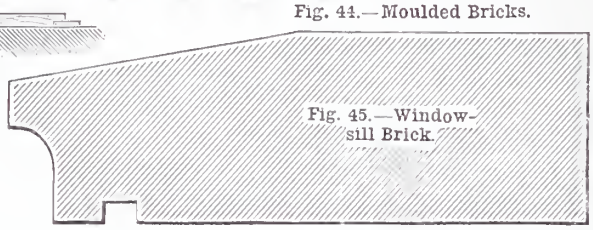


Fig. 45.—Window-sill Brick.

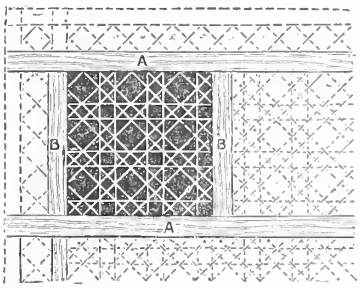
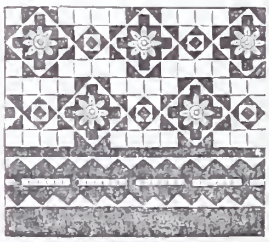


Fig. 48 A.—Ornamental Tile.

Fig. 48.—Geometrical Tile.



Geometrical and Encaustic Tile Laying.

Geometrical tiles are used for the floors of churches, halls, passages, etc. They are made in various shapes and sizes from 1 to 6 in. square, also in triangles, hexagons, and octagons, and are generally ½ in. thick. They are of various colours, as red, blue, green, black, white, and many others. Fig. 48 represents a portion of a geometrical floor. Encaustic tiles are ornamented on the surface, either by painting, or by different coloured clays let into the surface. They are from ¾ to 1 in. thick; they are generally used in connection with geometrical tiles as centres, borders, etc., and also for dados and wall linings.

The following method of laying these tiles is recommended by Messrs. Maw and Co., of Broseley. Level up and well ram the foundation, and cover it with a 3 in. layer of broken stones to pass through a 2 in. ring, and upon this lay a bed of cement concrete 1½ or 2 in. thick, the top finished level, and ⅜ in. below the under side of the tiles. Then lay out a portion of the tiles on a level floor, and also the border, so as to get the actual sizes, and mark the sizes on the concrete with chalk lines, and nail down to these lines strips of wood 3 in. wide and 1 in. thick, the top side of the strips being level with the finished surface of floor. Two cross strips must also be fixed between the two long strips, two or three feet apart, as shown in Fig. 49. Then wet the foundation, and spread upon it a bed of Portland cement mixed with clean sharp sand, and level it by means of a lath or screeder, running on the strips, the ends being notched to the thickness of the tiles, which level the cement (see Fig. 50). Then, having soaked the tiles well in water, lay them down according to pattern, beating them down to the level of the strips, under a piece of wood, by means of a mason's hammer, and regulating the joints at the same time by means of a small trowel. By this process the tiles will be brought to a perfectly even surface, and thoroughly consolidated with the cement, which the beating down regularly distributes under them. The surface of the floor should be also tested by a straightedge

laid across the strips. As soon as the tiles are laid up to the cross-piece, it must be removed and refixed, and another square of tiles laid, and so on till the centre of the floor is completed. Care must be taken in marking out for the strips, that the borders at each side are equal in width.

After the centre portion is laid, take up the strips, and refix them for the border, one tile width from the wall, and lay the border all round; take up the strips, and lay the tile next the wall, levelling it from the tiles already laid. When the tiles are sufficiently set, the whole of the joints must be grouted and run full of pure cement, mixed to a thin consistency. The grouting must be cleaned off the surface of the tiles before it sets hard, or it will be impossible to get it off after. Dry sawdust brushed over the surface is a good material for cleaning off the cement. The surface of the tiles must also be kept clean while they are being laid.

The tiles should always be laid before the skirting boards are fixed, to save cutting the tiles, and in an old house the skirting boards should be taken off while the tiles are being laid, and refixed after.

When a tile requires cutting, mark a line across it, and lay it on the sharp edge of a stone, with the mark over the edge, and nick it across the line with a chisel, when it will easily break. When a recess is to be formed for a mat, a stone, wood, or iron margin must be laid round it, and the tiles laid at the bottom as already described; but it is a much better method to keep the threshold of the door the thickness of the mat above the tiles, so that the door opens clear over it, as the recess forms a receptacle for dust.

Skirtings, dados, and wall-linings are fixed in the same manner as flooring tiles, the strips being nailed to the walls. The tiles are fixed with Keen's cement, except in cases where the walls are liable to damp, when Portland cement should be used. Tiled floors should be covered 1 in. thick with dry sawdust, to protect them from paint stains, dirt, etc., till all is complete. That the introduction of tiles in entrances and passages frequently adds very considerably to the general effect is a truth on which I need not dwell here.

FITTING AN ELLIPTIC CHUCK.

BY JAMES LUKIN.

THE SIMPLER FORM OF CHUCK—BACK PLATE—FRONT PLATE—NOSE PLATE AND RING.

THE elliptic, or oval, chuck, as it is often called, adds materially to the capabilities of a lathe, but is, unfortunately, of sheer necessity, an expensive article, costing from £7 to £15, or even more, according to the way in which it is made, the finish put upon it, and the maker's estimate of the worth of his own name; and in respect of lathes and their manifold appliances, a good name is decidedly better than precious ointment, being generally, if not invariably, a guarantee of good workmanship. High prices, moreover, permit the time to be spent upon work which is absolutely required for its efficient construction. Hurried work is always bad, and it is such alone that can be cheaply produced. At the same time, prices ought not now to rule as high as when chipping and filing were the sole means of bringing the work into its intended form. With the appliances of modern machinery, much tedious labour is avoided, and the earlier stages of manufacture are greatly facilitated. If lathe appliances, indeed, were as marketable commodities as clocks and watches, there is no doubt they could be produced by machinery as easily as the Waltham watches, and perhaps completely fitted in that way. But the sale is so comparatively limited that it would not pay a maker to set up elaborate and, therefore, costly machinery to make a few chucks, which can be made by hand in quite sufficient number to meet the demand. Two or three lathe makers, moreover, have tried to bring ornamental lathe apparatus within the reach of amateurs of limited means, offering it, fairly well made, at prices far below that demanded by the leading lathe makers; but the result has not proved satisfactory to makers or buyers, as the sale is too limited to make it a profitable speculation, and the desired accuracy of workmanship is hardly thus attainable.

The natural result is that amateurs find it expedient to become home manufacturers. They have little difficulty in obtaining castings, and with file and scraper, and a little plain turning, they often succeed in making workable apparatus of various kinds. A moment's consideration will show why their success is comparatively limited. The fault is that they attack a dozen distinct trades, each of which demands apprenticeship and lengthened practice to ensure success. There is little hope of much practical skill being attained as long as amateurs attempt to become blacksmiths, carpenters, turners, watchmakers, and so forth without a proper training in any one of these difficult handicrafts. If, indeed, there must be allowed to an amateur a little special freedom in this way, I would suggest either metal or wood as his material, but not both—plain and ornamental turning in wood and ivory, with some amount of cabinet or joinery work, to enable him to utilise his lathe productions; or, as an alternative, metal-turning—filing, scraping, engine-model making, and so forth, which will give him the skill required for making and mending any sort of metal work that may fall in his way. I know a few—very few—who make well, and use equally well, ornamental lathe apparatus, but they have had sound technical instruction to begin with, and these exceptions do not materially affect my suggestion that the fewer trades an amateur takes up, the more satisfactory will be his work.

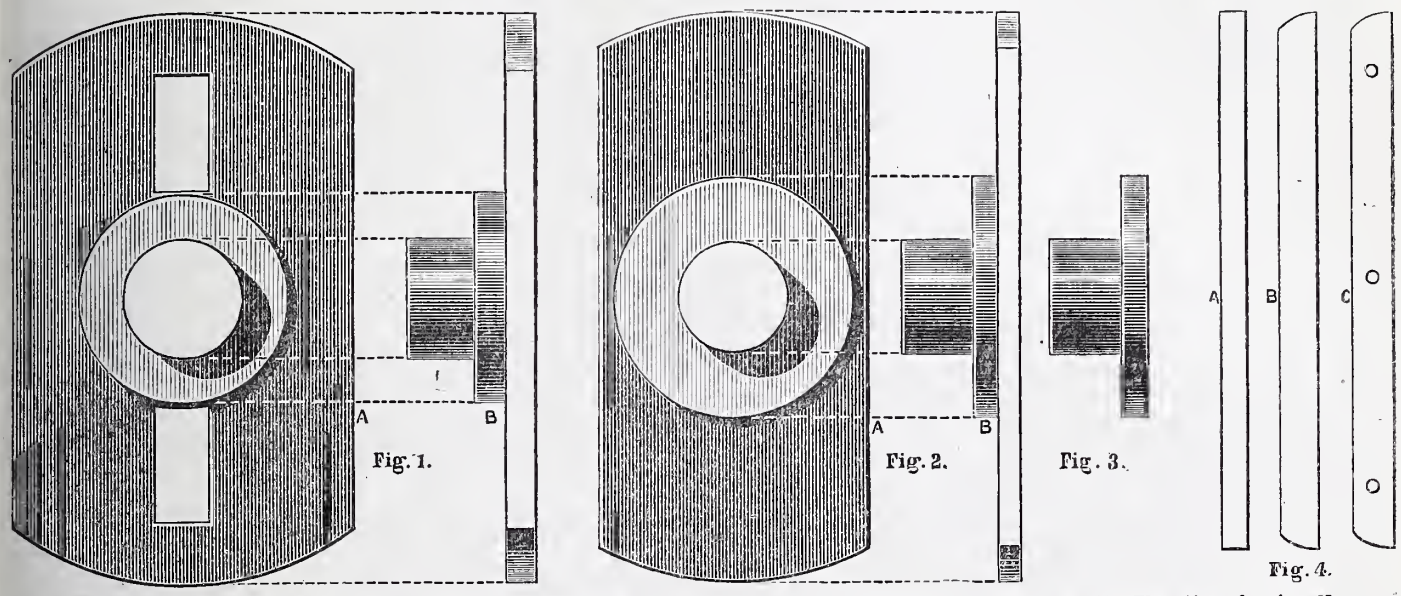


Fig. 1.—Back or Foundation Plate—A, Plan; B, Side Elevation. Fig. 2.—The Slide with Nose cast on—A, Plan; B, Side Elevation showing Nose cast on. Fig. 3.—Nose separate from Slide. Fig. 4.—Steel Bars for Base Plate—A, Edge; B, Flat Front; C, Front drilled for Screws.

In detailing, however, the process of making and fitting an elliptic chuck, I am obliged to presume a certain amount of skill in filing, scraping, and turning metal. This, again, presupposes a lathe and slide rest, files, scrapers, punch, drills, screw tackle, and a scribing block; and a few other tools would be an advantage. A vice-bench, hammers, and such-like are always at hand in any place that can be called a workshop; also squares, callipers, and compasses, as necessary tools of a metal-worker.

A most useful appliance—quite essential if much accurate work is to be done, apart from turning—is the surface plate, but for a chance job, such as the elliptic chuck, it can be done without. We will begin with the chuck itself, and then pass on to the adjustable ring which regulates and controls the action of its slide. It is as well to explain that this chuck is made in two forms. In one it has a fixed nozzle screwed to the same pitch as the nose of the mandrel, that the ordinary chuck may be attached. This

nozzle is securely and permanently attached to the sliding plate, and when the latter is in its central position, the nozzle forms, to all intents and purposes, a continuation of the mandrel. In more complete, but more expensive, chucks, this screwed nose-piece is attached to a circular division plate, and revolves on a central pin riveted into the sliding plate. The division plate is either cut into cogs so as to be held by a spring ratchet, or it is fitted to work with a tangent screw. The former is, perhaps, easier to make, but the latter has, in all the high-priced chucks, supplanted it.

The several parts of the simpler pattern will be a casting of the back plate, another of the front plate, a third of the nose-piece, and, fourthly, a casting of the ring. There will have to be provided two steel bars to be fitted on the base plate, and two screw blanks, which should be eventually cut with a fine screw thread, as they are to be tapped into the lugs of the ring plate, and ought to be capable of fine adjustment. The size will be, for a 5 in. lathe, about 6 in. by $3\frac{1}{2}$ in., and the thickness $\frac{3}{8}$ in. when finished, which will be $\frac{7}{16}$ in. in the rough. The boss which is to be bored and screwed on the mandrel will be $1\frac{1}{2}$ in. in diameter, or $1\frac{3}{4}$ in., according to the size of the mandrel nose. The several parts are given in the drawing. Fig. 1 is the back or foundation plate; Fig. 2, the slide; Fig. 3, the nose; Fig. 4, the bars. Figs. 2 and 3 may, if preferred, be in a single casting, if there is to be no division plate, and it will be easier, as a first attempt, to make it thus, because all parts can be faced in the lathe, thus saving much difficult work with file and scraper. The solid nose-piece will facilitate chucking, and in planning such work, it is always well to consider this detail. Indeed, it is sometimes advisable to cast a boss on a piece of work solely as a means of holding it in the lathe, such boss being removed subsequently.

Two slots will be noticed in the drawing of the back plate, which will file up to half an inch wide; two steel arms which grasp the ring work in these slots, and are secured to the slides; these will be described in due time. As I have suggested buying castings, because they are then certain to be correctly proportioned, and of nice fine metal, I may state that some makers now fit the bars on the back of the sliding plate, and, in that case, it will be found that the foundation plate is narrowest. As far as fitting is concerned, one way is about as easy, or as difficult, as the other, the several operations being similar. In both it is a question of accuracy in filing, grooving, and turning, and it will require the greatest patience and care if the result is to prove satisfactory.

The base plate calls first for attention, and the sooner it can be mounted on its own mandrel the better; and on its own mandrel all the turning and fitting must be done, or it will fail in that perfect accuracy which is so essential in this particular chuck. Examine the casting first of all, and if it is free, as it ought to be, from little excrescences, and of a nice, uniform surface, it may at once be mounted by means of suitable clamps on the face plate of the lathe, the boss being outwards. If, on trial, it is found that this boss, after being accurately centred, still wobbles out of truth, the casting is in "winding," and is, probably, useless.

In a good casting, this plate should run with very nearly absolute truth, and will need, at most, a little cleaning off with the file, in order to render it true enough to bed closely upon the face plate. If the latter is of a bright surface—and lathe makers seem fond of putting that sort of finish upon it—the easting is liable to slip, and it will be found a good plan to lay under it a sheet of coarse brown paper. This gives a little grip without interfering with the accuracy of the surface. A rub of chalk will serve the same purpose. In my own lathe, which had a very smooth 10 in. face plate, I went over the surface with a sharp-pointed tool, just cutting deep enough to give it a grain, and I have never had cause to regret it. The clips used to secure the work must be placed round the edge in order to get at the greater part of the surface with the turning tool; but after all has been so turned that can be reached, and the boss turned, bored, and screwed, a pair of clamps can be fitted through the slots, and then, after these have been tightened up—but on no account before—the others can be removed, and the turning carried out to the edge of the plate. The tool used should be either a round-nose or a point tool, the former having an elliptical end so as to approach somewhat to a point, and the angle of edge 80°. With this angle it may, and ought, to have a *sharp* edge, and, to preserve it, it is a good plan to file a bevel to the brass plate before allowing the tool to work. It will thus begin in clear metal, and at once get somewhat below the hard rough surface of the casting. A slow motion must be used and light cuts taken. Remember always that a tool of acute angle of cutting edge—under 70°—is almost certain to catch in if used upon brass or gun-metal, but it is not good practice by any means to use a tool that has blunted upon iron for the purpose of cutting, or even roughing-down, brass. Use well-sharpened tools always, ground to the angle, which experience has proved to be the best angle for the material, and metal turning will be found quite as pleasant and interesting as ornamental work in ivory.

Before taking a finishing cut with a well-sharpened and oil-stoned edge of 85° to 90°, the hole is to be bored for the lathe mandrel nose. Face the boss, but its cylindrical side can remain for awhile. If this boss has not been cored out by the founder, it will have to be drilled and the hole subsequently enlarged. With the sharp angle of a graver, or point tool, make a central shallow hole to take a drill point, taking care it is a conical depression without a little bit of metal in the centre, as will happen if care is not taken to cut it clean to the bottom.

A twist or other drill is now to be centered on the back poppet, with its end in the conical recess, a small spanner being used to prevent it from turning, and this is to be carefully fed into the hole by means of the back poppet centre screw. Another way is to place a flat drill in the slide-rest, but I prefer to start a true hole first of all of, say, $\frac{1}{4}$ in. diameter, and then to enlarge it with a slide-rest drill. A half-round engineer's bit will either clear out a cored hole, if an entrance is given by turning a quarter of an inch first of all to fit it; or, in a similar way, it may be used to follow the drill, which will somewhat relieve its work. But we are obliged to consider here the capabilities of the lathe, which may not be fitted with back gear; in which case, the easiest mode is to drill and follow up very gradually with a larger tool, leaving the final cut for an inside slide-rest tool, with which to make the hole quite true and parallel. It is not, after all, a very difficult job, yet it is one that may very quickly be spoilt by undue haste. The hole should, at this point, be still left a shade smaller than it is eventually to be, as a loosely fitted screw will be detrimental to the working of the chuck.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

Useful Methods of Graining and Finishing Cheap Furniture.

With a view to avoid any feeling of dry monotony which the continuance of a set of papers of a purely instructive and theoretical nature might result in to the general reader of Work, I purpose to vary these lessons by occasional chapters dealing not so much with the art and technical aspect of graining as with the practical and every-day purposes to which the instructions can be applied. In due course, a consideration of the *decorative* application of these imitations may furnish herein some matter of interest and, I hope, guidance to operative painters and grainers especially. For the present, however, we will content ourselves with putting into practice some of the knowledge and skill which the student should have now acquired from this series.

The furniture of the home, be it ever so common and plain, is a topic that every reader can be interested in; and amongst such a large community of wood-workers as our magazine circulates, the subject of its *cheap, durable, and effective finish* will provide a welcome paper for many. Notwithstanding, it may be remarked, with perfect truth, that the learner who, from a preceding lesson, can grain a door will surely be able to grain a wardrobe, there is much information that can with advantage be tendered such an one upon the above imperative conditions of method and cost, and which, to the wage-earning worker, would make all the difference between profit and loss in graining cheaply-made furniture.

In graining bedroom furniture—the bulk of cheap *suites* of which are so finished—we may here consider, in the first place, what is the most suitable colour and aspect to give them. The most favoured appearance for all things connected with the sleeping apartment is, at the present time, that of lightness and "sweet cleanliness," if I may so term it. This is as it should be, for however much there may be to admire in the "good old times," the disappearance of its massive and cumbersome bedsteads and chests of drawers, with the arrangements of "dust-harbouring" hangings and "valances," of fifty years ago, can scarcely be grieved over—that is, from the sanitary and progressive point of view. How far this is a change for the better or for worse, in that a *suite* of bedroom furniture can now be purchased for the price of about a single article of the past generation, is a question of political economy that does not here concern us. We will take these things as we find them, and assuming that you, my individual reader, have purchased such a bedroom set "in the white"—viz., the common plain deal or pine—I will endeavour to help you in making them appear a credit to your little homestead and the admiration of your "better half."

Under this category of lightness and cheerfulness we have, therefore, the imitations of light "maiden" oak, maple, satinwood, pitch-pine, birch, etc. The first-mentioned

ght oak is, without doubt, the most opular of the list, and as imitations of oak ave been thoroughly explored herein, we ill apply ourselves to the "getting up" of ie furniture.

The preparation of furniture for graining pon may be considered from the various spects of cost, durability, and excellence of nish. These we will return to farther on.)ur present purpose shall be to make a ood permanent job without stinting our ime or the cost of a little material. Ready-iade furniture which is essentially cheap an scarcely be finely finished in the wood,) we commence by glass-papering the work own, where required, with No. 1½, then, fter dusting it well over, we coat the knots vith "patent knotting," and stand aside to ry whilst we prepare our first or priming oat. This is best made with white lead—ay, 4 lbs.; patent driers, ¾ lb.; red lead, lb. Beat up in linseed oil and turpentine, n parts three to one respectively, until our aint is of thin working consistency. This nakes a hard-drying paint of an oily nature o stop the suction of the new wood. Our econd coat is made with white lead and lriers of similar proportions and a little nore "turps." This is, however, first tinted . decided light buff with ochre in oil, and trained before being used; and our furni-ure must also be again papered down and ll holes puttied up before the second coat-ng is spread. It is advisable to make our econd coating a little darker than the de-ired tint of ground for graining upon. After standing a day, and without further glass-papering, we may spread the third ind grounding coat. This should be made is before, but with equal parts of oil and urps, to give a hard and fairly glossy sur-ace for the combing and figuring. The urniture is now ready for oil-graining, over-graining, and varnishing. The colour being nade with raw umber in oil, according to earlier lessons, each article of furniture is parely rubbed in and then combed. In working the usual "turned" table-legs, it is best to stipple them with a dry duster or cool, and comb only the plainest portions of such surfaces. Care must be taken to main-tain the proper direction of the grain, and, as when working a door, the panels and drawer-fronts only should be figured, and the surrounding portions finished with varieties of plain combing. When dry, we may overgrain the figure and further im-prove the plain parts with a shading of different natural depths and stronger con-trasts, according to personal fancy. The top of the wash-hand stand is better finished with an easy imitation of marble, called usually "black and white." Instead of, therefore, painting this portion twice with buff, we use white paint; and after the graining is finished we again coat it care-fully with quick-drying white paint, and with a black crayon, or fine pencil and black, put in the veins, and then blend them slightly whilst the white is wet. The furniture should, finally, have one or two coats of "hard-drying" or "church oak" varnish, as ordinary oak or copal may not, and does not usually, harden sufficiently for much handling. The "marbled" top should be varnished with two or three coats of "white hard" *Bath varnish*, and the articles will then last, with ordinary care, a lifetime. The wash-hand stand, which usually gets the most wear, will need a periodical touch-up and re-varnishing; and, especially with regard to the top, be it remembered that an occasional coat or two of varnish will save the trouble of repainting many times over.

The *graining of furniture in maple, satin-wood, and pitch-pine*, etc., will appear to most advantage when used on better-made woodwork than that of the ordinary fac-tory articles. They should be prepared and "brought on" in white lead paint, if a good job is desired, in the same manner as I have described for oak, and the lessons in my succeeding papers upon imitating these woods will form a useful sequence to this *résumé*. Most of these woods are usually grained in distemper, and to get an effec-tive display, larger spaces and portions are necessary; whereas with oak, no matter how small the work, the figure can be pleasingly adapted thereto. Some of the prettiest bedroom *suites* I remember seeing were at a City house, ten or more years ago. They were made—or veneered, I suppose—in maple and satin-wood, and were partly polished before being turned over to an artist. This art-worker embellished the articles with ornament in semi-natural colours of the Adams type of design, but with all the charm and elegance of Louis XIV. decorative work. The predominant tone of the painted ornament was blue, and this served to heighten, by contrast, the richness of the golden-coloured woods. This work was finally polished, over paint-ing as well.

American walnut and pitch-pine are two varieties of wood that have become very popular for bedroom furniture during the last few years. Some effective suites of these two woods combined have recently attracted some notice. The panels were walnut, with inlay of lighter wood, and the framing portions were of the pitch-pine. Any reader who has the skill, and with it a well-made suite of such goods, is recom-mended to try this imitation. Maple com-bined with American walnut I have also used to decided advantage and satisfaction, but in such a case, with light panels and walnut framework. Such ornate treat-ments of bedroom furniture would, of course, be entirely misapplied to the com-mon goods first alluded to; but in the face of a present and growing tendency to make the bedroom a pleasant private sanctum as well as the sleeping room, their appearance is one sure to meet with much favour.

The imitation of mahogany, rosewood, and other hard and costly woods, is very seldom required or advisable with bedroom furniture. The comparative cheapness of real American walnut has been the main reason for its use in sleeping apartments, and chiefly accounts for its increasing popu-larity, notwithstanding the current "rage" for light painted and enamelled work. What is acceptable in the real polished wood re-specting the walnut is scarcely so of its imi-tations, for one reason especially: dark-grained woods are very prone to show white wherever they get a knock, and the ordinary copal varnish never appears to so much advantage upon dark woods as upon light ones—loss of gloss and "bloom" is much more readily apparent upon the former sur-faces. Where there is much "wear and tear," light wood imitations are, therefore, undoubtedly the best for bedroom furni-ture. It is possible, nevertheless, to avoid the disadvantage of dark woods showing when knocked or rubbed by graining the imitation directly upon the natural wood's colours. This is a treatment capable of giving most excellent and woody effects, combined with extreme durability, when the time and cost is no great object. To this process I will return in a future paper.

The *cheapest modes of preparing and graining furniture* will prove a matter of some further useful instruction herein, and will enable the poorer worker to get the best show and wear at the smallest cost, and will also explain how such articles are grained "wholesale" for the large and cheap makers.

A distemper "grounding" paint is made with well-washed whiting and strong patent or best glue size, and this is substituted for the previous coats of white lead paint. Common and the cheapest whiting will suffice, but if such is at all gritty, we must strain it through a hair-sieve. A few pounds of whiting are broken up into suffi-cient only of water to slacken it. The stainer is now added in the form of cheap powdered pigments — ochre, umber, and Venetian red—according to desired ground colour. These stainers can be purchased at about one penny per pound; and, as the whiting is usually retailed at not more than a halfpenny per pound, the most ex-pensive ingredient is, therefore, the glue or patent size. The latter being the most convenient, we take about the same quan-tity as we have whiting, and having melted it, with a very little water, over a fire, we stir it into the stained whiting. The worker must here remember that the distemper ground will dry much lighter, but that the ordinary hard-drying varnish will also re-store much yellowness of colour.

Usually, without knotting or glass-paper-ing, the goods are simply dusted and given a good coating of the hot distemper paint. When thoroughly dry, a second coat is spread, and this gives a solid and hard ground for the graining colour. If the dis-temper is free from grit and has been well spread, it is not necessary or advisable to glass-paper the cheapest goods. For grain-ing, we take a little fine umber, ground in beer—or such pigments as we know will best suit our imitation—and dilute it to working consistency with weak beer. With a large sash tool we rub over the different portions, and by streaking it with a dust-ing brush and then using gutta-percha or indiarubber combs, we get the varieties of grain. Now with a piece of wash-leather instead of rag we quickly wipe out the lights, or figure, before the graining colour dries, and finish each panel or division right off. The roughest goods are then coated with the cheapest resin varnish. In order to obtain a superior finish to this quick process, the articles may be given a thin coat of japan gold-size and turps in equal portions. The overgraining by the usual distemper process is then done, and a final good coat of varnish will make a fair and durable finish to a cheap imitation.

When graining dark woods after this method, one coat of the distemper ground will suffice to cover up the wood, but it is a good plan to give a second coat of strong clear size only, which will enable us to work either oil-graining colour or water-colour upon it with much more facility and effect.

In graining with oil-colour upon these distemper grounds, it need scarcely be pointed out that there is no necessity to "bind down" before over-graining, as is re-quired upon water graining. The strong size used with the ground, or in the after-sizing, effectually prevents the varnish from blackening and discolouring the whiting contained therein. For a good class of grained furniture we may get the surface up in strong size and whiting, then well glass-paper it down, coat with clear size, and give one coat of white lead paint. For maple this is by far the best plan, and

much of the cheap plain-painted and enamelled furniture is also so treated.

Patent knotting composition or varnish is sometimes used as a first coating, then a coat of size will effectually stop the suction of new wood. The "knotting," as it is usually termed, will alone make a good and rich stain for deal wood, and one which can be either polished or varnished upon almost immediately.

Lest there be any doubt in the mind of the worker as to the durability of imitations grained upon size colour, I may add that for the usual wear of bedroom furniture such work will last any reasonable length of time. To summarise the *pros and cons* of the two preparatory methods, oil-paint *v.* distemper, we have the greater durability, accompanied with extra cost of time and material and the objectionable smell of the former, as against the cheapness and quickness, with less wear, of the latter, while the absence of the smell of paint compensates for the dustier and dirtier manipulation of size and whiting colours.

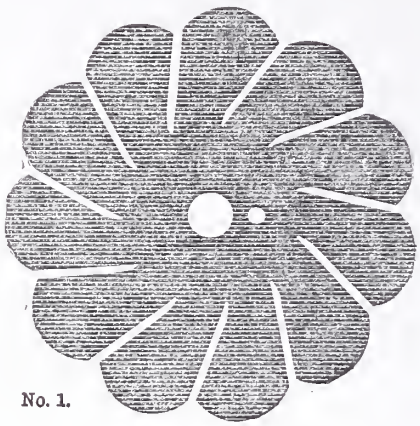
KEATS'S STAR-DISCS FOR SEWING MACHINES:

BEING IMPROVEMENTS IN WINDING MACHINERY FOR SILK, COTTON, THREAD, AND WOOL.

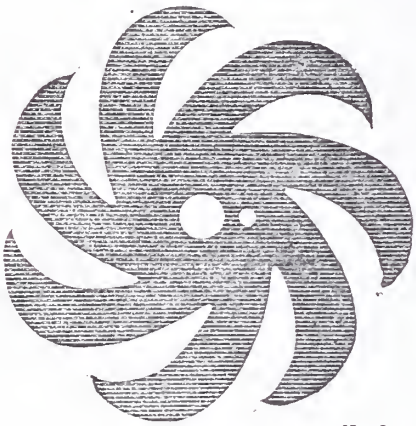
BY JOHN CHARLES KING.

In introducing something new—applicable to textile or sewing machines—the inventor, if wise, first ascertains if there is a demand for it, or can be created with commercial advantage. That this has been done will be obvious when the above-named invention is explained, and the improvements demonstrated. To show that a demand—in relation to the winding and unwinding of spun-silk, cotton, thread, or wool—is, and has long been, urged by users and merchants, we will take a rapid retrospective glance for a half-century: when the tailor and seamstress bought their silk retail by the "skein" at twopence; their cotton by the ball at a penny; their thread by the "knot" at a penny. The boot closers their skein of thread called "barber's twist" for a penny, and flax thread—grey or yellow—called closing flax, for a penny, or threepence, and the wool or worsted by the "hank," etc. In all these various forms of putting-up this spun material, there was no complaint of strain, pressure, or "kink," affecting the material.

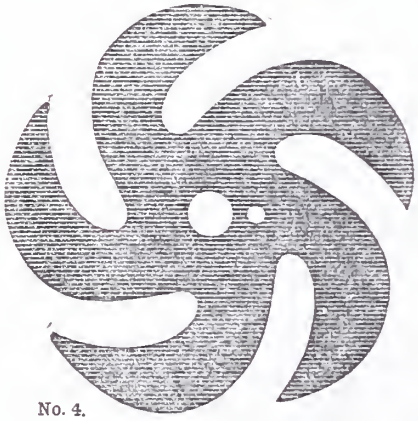
The advent of the sewing machine, now a requisite in every household nearly all over the civilised world, created new requirements for feeding the machine. The "reel" was introduced; this graft on to the sewing machine required regulating in its unwinding, and a "brake" was put on the reel for that purpose. This was found to strain the silk or thread too much, causing an uneven stitch; then the "brake" was put on the thread, and the reel allowed free play in unwinding. This acted; yet withal there arose complaints against the silk and thread used on the sewing machine; it did not yield the "pearl" stitch equal to hand work, and the evil was judged to be in the reel. The best tailors of Paris and London, and seamstresses at high-class work, were supplied with silk thread, etc., wound on cards of various shapes called "Carton" silk, or thread; and about five years ago a form of card called "Plastron" was introduced; but this, besides being unsuited for use direct with the sewing machine, "kinked" the material by being wound over the edge of the card in successive layers. The objectionable reel still at present holds its place, with its admitted evils. This year a gentleman, who combines the philosopher and the mechanician in his mental attributes, was thinking of the best plan of winding spun-silk, and had his attention drawn to the camels being loaded at Scutari



No. 1.



No. 3.



No. 4.

Keats's Star-Discs for Sewing Machines. No. 1.—For Silk or Fine Cotton. No. 3.—For Large Thread or Fine Worsted. No. 4.—For Wool. The above Diagrams are reproduced on a scale of two-thirds actual size.

for their journey with spools of silk for Teheran, and on inquiry found they had to carry 75 per cent. of wood for 25 per cent. of silk; and the weight, and bad pack-saddles, caused a loss of 10 per cent. of camels on the journey. He set himself the task of inquiring into the complaints of sewing-machine workers, and also to diminish the load of wood used in the export of spun-silk and thread.

In investigating the silk worked from reels he found that it was not round silk, but *square*, consequent upon a demand of users for highly-finished silk and thread. To effect this, the strain put on the silk or thread in winding sometimes reduced its tensile strength one-half; and the effect of winding silk or thread tight upon a hard wood cylinder, between two end discs forming the reel, was that packed side by side, and layer upon layer, the silk or thread was converted from round to square—this is easily felt by the fingers. In the action of passing through the needle eye, and through the stuff being sewn, the square edges become abraided, and a "pearl" stitch—so much sought for by good workers—cannot be got. To obviate these evils, Mr. Keats invented star-discs of card of such forms as would readily receive either silk, cotton, thread, or wool direct from bobbins or the "twister's frame;" and in the transfer, not to injure the spun silk or thread by strain, pressure, or kinks, as with reels or plastrons.

The star-discs are made of card with five, seven, nine, or eleven points (even numbers would not work) to receive the spun silk of the finest sort or the largest wool. Of these, the discs with eleven, seven, and five points are shown in the accompanying illustration. The radiation is in tangential curves, so formed that the lay of the silk, etc., starting at the inner interstice of the star-rings, is wound not round the star-disc direct, but in and out on the star-points till the outside edge of the disc is reached. The machinery which carries the twelve star-discs at once has a rocking action, which allows the lay of the silk to enter in and out each side of the star points with regularity and automatic precision.

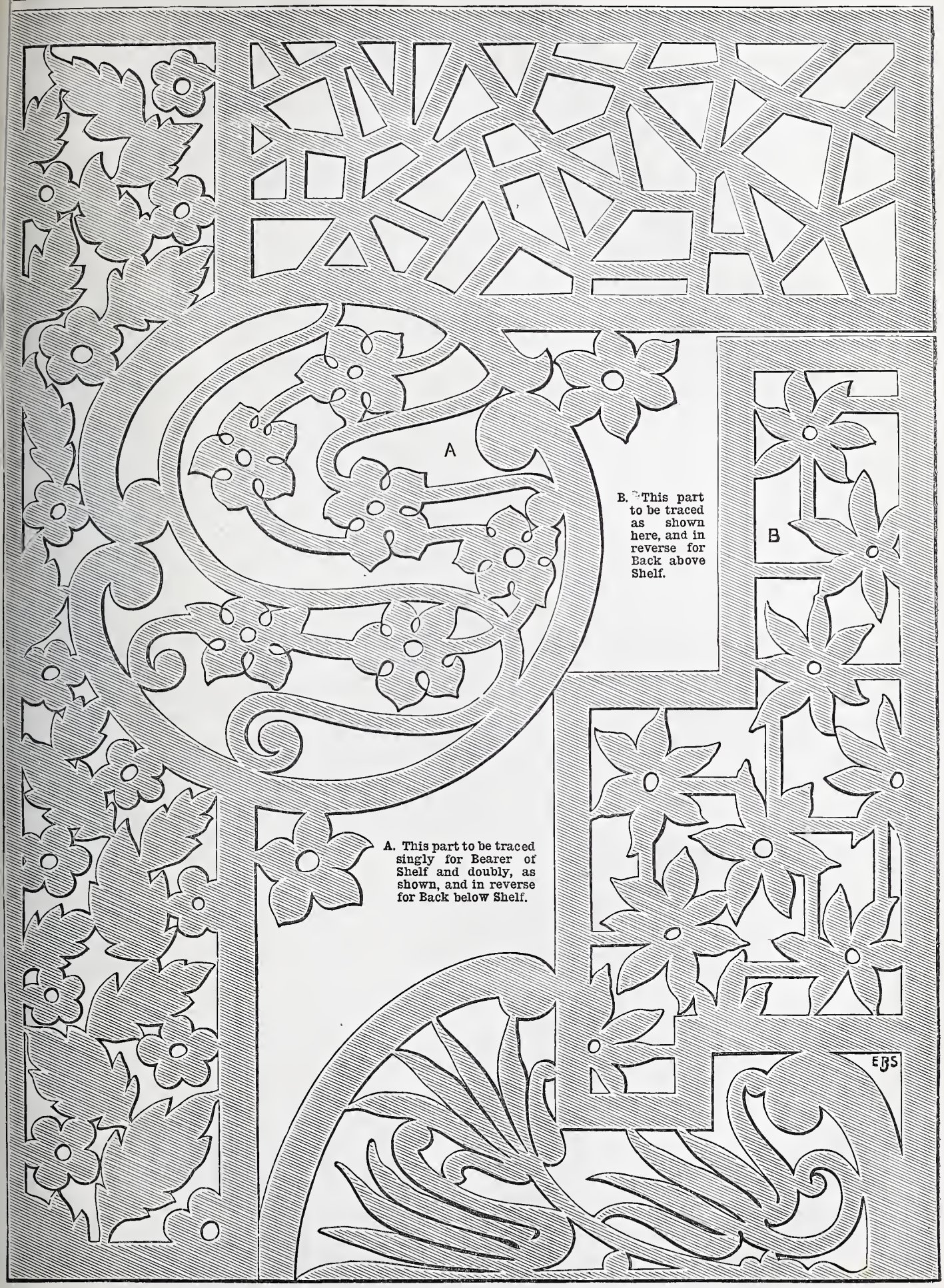
In its use on the sewing machine, it requires no brake; the draft, it will be seen, is not from the periphery as in reels, but nearly central.

For wool working and hand-embroidery, several star-discs may hang from a wrist-hook without any inconvenience to the worker. The fact that sixty millions of plastrons were sold in France in 1888, is a marked protest against the reel, and an encouragement to the inventor of the star-discs and winding machinery; which, with other new inventions of his, obtained the Grand Prize at this year's Paris Exposition. The demand for absolute quantities of silk, linen, and cotton threads on the "Keats Cards" is now met by a further improved machine, which measures off any requisite length desired; and, on the length being determined, the thread is cut off automatically, ensuring absolute quantities—from 10 to 500 yards—so that a poor dress-maker in buying her "penn'orth" of silk or linen thread knows exactly what length she gets to a certainty never before arrived at. It may not be uninteresting to know that Mr. John Keats is grandson to the brother of the poet Keats's father.

DESIGN FOR A BRACKET IN FRETWORK.

BY E. BONNEY STEYNE.

To produce a pattern for amateur fret-cutters, on which they might try their 'prentice hand, is all that has been attempted here. Whether satisfactory as a pleasing design, or regarded as a mere jumble of heterogeneous details, matters little, but if one who is anxious to try the mechanism of the craft wishes for a subject



A Design for Bracket in Fretwork, measuring 15 in. by 14½ in., drawn expressly for WORK by E. Bonney Steyne.

that shall test his resources, this may serve his purpose and try his patience, for even the worst bugbear of raw workers has been introduced in one part of the ornament—a quantity of straight lines cut in true parallels. In kindness to the operator, this has been placed where the shadow of the shelf will prevent the close examination of his attempt. To utilise the idea, first make a replica of the printed pattern. Take a piece of tracing-paper, about 16 in. square, fold it accurately in the centre, place the page where the design is printed on a board, with the crease of the pattern exactly over the left-hand upright edge; trace the A portion, and then removing the paper, trace the B part, so that the line at the bottom of the page touches the crease in the tracing-paper, and the line, now upright at the right-hand edge, touches the line at the top of the A, previously traced. Then removing the paper, double it again, and complete the pattern by tracing the portion already drawn. This process will yield the complete pattern of the main portion of the bracket, as it is intended to be used. Of course, it is quite open to employ only the A portion, and have no fretwork above the shelf, if that way is preferred.

For wood, choose a piece of mahogany, walnut, or similar wood, about $\frac{3}{16}$ in. thick, or a piece of the three-ply wood sold specially for fret-cutting; work with a No. 1 saw. When the cutting is done, remove the pattern by passing a wet sponge over the surface and peeling off the paper. To avoid warping, see that the back of the wood is also moistened at the same time. When quite dry, some hours after, take a piece of coarse glass-paper, wrap it over a level piece of cork or wood, and rub down the surface, finishing with a very fine piece. The bracket support for the shelf should be either a duplicate of A, but with about 2 in. of the irregular trellis-work cut off and replaced by a plain border of wood, or else a simple L-shaped piece of wood. The shelf may be entirely at the discretion of the worker. Whether the finish be polish stain or gilded with gold bronze is purely a matter of taste.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

66.—Anderson's Patent Expanding Centre-bit.

I have received from Mr. Robert J. Anderson, Engineer, 3, Poulton Road, Seacombe, one of his new Patent Expanding Centre-bits, of which an illustration on a small scale is given in Fig. 1, and let me say at once, before proceeding to describe the tool itself and the principle on

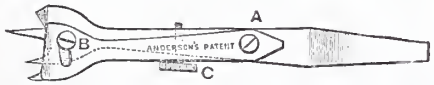


Fig. 1.—Anderson's Patent Expanding Centre-bit.

which it is made, that I understand from Mr. Anderson that he has decided to make them in three sizes, namely, $\frac{5}{16}$ in., $\frac{9}{16}$ in., and 1 in., instead of $\frac{1}{4}$ in., $\frac{1}{2}$ in., and 1 in., as he had originally determined, and that the centre-bits at the sizes named will be sold at 1s. 6d., 2s., and 3s. respectively. Now the first thing to be said of these bits is that each will cut a hole double its size, and any hole intermediate between the two extremes of the size of the bit and twice its size; that a $\frac{5}{16}$ in. bit will cut any hole from $\frac{5}{16}$ in. up to $\frac{5}{8}$ in.; the $\frac{9}{16}$ in. bit, any hole from $\frac{9}{16}$ in. to $1\frac{1}{8}$ in.; and the 1 in. bit, any hole between 1 in. and 2 in. Thus the workman who owns these three sizes would be able to bore any sized hole whatever between $\frac{5}{16}$ in. and 2 in., a great advantage when it is remembered that there are only three sizes made under $\frac{5}{16}$ in., namely, $\frac{1}{4}$ in., $\frac{3}{16}$ in., and $\frac{1}{8}$ in., at all events, to the best of my belief and knowledge, seeing that these three sizes are the smallest that I have in my own set. Again, looking at the price lists, I notice that best black centre-bits are quoted at 4d. each *up to* $\frac{5}{8}$ in., which would include the sizes I have just named, and thence to 2 in. there being about eighteen sizes, Gedge & Douglas's Pattern Auger Bits and Jennings' Pattern Auger Bits ranging from $\frac{1}{4}$ in. to $1\frac{1}{2}$ in. in seventeen sizes. Thus by the purchase of Anderson's Expanding Bits as named, and the three very small sizes below $\frac{5}{16}$ in., a workman not only saves money, but he has a fewer number, and, therefore, less weight of tools to handle when he requires them, and can do more with them than he possibly could with bits of the ordinary set sizes, as he can cut any size whatever intermediate to any two of the set sizes. The principles of the expansion will be seen from the illustration. Thus to an ordinary $\frac{9}{16}$ in. centre-bit, a side-piece is attached by means of a screw entering the bit at A. Another screw enters the bit at B, passing through a slot in the movable piece, thus restraining its motion outwards to the length of the slot. The arm may be regulated in its outward movement by the milled screw head C, which is the head of a screw passing through the bit. In setting these expanding bits, nothing more is necessary than to move the milled headed regulating screw as far as may be required. The notched mushroom-headed screws do not require touching at all, the one at B near the point being close enough down to the plate to prevent any chatter, and yet near enough to allow the movable cutter to slide. When commencing to bore, directly the little side blade takes the wood it expands the sliding cutter to the proper diameter—that is, until it comes in contact with the head of the regulating screw, beyond which, of course, it cannot go, its tendency being to expand, and will not collapse. It will be found that these bits cut a beautifully clear hole. I believe the only other bit of the kind in the market is Clark's Patent Expansive Bit, which is more expensive, costing 7s. with two cutters boring from $\frac{1}{2}$ in. to $1\frac{1}{2}$ in., and 10s. boring from $\frac{7}{8}$ in. to 3 in., the principle on which the expansion is effected being altogether different.

67.—Practical Perspective Diagrams.

Messrs. F. O. Ferguson & Co., 400, Goldhawk Road, Hammersmith, London, S.W., send three large sheets, embodying by means of some excellent diagrams, though rather coarsely drawn, instructions of a simple character, and, therefore, more readily understood, in "Practical Perspective: Means, Course, and Operations." The instructions are rendered and the drawings executed by "A Draughtsman" whose identity with the publisher is indicated by Part III., in which is given a large sketch of a dwelling-house in a style which finds much favour in these days. Part I. deals with the elementary rules of perspective by means of a series of progressive diagrams, with brief but clear and sufficient remarks at the side for the guidance of the student. The rules thus exemplified are applied in Part II. to putting on paper in proper perspective the building sketched in Part III. The course laid down in Part I. applies, it should be said, to putting a small house into perspective, so that the student is led on from commencement to finish, and enabled to understand and appreciate the rules and the reason for them far better than if they had been brought under his notice without actual practical application. The whole scheme is well conceived and cleverly carried out, and will be found useful by all who are seeking to acquire a knowledge of perspective by self-tuition.

68.—The "Hercules" Revolving Pocket Folding Stool.

Hitherto all folding stools have assumed a form that is more or less cumbersome when carried about in the open air for the purpose of obtaining a temporary rest or assuming a sitting posture when needed. Of these the most common are two frames, of which one fits within the other, both having the legs or longer sides of the frame connected about the middle by screws on which they turn as on pivots, the seat being formed by strips of webbing nailed to the top of each frame, thus preventing them from opening beyond a certain distance. Another form is that of a tripod, in which the three legs are pivoted in the centre and connected in a similar way at the top by webbing which forms the seat, one of the legs being extended from the top in the form of a crutch handle, so that the whole, when closed up, may form a sort of clumsy and inconvenient walking-stick. It has been reserved, however, for Messrs. Richford & Co., 149, Fleet Street, London, E.C., to produce a folding stool or outdoor seat, that is at the same time portable and convenient in being easily carried. This appliance, which is shown in Fig. 2, is known as the "Hercules Revolving Pocket Folding Stool," and is offered at 3s. 6d.; the framework in this case being japanned, although, if preferred, the metal work may be had galvanised. The folding stool, as may be judged from Fig. 2, affords a desirable seat on the lawn-tennis ground and the cricket-field, and is equally useful when shooting, fishing, sketching, or at picnics. The legs are made of steel, and the joints of the legs, etc., of galvanised iron; they fold together round the central stem; the seat is of canvas. The height of the stool when open for use is 23 in., and its weight is only 28 ozs. When folded up in a bag, it assumes the form shown at A, in which it can be easily carried in the hand or the pocket; or it may be carried over the shoulder, slung in straps like a telescope. The seat is patented.

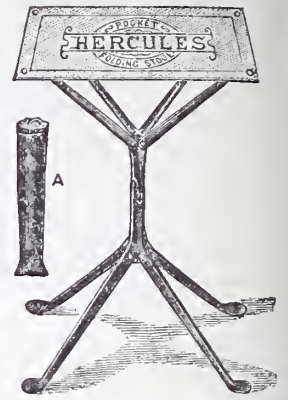


Fig. 2.—"Hercules" Revolving Pocket Folding Stool—A, Stool folded up and placed in Bag.

69.—Gorringe's Paint Strainers.

Messrs. R. Gorringe & Co., Varnish, Colour, and White Lead Manufacturers and Oil Merchants, and also dealers in lancewood shafts and bent timber of every description, Brewery Road, Caledonian Road, Islington, London, N., have recently introduced a great improvement in paint strainers. This consists in making the strainer in such a form that the copper wire gauze which is used as a strainer may be removed, and a fresh piece put on in a very short space of time, thus saving the body of the strainer and rendering it still useful when the

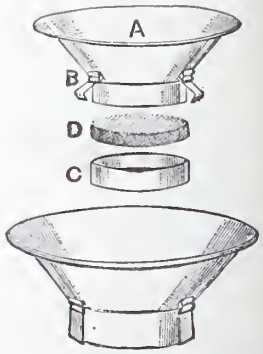


Fig. 3.—Gorringe's Patent Paint Strainer—A, Body; B, Clips holding Compression Band C; D, Wire Gauze Strainer.

wire gauze has been worn out. In Fig. 3, A at top shows the body of the strainer, fitted with the clips B. The wire gauze D fits over the lower part of the strainer, and is held in place by what is called the compression band C, over which the clips B fit down, holding the different parts tightly together. In the lower part of the illustration the strainer is shown with the gauze and band on, and the clips closed down. The strainer costs 2s., and the gauzes, which are made in three sizes, are sold at 5d. per piece. The contrivance is one which ought to find favour among painters and oil and colourmen.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Sheet Metal Work Book.—TINKER writes in rejoinder to ALIQUANDO (see page 355, Vol. II., No. 74):—"I must say that my position is rather a difficult one, from the fact that all of my first letter was not inserted, for had it been, my position would have been different. I stated particularly that I had not used a great many of the problems in Warn's book; but what I had, had greatly assisted me in my work, especially the elbow pattern, which has saved me many an hour of chipping and cutting with the snips, and which alone I, as far as myself am concerned, consider worth the money. The plates also on page 11 just come in for my line of work; also the round tapering body in sections on page 9. As regards the bath patterns, I can only say that, at present, I have not required them, so need not give them any consideration. As regards ALIQUANDO's offer to go into any problem, I must thank him and decline, as I have neither the time or the ability to wrestle with and correct Warn's mistakes, as I am a poor man and have my living to get, so to me time is money. In conclusion I should like to say that I think every praise is due to Warn from his fellow-workmen for his effort in trying to help them to the best of his ability, and I, for one, can appreciate it. But let one man try to help another, and you will always find some to find fault, and at the same time give us nothing better. And as Warn, I believe, was nearly or quite the first to bring such a work out, he deserves special praise. I don't doubt for a moment that his book can be improved upon, but that doesn't justify me in cavilling at his honest efforts to help me, so his shortcomings I can overlook on those grounds. I cannot also quite understand how anything full (or nearly so) of errors, deficiencies, and impossibilities, could have been of immense benefit at any time in its career."

How to fret a Banjo.—J. G. W. (*London, N.*) writes in sequence to F. H. (*Streatham*):—"You state (see No. 74, Vol. II., page 355) that my method of fretting a banjo by dividing by eighteenths is not right; but that a banjo so fretted would not sound the correct notes. Do you mean that the notes stopped at the frets will sound out of tune? I suppose that is what you do mean. If, as you say, the notes are not in tune when stopped on the frets, then my method of setting out a fretting scale must be all wrong. I have made a great number of banjos, which I am pleased to say have given great satisfaction to my customers, amateur and professional, and to which my very numerous testimonials will also verify, and yet not one of these players has discovered that the banjo they have been playing upon was fretted out of tune. I think they ought to feel extremely obliged to you for enlightening them on the subject. You cannot have tried my method or you would not have written as you have done. The method you give is the same in comparison to a carpenter using a piece of string with knots along it for a rule, the knots marking the inches and the divisions of an inch, why he can guess *near enough*. One might think you had written out your method intending it for some of the comic papers, and had sent it to WORK in mistake. Why, your diagram is marked wrong—it shows fourteen frets when you only intended it to show twelve! The next time you send any of your superior ideas I should advise you to be more careful in drawing the diagrams. By my method the scale is graduated properly from the first to the last fret, and is practically correct, and when once set out will mark off any number of banjos of the same size. If you *have* tried my method, and set the scale out accurately, and when you tested it and found it, as you thought, wrong, your strings have been false: that is, the strings are not the same thickness from end, but thicker in some parts than others; to make such strings sound in tune they would have to be fingered a fret higher or a fret lower as the case may be. In conclusion I should advise you to be certain that you thoroughly understand the subject yourself before rushing into print and trying to correct what does not happen to be wrong, and written by one of the many old and *practical* stagers who write for WORK."

Watch and Clock Repairs.—ONE THAT PAYS BUT WANTS STEADY TICK (*Pall Mall, S.W.*) writes:—"As a constant reader of WORK, I have been much interested on the subject of "Hints to Watch Wearers," and agree with the advice given. But it is of little use, unless one knows where an honest, capable workman is to be found. I possess several valuable clocks and watches. Not long since I took a carriage repeating clock to a man who, to hear him talk, professed to know all about cleaning clocks, etc., of all sorts, informing me that he had worked for years in Paris for the first firms there. The result was that I let him have my clock to clean, and he completely spoilt it. Finding it did not go, I took it to another shop in B—— Street; their remark was, "This clock looks as if it had been in the hands of a blacksmith." To repair the harm done would cost almost as much as a new clock, therefore I decided not to have it done. Again, not long ago, I took a valuable gold watch to a shop of great repute to be cleaned, which they told me was all it required. On getting it back it constantly stopped; therefore I called at another of their branch shops, which I happened to pass, and asked what was the matter with it. They said it wanted cleaning. Why, I said, it was cleaned at their other shop a few days ago. The man looked surprised, and was puzzled what to say. Finding there was no reliance to be placed in this shop, I now have my watch, and am at a loss who to trust. Perhaps your contributor would enlighten your readers by giving the address of one or two respectable workmen of experience and mature age—as experience is only gained by age. There is one point in which I do not agree with the writer—viz., that clocks and watches ought to be cleaned every eighteen months; three years I have always heard was the length of time a properly cleaned watch ought to go, and every watchmaker I have ever spoken to on the subject is of that opinion. If I were to pay the enormous price asked by expensive shops for having my repeating clocks cleaned every eighteen months, in a few years cleaning so often would cost more than the price of a new clock. Of course, these shops charge according to their expensive rents and establishments, therefore it would be a public benefit to society in general if the gentleman who gives such good advice would add to it the address of some reliable working clock and watch makers that are honest and can be trusted, also the usual charges for cleaning watches and repeating clocks, etc."—[HERR SPRING replies as follows to the above:—"The watchmakers with whom you have spoken on the subject of cleaning watches, and who are agreed that a 'properly cleaned' watch ought to go for three years, can scarcely be trusted as safe guides. It is not so much the accumulated dirt that stops a watch as the thickening and drying up of the oil used on the pivots and other parts; and, no matter how perfectly a watch may be cleaned, the oil will thicken, run away, or evaporate in a much shorter time than three years. Speaking now with the authority of several matured and distinguished watch manufacturers at my back, I distinctly assert that a period of eighteen months is the longest average that one may safely rely upon for a watch to go without cleaning. Of course, in all questions of this sort one speaks of averages only. It sometimes happens that a combination of favourable circumstances entirely refute one's average experience. But if you have a good watch, you would be very unwise to trust to exceptional circumstances. Better by far adopt the eighteen months' rule, even if it sometimes happens that, owing to the exceptional and accidental quality of the particular oil used, your watch could go on without injury for a much longer period. You speak of having taken a valuable gold watch to a shop of great repute, and there having it cleaned. After the cleaning the watch stopped, and you took it to another watchmaker, who told you that the watch wanted cleaning. At the same time you yourself knew that the watch had been cleaned only a few days before. You will naturally be surprised to hear that the opinion given by the second watchmaker was not by any means a necessary sign of ignorance. If the wearer of a watch is a 'clean wearer,' there will probably be very little sign, even after eighteen months' time has elapsed, that it requires cleaning. But the clean appearance of a watch is no reliable guide to its condition. Probably under the dial, or in some hidden place, the oil has run away from one pivot, or from some other unseen part of the machinery, and yet the watchmaker on casually examining the watch on the surface, when brought in by a client, could know nothing of this. Still, the lack of oil on some unseen part would, of course, be a certain cause of stoppage or of erratic behaviour. Generally speaking, a watchmaker should, however, detect with his glass if a watch has recently been cleaned, for he would observe the freshness and the quantity of the oil. But when you visited the second watchmaker, you should have said: 'This watch was cleaned a few days ago, but constantly stops.' A watchmaker is as much entitled to an explanation of this sort as a doctor would be with a patient. As regards your carriage repeater clock, I need scarcely tell you that it is a very delicate piece of machinery. Clocks of this kind may be allowed to go without cleaning for a longer time than a watch, because they hold more oil. But carriage clocks usually have watch escapements, and it would be advisable to have the escapement oiled within a reasonable time; the rest of the clock may go on without much injury. It would be rather invidious on my part to indicate the names of certain selected watchmakers; I would prefer for the present, at least, to give a broad idea of the state of affairs among watchmakers. It does not follow that because a watchmaker has a fine shop and gorgeous window that he is a skilful man. The best men to go to are those who do essentially a watch business as distinguished from the jewellery trade. There are a number of quiet, old-standing watchmaking establishments in London, as elsewhere, in which your watches and clocks would be quite safe. These people usually employ good men, and if in any difficulty, know where to send the work to specialists in Clerkenwell and elsewhere. Watchmakers, unless they are well-known men in the trade itself, probably working in their own homes, are like doctors: you require experience of them. No doubt some of your friends, especially if you have any friends who wear very highly adjusted or complicated watches, will be acquainted with a thoroughly reliable watchmaker. By all means give the preference to the man who actually works himself at the bench, and avoid shops where the workmen are cramped together. Good work can only be done in good light, and with ample space and protection from interruption. I think, however, that you do not act wisely in taking your valuable watches from one shop to another. It is advisable to stick to one man, and return the watch or clock to him until it is made right. Armed with the information now given, you could ask him to send it to Clerkenwell if unable to accomplish the work himself. There are men in Clerkenwell—Englishmen, Frenchmen, Germans, and Swiss—who can do any imaginable work in connection with horology. As to prices for cleaning, there is, of course, no hard and fast line. A first-class lever watch, with escapement on end pieces, etc. etc., and keyless work, you should not pay for cleaning more than about 7s. 6d., if really well done. For plain watches, you should get the cleaning well done for about 4s. 6d.; complicated watches run to all prices for cleaning. Repeater carriage clocks should be well done, if they are not too complicated, for half a guinea."]

Worn Bearings.—E. T. (*Hackney, N.E.*) writes:—"As to A. L. B's. question about bearings in 'Shop' (see page 326, Vol. II.), I have great pleasure in being able to tell him how we used to reline worn bearings with white metal, and if he prefers to make new ones he can do so by first removing the worn brasses and following the same directions. The brasses must first be cleaned so as to remove grease and dirt, then the shaft must be slightly greased, but also free from dirt and grit. Now take a piece of ordinary clay and close up one end of the bearing, care being taken not to let the clay project into the crevice between the shaft and bearing brass; now the lower part of the other side is to be stopped in the same manner; but in closing the upper half a passage must be formed sufficiently large for the passage of the hot metal; when this is finished the metal must be made hot in a ladle and then poured into the passage, when it will run into the crevice between the shaft and the brasses, and when cold and the clay removed, A. L. B. will find that he has a perfectly light and durable bearing; if he wants a hole for lubricating he must ram a piece of clay into the hole in the brass, taking care that it touches the shaft, and he will find that it answers first class. I may as well state that our bearings were for overhead shafting, by which we used to drive eight lathes, 8 ft. beds, and one grindstone."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Dulcimer for Sale.—W. S. (*Appleby*).—Thanks for your letter, but you and all other correspondents having articles for sale or exchange should advertise them in the Sale and Exchange column of WORK. The "Shop" columns are not open to advertisements.—ED.

Electric Clock Fitment.—J. N. (*Rochester*).—By saying that I used a single-stroke bell, I thought it would be quite plain that as the hammer would complete the circuit each time it rose, therefore the electric bell would strike each time the hammer rose. My clock never gives any trouble, and answers perfectly.—H. J. L. J. M.

Builders' Price Book.—A. B. C. (*Birmingham*).—The book you mean is Laxton's "Builders' Price Book," published by Kelly & Co., 51, Great Queen Street, Lincoln's Inn, London. You would find "Beaton's Pocket Estimator," published by Crosby Lockwood & Co., London, of great service.—E. D.

Terra-cotta Painting.—AMATEUR.—No special article on this particular branch of painting has appeared in WORK, and I do not know that there are any special difficulties in it that call for one. If, however, you will state any difficulties under which you labour, there are many on my staff who will be happy to help you. In painting on terra-cotta you would simply use the ordinary oil colours in tubes, and select such flowers and foliage as would

contrast well with the red colour of the pottery. Perhaps your chief trouble lies in how and where to get suitable designs.—ED.

Lamp.—ONE IN THE DARK.—I am quite unable to answer this query. I should think that you would have seen where to get it in the paper, or wherever it was you saw the description. As you describe it, it is, to say the least, very vague. I can find no one who knows anything about it.—J. L.

Arrangement of WORK. — E. B. (*Bath*).—I am much obliged to you for your kind suggestions, but no change can be made in the arrangements at present adopted for WORK.—ED.

Stone Cutting and Masonry.—PIXIE.—I am dealing with bricklayers' work now, and after that we must hope for papers on the subject you mention. My great difficulty, as you must see, is want of space. There is no difficulty whatever in dealing with any and every subject, but it is not possible to get more into, or give greater variety in, each number than at present, and when any particular subject is once started it 's as well to work it off as quickly as other demands on space will allow.—ED.

Violin Making.—A DISAPPOINTED SUBSCRIBER.—The articles on "Violin Making" are in my hands, the manuscript ready to be put into type, and the illustrations ready for the engraver. Beyond this I shall decline to satisfy you, for courtesy is desirable even from those who smart and writhe under disappointment, which after all, in your case, is only pleasure deferred. I wonder if you will like fragments of your letter in type as much as you evidently relished them in pen and ink. This is your style: "Can you give us would-be fiddle makers any idea when you will begin them, or have you been blowing your horn, and promising something that your sign-writing piano-constructing head cannot grapple with? In my opinion your paper is full of promises which you have not the ability to perform. There are very few of the original subscribers here now taking it, and unless you be a little more truthful and perform what you promise you will have none on Tyneside. Will you be so good as to let me know when the Index to Vol. I. will be ready? Be as near the truth as you can." I am afraid you will hardly believe me when I say that the Index to Vol. I. has been ready since March 25, and can be had for 1d. through your newsagent on Tyneside, and although you put me down as a hardened and confirmed sinner in a multiplicity of ways, I think I could put a sufficient number of trustworthy gentlemen into the witness box to satisfy even you that in this case I have so far forsaken the errors of my utterances as to speak the truth, the whole truth, and nothing but the truth, so help, etc. etc.—ED.

Cement.—G. K.—I do not know the receipt for the cement you mention, but the following will, I think, suit your purpose. Soak 2 drs. of isinglass in 2 oz. water for twenty-four hours in a wide-mouthed bottle, then place the bottle in a vessel of boiling water until the contents have evaporated to 1 oz. Now add 1 oz. methylated spirit and strain through very fine muslin. Dissolve 1 dr. gum mastic and ½ dr. powdered gum ammoniac in 1 oz. methylated spirit. Mix this thoroughly with the isinglass solution while hot, and keep in well-corked bottle. I find this a capital cement for such jobs as you mention, but in case you should like a simpler recipe try this: Place ½ oz. isinglass in a wide-mouthed bottle and add water sufficient to cover it; allow to stand for twelve hours; heat in water bath as in first receipt, and add ½ oz. glacial acetic acid. This, perhaps, comes nearer the particular cement mentioned in your query than any other.—OPIFEX.

Wall-paper Maker.—W. E. R. (*Penryn*).—The goods marked T are probably the manufacture of the old-established firm, James Toleman, 17, Goswell Road, London, E.C.—F. P.

Centrifugal Pump.—F. J. H. (*Salford*).—Your question carries me back to the old days, but I must curtail my reply In the Exhibition, 1851, Appold's pump was shown, and also Gwynne's. I am not allowed space enough to describe what you require, but write to Messrs. Gwynne & Co., Hammersmith, London, and they will give you full particulars.—F. C.

Mechanic's Tips.—H. P. (*Blackheath*).—In testing iron for strength and ductility it is usual to determine the rate of elongation under an increasing strain, the ultimate resistance and percentage elongation in a given length being specified. For instance, for bridge work, iron plates should have an ultimate tensile resistance of 22 tons per sectional square inch, and extend at least 10 per cent in a length of 8 in. before fracture. No permanent set should occur under a stress less than 8 tons per sectional square inch. Friction may be reduced by the employment of rollers; the way in which they are used will depend upon the nature of the work to be done. Screw-jacks are included as lifting-jacks, but bottle-jacks are used in roasting meat, and are not lifting appliances. If you will frame more definite questions I shall be happy to reply to them.—F. C.

Volumes of WORK, etc.—W. S. W. (*Gourock, N. B.*).—It is impossible to say how many volumes there will be of WORK. All connected with it hope it will run on, like Tennyson's brook, for ever! Papers on the subject you name are already in hand awaiting publication.—C.

Cantor Lectures.—P. R. (*Sunderland*).—Write to the Secretary of The Society of Arts, John Street, Adelphi, London.—C.

Fixing Dial by the Compass. — SEMPER FIDELIS can avail himself of the following directions for finding the true or astronomical north:—Place the compass on a level surface, adjust the north or south points of the needle or card correctly to the "lubber line" of the bowl (or point representing it), then (if looking south) turn the bowl carefully to the right (or west) till the lubber line is distant from the south end of the card so many degrees and minutes as represent the variation. The card will then show the direction of the magnetic meridian, and the lubber line the true. If looking north, turn the bowl to the east. The yearly variation (which in 1818 reached its western maximum of some 24½°) has now so nearly approached zero, and is such a small fraction of a degree, that for any practical purpose the variation for the particular place only seems worth taking into account. The true latitude of the observatory at Dublin is, according to Keith Johnstone, 53° 23′ 2″.—A. Y.

Carriage Cushions. — TRIMMER.—The sketch which you have sent is the back-rest; this, together with the side squabs, will be easier to make than seat cushions. In the first place get a couple of sheets of brown paper, extra stiff, and cut a pattern out until it fits the place intended. We next get some hacking canvas, or if preferred, black linen, and cut it out a ¼ in. larger than the pattern all round. Next cut out the upholstering material 1½ in. wider all round than the pattern. There are two ways of setting the diamonds out on the cloth. The first is by drawing the lines upon the pattern, and making a pounce of it by pricking the lines with a bradawl and dusting powdered chalk through the holes on to the cloth, or by setting the diamonds out on the cloth with a rule and a piece of chalk,

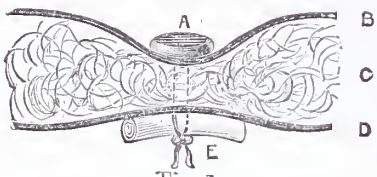


Fig. 1.

Carriage Cushions.—A, Button; B, Cloth; C, Hair; D, Canvas; E, Strip of Cloth or Tuft.

such as is used by tailors. In setting out diamonds, squares, etc., be sure to be careful and not do it in a hurry, as the beauty of the upholstery greatly depends upon the diamonds being all alike. When marked out we stitch the canvas to the material all round near the edge with strong thread, leaving a place at one side to stuff the cushion; some trimmers sew all up and cut a slit in the canvas at the back, afterwards sewing the slit when the cushion is stuffed; others object, as it sometimes happens that a couple of tufts just come where the slit is. We next stuff the back-rest full of the best curled horse hair and ram it in as tight as we can possibly get it. The back-rest will have swelled out to an enormous size. We therefore stitch the slit or end up when the back-rest will not hold any more hair and press the back-rest all over evenly. Next get the buttons or tufts and an upholsterer's needle 6 in. long, place the twine through, and push the needle through where the lines intersect each other. When all the buttons are placed at the front we turn the back-rest over and get some little pieces of cloth or canvas, then pull the strings which hold the buttons tightly, tie on a knot, then place the

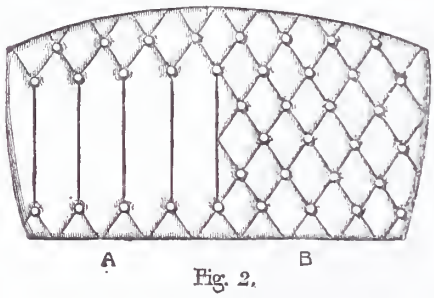


Fig. 2.

Carriage Cushions.—A, Diamond and Piping; B, Diamond.

roll between the twine, and tie up tightly. Tie the first bottom row of buttons first so that it makes the back-rest more full at the top, and more comfortable for the back to rest against. Finish upholstering the back-rest by stitching seaming lace all round the edge, afterwards arranging the diamonds more into shape with the hand, smoothing and arranging the creases out, then fasten with black tacks the back-rest in its place. Fig. 1 shows how the buttons are placed in the back, and Fig. 2 the back-rest finished.—W. P.

Brazing Band Saws.—S. B. (*Nottingham*).—For information concerning method of brazing hand saws by means of Duncan's machine, forward address and stamped envelope to the maker, T. Duncan, 305, Manchester Street, Oldham. He will supply printed instructions.—C.

Straightening Rods.—APPRENTICE.—First, are you sure that your rods are properly straightened before they are put into the lathe; and, second, is the steady true with the lathe centres? If you are sure on these points, then the rods must spring solely in consequence of the removal of the outer layer of metal. This is not unusual in long rods, for the skin is always harder and less elastic than the inner metal, and holds it in some constraint. The only way to ensure the straightness of the rods when the turning is finished, is to take a first heavy cut, and note the effect. If they bend, then straighten them before taking the finishing cut, which, if light, will leave them still straight.—J.

Embossing on Glass.—W. C. (*Forest Hill*) has written a long letter on the above subject, concluding with, "Hoping you will understand me." I confess I feel somewhat doubtful on the matter for statements and questions are somewhat mixed. I will, however, endeavour to unravel the meaning, and answer to the best of my ability. W. C. says he is in the gas lantern trade, and wants to know how to engrave on glass, as it would mean an addition to his income. He has read two or three books on the subject, and has watched glass writers do it, but still does not quite comprehend the how and the why. My emphatic advice is, if W. C. thinks he can increase his income by doing such work, then pay someone in the trade—a practical man—a fee to teach him. This, I think, will be the quickest and, in the end, the cheapest plan. I will, however, give such information as I trust may be helpful. Unless the job is a very small one, wax should not be used. Mark off the lettering on paper, and place it under the glass. Then with Brunswick black and a fine brush go over the glass, covering all except where the lettering has to appear. Let it harden, which will take about twenty-four hours. Examine carefully to see that there are no pin-holes, which must be carefully stopped. Clean the glass so that it is perfectly free from grease, not touching it even with the fingers. Build a small ledge around the glass of lard, and place the article on a perfectly level table out of doors. Pour a sufficient quantity of fluoric acid (which may be obtained of most chemists) to cover the glass. A dangerously corrosive fume is given off, which would be injurious to breathe, hence the need of working in the open air. From five to fifteen minutes may be required in etching the glass, depending on the strength of the acid. To determine the exact time, experiment on a piece of glass first. When the etching has been carried far enough, pour off the acid, well wash the glass, and remove the black. If coloured letters are required, then choose flashed glass of the colour desired. Paint the letters with B.B., and treat as before, biting down to the plain glass. If we desire embossed letters on ground glass, proceed as before, biting the letters, etc., fairly deep. The "ground" must be produced by rubbing the surface with fine emery and water, by the means of a piece of smooth iron. Any degree of fineness may be obtained by using varying Nos. of emery. As to the names of the makers of lamp glasses embossed on the chimneys, I presume it is done by the sand blast; at any rate, it has such an appearance to me. If W. C. will carry out these instructions, I think he will meet with success; but should any further difficulty arise, and he will state his want, I will do my best to meet it.—O. B.

Dulcimer Playing.—P. J. (*Birmingham*).—I am very pleased that P. J. has so far succeeded with his dulcimer, and hope he will be equally as successful in learning to play it. He must not be disheartened at making apparently slow progress at first, as this, if he perseveres, will soon give place to more rapid advance, and after a short time he will find almost any tune come comparatively easy to him, especially if he "has an ear," as it is called. First for the position of the instrument and the performer. Place the instrument on a table with the back end raised on the stand; this will bring the upper notes within easy striking distance, and also enable the player to strike the notes clear of each other. The seat should be of such a height as will bring the elbows (which should be kept close to, but not touching, the sides) on a level with the front edge of the instrument. The beaters should be lightly held, not gripped, between the thumb and the first and second fingers, and the blow should be given not with a stiff forearm, as such is fatal to good playing, but with the slightest possible movement of the wrist aided by an almost insensible contraction of the muscles of the thumb and fingers. Commence by practising the scale of G, starting with the first two bass notes. These should be struck with the right hand, the next two with the left hand, the next three with the right hand, which will bring us to the seventh note of the scale, and the left hand is now ready to commence the next octave, which commences on the right-hand side of the centre bridges. The first two notes, G A, are struck with the left hand, the next two, B C, with the right, the next two, D E (on the left of the bridges), with the left, and so on to the top, taking two notes with each hand and returning down scale in exactly the same order. When the scale can be played up and down with equal facility, *and not till then*, the learner may proceed to some simple air, taking care that he does not attempt another till the first is thoroughly mastered. I know of nothing more unpleasant than listening to a

player" who can tinker innumerable snatches of nes, but who cannot get through one without a ngle; such a one is sure to have the wind taken it of his sails by the first who comes along who n rattle a tune, be it ever so simple, right off the el. Again I say don't be discouraged if you don't pear to be getting on. Over anxiety is a very werful factor against progress, and very often a ne or exercise that *won't* come right one day, will me as easy as possible the very next time of try- g. It is not advisable to sit too long at a stretch, the ear gets dull and tired, as well as the muscles, nd "little and often" is generally found to ensure etter progress than long drudging practices with rresponding intervals between. One very impor- nt part must not be forgotten, and that is to keep e instrument well in tune; frequent tuning ccustoms the hand to the places where the notes re to be found, and also keeps the ear trained, and as a far more beneficial effect than at first appears, oth upon the instrument and the player.—R. F.

Piano Soundboard.—PIANO.—You will have ead, by the time you see this, that an iron plate is laced at the bottom of the piano to receive the ass strings. Glue all edges of the sonndboard xcept the bottom; of course that includes the bent ide edges. The soundboard rests on fillets or slips f wood, the rabbet on the bent side forming one. he reason the soundboard is left ½ in. below the vrest plank is in case tho back bends a little; when he strain is on it will not jam the soundboard. Vow with reference to your Broadwood piano, if t is going to remain the same height, you will have o string it as it was before. If you are remaking t, and you make it according to instructions given y NIL DESPERANDUM, of course it will be strength- ned, and you can string it according to instructions iven in No. 41 of WORK.—T. E.

Table Piano.—SINBAD.—Your idea for making a table piano with metal bars instead of strings has een anticipated in some measure by an instrument alled the Audiphono, tuning forks being used nstead of strings; but as to cost, they are more xpensive than some pianos, the merit in them hiefly being in their remaining in tune longer than a piano. Those of one or two octaves sold in shops are only toys; the difficulty would be to get the lower notes, then you would require keyboard and action, which form a large item in the cost of a piano.—T. E.

Phonograph Parts.—OGRAPH.—I am pleased to see that you take an interest in WORK; and as you are a constant reader of it, it will doubtless be of great service to you. I am also pleased to learn that you are interested in the phonograph, and would like to make one. It is true that I did promise to give working drawings and instructions for making a phonograph, but you know such a thing is too long for publication in "Shop," and there are many things of more importance to the reading public awaiting publication in the body of the paper; these, of course, must be attended to and get the preference. Perhaps sometime, when the demand for such an article will have arisen, the Editor will find room for it. In the meantime, if you have a definite want in this or any other matter, write stating the same as plainly as you can, and we will do our level best to help you.—W. D.

Acacia Wood.—LEO.—This wood will not hurt by keeping either in the "round" or "plank," as it is very dense, and will require a very considerable time to dry and season, especially if cut into thick planks. As regards when to cut, as wood does not deteriorate by being kept, this is quite immaterial.—A. J. H.

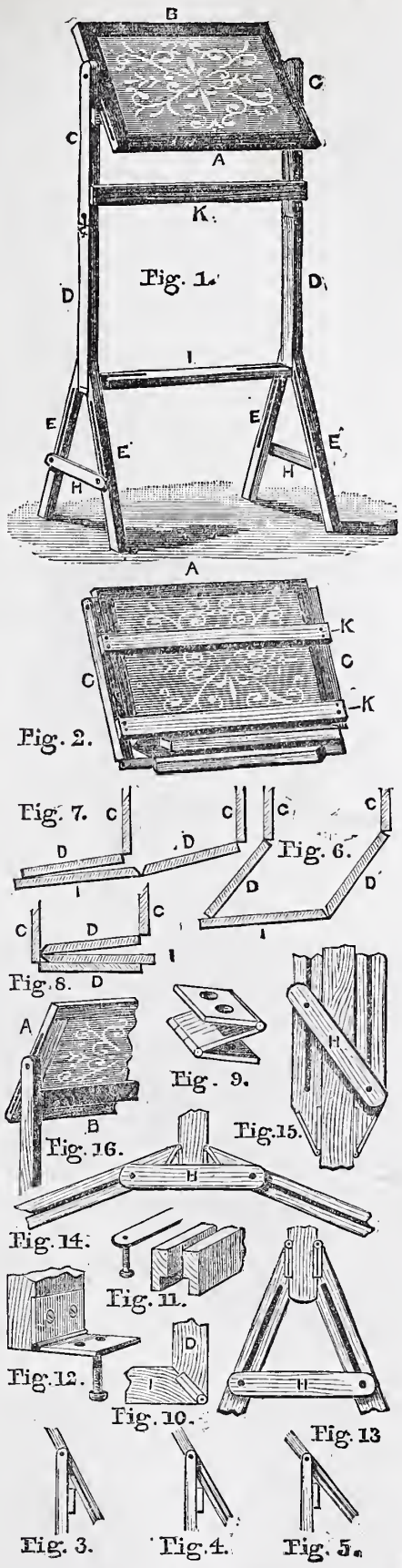
Engineering Employment. — 'PRENTICE. — Some shops take working apprentices, and if you send your address to T. M. Bear, Britannia Works, Colchester, he may, perhaps, give you the names of some likely firms.—ED.

Bismuth and Metal Sample.—IGNORAMUS.—You can buy bismuth at Messrs. Johnson, Matthey, and Co., Hatton Garden, E.C., but as the price varies with the market and the form in which it is required, you had better write to them, stating what you require, and asking for an estimate. The sample you sent was a piece of galena, which is sulphide of lead, and which forms extensive veins running through a limestone rock in Cumberland and Derbyshire and through a clay slate in Cornwall; 100 parts of the pure ore contain 86½ parts of lead. Galena almost invariably contains silver, and even so small a proportion as two parts of the latter in a thousand of ore can be profitably extracted from the lead after smelting it from the ore.—F. B. C.

Metals, Purchasing.—J. M. H. (*Wallsend-on-Tyne*).—You can obtain antimony and bismuth from Messrs. Johnson, Matthey, & Co., Hatton Garden, London, E.C., but as the prices vary with the market and the form in which it is required, you had better write to them, stating what you require, and asking for an estimate.—F. B. C.

Dresser, Dovetailing, etc.—T. T. (*Kilburn*).—Two articles on the former have appeared in Vol. II., pages 117 and 170, otherwise Nos. 60 and 63. Kindly look them up. Dovetailing will be treated in time, but as all wants have to be supplied, as well as those of amateur joiners, too much space cannot be given to articles on woodwork. Very pleased to hear you are always willing to listen to advice, of which you will find plenty in WORK.—D. A.

Folding Reading Stand.—E. H. (*London, N.*).—I have lately given two designs, one of which might suit you. But as "tastes differ," and as you might not fancy either of those two, I have designed the one here shown. If well made it should be as rigid as if made *minus* its folding facilities. You may imagine that the article would be a rickety affair—no such thing. Sizes must be left to yourself, but I will give you a few hints. No piece comes entirely apart from the others. It may seem a lot of trouble necessary to make this stand, but you will know best whether it will recompense you. The rails C, C are connected by cross rails K, K, screwed on to their fronts, not between them. Through C, C pass pivots, which enter into the side thicknesses of the frame. The latter are grooved for about three-parts their length, starting from the A end. According to the distance the top rail K is screwed from the tops of C, C, so will be regulated the angle at which the frame will be adjusted. Figs. 3, 4, and 5 explain this. In folding, the frame is turned up and over; it then runs down between C, C. This action can be seen by Fig. 16. The rails D, D, are hinged to C, C, so that they may fold as in Figs. 6, 7, and 8, where is shown the process of closing. The right-hand D is united to C by an ordinary hinge. The left-hand D must be connected to C by a hinge similar to Fig. 9. I do not know whether such a hinge is obtainable. It, or something like it, could be easily made by yourself. It will be necessary, as the left-hand D turns both to left and right. The rail I is hinged, as in Fig. 10, at one end to D, and, at the left-hand end is shaped for an inch or so, as in section in Fig. 11. On the inner thickness of D at the end is a hinge, to the lower half of which is screwed a pivot, as in Fig. 12. The pivot travels along I when folded, as in Figs. 6, 7, and 8. D, D must not be longer than the length of the frame—the left-hand one being the longer by the combined thicknesses of one D and I. The feet are shown in Figs. 13, 14, and 15. H, H are *very* thin flat metal rails, at each end of which is a pivot, as in Fig. 12, which runs along the feet, which will be in section for some distance similar to Fig. 11. When folding, H is pushed up, taking with it the feet, as in Fig. 14, and finally as in Fig. 15. H, H must run a good distance down the feet, or they will be useless. A small hook or bolt must be fixed to the left-hand C, to connect it and D, and prevent the stand from collapsing. Thickness of wood you will, no doubt, be able to judge of. If not, write again. Space is important.—J. S.



Folding Reading Stand.

Fig. 1.—Stand erect. Fig. 2.—Closed. Figs. 3, 4, and 5.—Angles at which frame can be adjusted by fixing Rail K in Figs. 1 and 2. Figs. 6, 7, and 8.—Showing process of part of Stand folding. Fig. 9.—Hinge to be used in connection with C and D. Fig. 10.—Junction of right-hand D and I. Fig. 11.—Pivots to be used at ends of H, H and also section of part of Rails E and I. Fig. 12.—Hinge and Pivot at bottom of left-hand D. Figs. 13, 14, and 15.—Process of closing the Feet E, E. Fig. 16.—Showing how to fold Frame.

Carpenter's Paper Cap.—CARADOC.—The construction of a paper cap can hardly be described in WORK while there are so many more useful and practical subjects requiring attention.—D. A.

Initials and Tool Chest.—S. H. D. (*Newtown*).—Unless you can engrave neatly, do not attempt to do the initials. Any engraver will do the work for you much better than you could possibly do it without considerable practice and skill. I presume you are wanting the initials for trade purposes. Yes, you may be sure that a joiner's tool chest will not be overlooked, but no time can be named for the appearance of an article on it.—D. D.

French Polish.—J. G. (*Ashton-under-Lyne*).—French polish for oak or bay wood is just the same as any other French polish. It is a solution of shellac and methylated spirit. Other ingredients are often used, but they are of doubtful advantage. The polish may be made either thick or thin, according to the proportions of lac and spirit.—D. D.

Enamelling.—P. W. B. (*Keynsham*).—There are several ways of enamelling furniture of the kind you refer to. If the ordinary enamel paints do not produce a sufficiently good result, you may try the following process, but to get it to the high finish "which is seen on the best furniture of the kind," requires skill and experience. Stain the wood (pine?) with vermilion mixed with French polish. Then in the usual way get up the polish with spirit rubber. Unless you can do French polishing well, you may as well be content with enamel paint.—D. D.

Bagatelle Table Covering.—LITTLE SCOT.—A good deal will depend on the construction of the table. You will not find the job an easy one, though it will be much simplified if you can unscrew the bed. If you can do this, and notice how the present cloth is fastened, directions are unnecessary. If you cannot, I must ask for further particulars before I can help you.—D. D.

Marble Stains.—G. F. H. (*South Lambeth*).—The simplest mixture you can use for restoring marble and removing stains, is one of whiting, oxalic acid, and water. Dissolve some of the acid and then make a paste with the whiting. Let the paste remain on the marble for a few hours and then wash off. The application may be repeated if necessary. Remember that oxalic acid is a deadly poison.—D. D.

Worm in Wood.—R. J. (*Edinburgh*).—Unless your chairs are very old, the state of the wood shows that the material has been unsuited to the purpose. You can do little or nothing to arrest the decay, which from your account should not have been allowed to proceed so far as it has. The best thing you can do is to impregnate the defective parts with benzoline. This will kill the worms, and, so far as is possible, will prevent the injury extending. From your description, I imagine the suite is only a common one, so pray do not let my remarks in any way be taken as implying that you have been taken in. If you are inclined to tinker with the chairs yourself, the hint that decayed parts may be cut out and replaced by sound wood will perhaps be of service to you.—D. D.

Boring out Rifle.—J. W. S. (*Orkney*).—To make it suit for a shot-gun :—For this job a good lathe is wanted, and a plug-reamer with a cutting shoulder; the plug to fit snugly into the barrel, and the cutting shoulder as much larger in diameter as will cut away the lands of the rifling. To attempt this job, the worker must be expert at the use of the lathe, and handy at adapting tools to the requirement of the job as it progresses. This plug-reamer must be followed by a reamer that will finish the inside of the barrel quite smooth. Great care will be required in using the cutting reamer, or some parts will cut up roughly and leave a faulty surface that cannot be removed in the finishing.—LIVERPOOL.

Rubber Sheeting.—MAZINNDAR (*Rawal Pindi*).—I am afraid that anything which could be said in "Shop" about the manufacture of rubber sheeting would be of very little assistance to you, but your suggestion shall be kept in mind. I am pleased to hear that the article on rubber-stamp making has been of assistance to you, and your letter is another evidence of the utility of WORK in any part of the world.—D. A.

Lead Lights.—CINQUE PORTS.—The material used for cementing or stopping in the glass leaded lights is a mixture of lamp black and putty (painter's), and then cleaned off with plaster of Paris, the plaster helping the setting of the putty.—E. D.

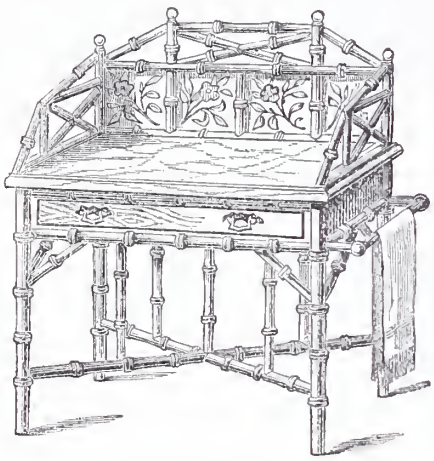
Addresses of Writers in WORK. — F. B. (*Taunton*).—The addresses of the members of the staff of WORK cannot be given; but any sealed and stamped communication sent to the office of WORK will be forwarded to the desired destination.—C.

Windmill Speed.—WINDMILL.—The angle at which to set the sails of a windmill varies from 15 degrees at the shaft to 27 degrees at the end of each blade. You can regulate your mill by a "counter-fan" if on level ground. If you will send full particulars as to load and nature of work to be done by the mill, I can furnish the information you seem to require.—F. C.

Dialling.—H. E. T. S. (*Lewisham*).—I am not acquainted with the table referred to, unless it be a table of Mean Time, *i.e.*, of the differences between dial and clock. Many good almanacs, Whitaker's for instance, give this difference for every day in the year. Would not H. E. T. S. do better to work out his dial, full size, by rule? In the process of engraving a small diagram trifling errors may creep in which become grave ones when enlarged. I am not aware that ring dials are made at the present time, but I believe that in the old "Chambers's Encyclopædia," published last century, such a dial is figured, and its construction explained.—A. Y.

Locomotive Boiler.—T. L. P. (*Liverpool*).—To make a locomotive boiler you must, after the designing and drawing is completed, lay out all the several plates to full size, giving their proper allowances for flanging; and cutting out such holes as may be required before attempting to put them together. The flanging must be done over a block of cast iron whose edges are rounded to the same radius as the insides of the plates. This will be stiff work in these plates, especially in the tube plates, whose thickness for your boiler should not be less than 6 or 7 gauge. The radius over which they are flanged should not be less than ¾ in. The plates will have to be held down on the block by means of a collared or a screwed bolt passing through any convenient hole or holes. Properly each plate should have its own special block, made to the contour of the internal part of the flange. Great care and patience are necessary to the formation of neat and even flanges, and if they are not regular, proper joints cannot be made between the plates. The barrel need not be made in three rings as in practice, but a single sheet will do just as well. It should be about 18½ in. or 19 in. long, and be rolled round to make a butt joint, and then be united with a strip of about ⅜ in. wide with two rows of $\frac{1}{16}$ in. or ¼ in. rivets. When rivetting the various parts you must pitch the rivets pretty closely together, say not further apart than ⅝ in. from centre to centre; better $\frac{9}{16}$ in. or ½ in., for if too far apart the seams will certainly leak. You had better buy the rivets of copper, not iron, or else you will have galvanic action going on; have snap or cup heads everywhere rather than countersunk heads. The head of the rivet will be held up by means of a dolly or bar of iron slightly hollowed on the end to support it, while the tail is hammered over with the narrow pane of a hammer, and finally finished and rounded neatly with a snap tool. In positions where a dolly cannot be made to afford direct support to the rivet head, a hammer with an elastic ash handle, called a "holding-up hammer," is pressed against a suitable fulcrum, and forced up underneath the rivet head. Your fire tubes should be about ¾ in. internal diameter, and from nine to twelve in number. They must be expanded in their holes to make them water-tight, and beaded over in the fire box to protect them from the action of the flame. They may be of copper or of brass, but not iron. When the rivetting is done the seams are caulked—that is, the ends of the plates are all dumped up in minute detail by driving a blunt chisel-like bent tool, say ⅛ in. thick at the end, against them with a hammer. This slightly spreads the metal and causes close contact to take place between the plates. Caulking is always necessary, and if neglected, or done hurriedly, the boiler will inevitably leak. When the boiler is finished, you must test it under water pressure to, say, 50 per cent. higher pressure than you intend to steam it under. Then more caulking will have to be done at those sections where water weeps out. There is so very much work in a locomotive boiler of the size you contemplate that it is impossible to give you full information in a mere reply. The various stays, fittings, and mountings should demand some attention. But if you want any information about special parts as you proceed, or drawings, or any hints in design, I will try and help you.—J.

Bamboo Washstand.—F. S. P. (*Whitworth*).—I have given you a design for a washstand in bamboo, but I regret that there is not sufficient space at my disposal for the necessary explanations in connection with the construction. This will be of little consequence to you, as you say you are acquainted with the joinery of bamboos, but it is an essential matter to those readers who are ignorant of this knowledge. I was at first about to send merely a verbal reply to your query—not a sketch in addition; for, as you will readily understand, answers are given to individual correspondents for the benefit of other readers besides themselves, and this reply can hardly be classed as beneficial to others without full working details; but I have done thus much because you are a new subscriber, and it is always our desire to show our regard for those whom we wish to continue (as you say you at present do) to appreciate us. Perhaps some brother contributor who has had more acquaintance with bamboo furniture than I have will note this



Bamboo Washstand.

reply, and let us have a few descriptive papers concerning this branch of industry. Bamboo canes are of such slender proportions and comparative lightness that it would almost appear that in building up such an article as a washstand, upon which a great amount of weight will necessarily be brought to bear in the shape of marble top, basin, and water, but a weak and feeble job would be the result of any amount of skill and labour; therefore, my having this in view will explain my reason for showing upright canes underneath the table, their purpose being to add to the strength of the stand in lending support for the just-mentioned weight. I do not know whether this design will suggest any details to you suitable for a toilette table, as you desire, but, of course, if you wish to match it properly you will have precisely the same underpart. You further say that you will probably make a wardrobe to complete a bedroom suite in bamboo. Now it strikes me that you will have a peculiar job before you, for a wardrobe being a species of cupboard, I fail to see how you can make a lighter article, or a better-looking one, by the aid of bamboos than you can with boards only. But I must leave you now, with the hope that you may, in the future, be fully instructed and pleased in bamboo furniture making.—J. S.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—G. H. (*London, E.C.*); C. A. W. (*Kentish Town*); A. E. W. (*Islington*); J. W. T. B. (*Brighton*); MAGNESIUM; A WORKER; G. W. R. (*Leyton*); E. A. W. (*Stratford*); R. C. (*South Lambeth*); J. H.; H. C. (*Walsall*); R. A. (*Islington*); G. H. M. (*Leeds*); A. M. (*Holborn*); S. P. (*Nottingham*); W. J. W. (*King's Cross*); J. C. R. (*Liverpool*); F. J. W. (*London, N.W.*); F. K. (*Manchester*); L. J. F. (*Maidenhead*); PLUMBER; DELPH; J. R. (*Redcar*); SUBSCRIBER (*Gosport*); READER (*Walsall*); HULTA (*Hull*); J. M. S. T. (*Govan*); N. Q. (*Manchester*); GOOD OLD JEFF; DABBLER; A. C. H. (*Kennington*); A. M. A. (*Ayrshire*); HOSIER'S ASSISTANT; E. A. (*Bristol*); J. R. C. (*Ashton-under-Lyne*); C. W. (*London, S.E.*); E. P. (*Castleford*); R. H. P. (*Redruth*); G. S. (*London, W.*); J. W. (*London, S.W.*); C. H. B. (*London, W.*); YACHT; AN ADMIRER OF "WORK"; E. E. B. (*Cockermouth*); W. P. (*Dartford*); AMATEUR CARPENTER; ONE WHO WOULD LIKE TO KNOW; J. W. (*South Wales*); H. J. G. (*Northampton*); C. J. (*Surrey*); F. W. P. (*Cockermouth*); W. C. (*Hulme*); MAGIC; H. H. (*Highbury*); G. P. (*Lower Edmonton*); H. H. (*Hull*); G. W. M. (*London, S.E.*); L. E. (*Camberwell*); J. G. (*Liverpool*); J. H. (*Burton-on-Trent*); M. R. (*Huddersfield*); J. M. J. (*Belfast*); F. W. (*Leicester*); A. H. (*Stratford, E.*); J. & E. M. (*London, E.C.*); G. W. H. (*Plumstead*); H. W. D. (*Bermondsey*); R. H. H. (*Shutter Oak*); J. S. (*Aberdeen*); IRONWORKER; W. P. (*Pipton*); D. McG. (*Renton*); A. E. B. (*Bow*).

"WORK" EXHIBITION.

(1890-91).

For Classification, Prize List, etc., see WORK Nos. 70 and 78.

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in pages 290 and 418 of this Magazine:—

For Design for Medal.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

For Design for Certificate.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

If any Competitors wish to submit a Model in Clay, Plaster, Wax, etc., as a Design for Medal instead of a Drawing, they are at liberty to do so.

Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

Prize Competition.
Medal (or Certificate, as the case may be.)

A Motto must be affixed to each Drawing, and the name and address of the sender enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted to three competent judges, who will select those that are considered most worthy of prizes.

The Prize Drawings will become the property of Messrs. CASSELL & COMPANY, Limited, who will return all Designs made by unsuccessful competitors to their respective owners carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced in WORK in due course.

For further particulars, all intending competitors should apply to the Secretary, "WORK" Exhibition, CASSELL & COMPANY, Limited, as above, stating which competition they intend to contest.

N.B.—Any Competitor, whether successful or not, is at liberty to exhibit his designs at the forthcoming WORK Exhibition, on filling in the proper application form for space; and success in this Competition will be held to be no bar to his receiving honours if awarded by the Jurors in addition to the above Prizes, but such forms must be filled in and forwarded previous to the 30th of Sept. to the Secretary, WORK Exhibition, as above.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT's, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [14 R

Buyers of Lathes and other Tools send 3d. for list of Second-hand Tools.—BRITANNIA WORKS, Colchester; or inspect largest stock in London, 100, Houndsditch. [16 R

Model Engine Castings.—Illustrated catalogue, 4d.; Screws and Bolts, list stamp.—STIFFIN & Co., 324, Essex Road, London, N. [1 S

Designs.—100 Fretwork (speciality), 100 Carving, 100 Repoussé, 100 Sign Stencils, (all full size), 300 Turning, 400 Stencils, 500 Shields etc. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Rd., Bournemouth. [2S

I.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Cycles.—A. G. H. (*Bolton*).—In answer to this correspondent, who writes criticising adversely the article on "A Few Hints to Intending Purchasers of Cycles," which appeared in No. 66 of WORK, it will be the best plan to reply to his strictures in the order in which they occur in his letter. He writes as follows:—"I was considerably astonished at the 'hints' to cyclists you publish in this week's issue, and am afraid novices following the writer of the article's advice will speedily 'get disgusted with it.' The vertical position he so strongly recommends is *now discarded by all our best riders both on the road and path.* Mr. A. Holhein, the hero of the great ride of 324 miles in twenty-four hours, says the *nose* of the saddle should be 3 to 6 in. *behind* the centre of crank axle, not 'centrally above crank shaft,' as your writer says. Mr. W. Chater Lea, champion hill climber, endorses Mr. Holhein's opinion, and this position is adopted by all the crack riders of the day." From the above remarks it is very evident that A. G. H. paid very slight attention to what he was reading, or he would most probably have found out that the author's intention in writing the article was not to teach the people he mentions, and brings forward as authorities on the best position of the saddle suitable to their style of riding, viz., heroes, path and road racers, champion hill climbers, crack riders, etc., nor himself, if he includes himself among the above, as, from his expression about "our crack riders," I suppose he does. On the contrary, it was for people who, knowing almost or absolutely nothing about riding, were about to commence this exhilarating pastime for getting about and seeing the beauties of the country. It was also especially written to persuade them to get a machine on which they could ride in a becoming and upright position, and still be able to get over the ground to the best advantage, as regards the application of the power and speed if desired, and not by any means for racing purposes, which A. G. H. seems to think is the acme and only use of cycling. At the present time, when racing is indulged in to such an extent that records are often beaten by only very small fractions of seconds, it is evident that racing men must bend almost horizontal to lessen the friction of the air, as when no wind is blowing, men travelling at fifteen miles and more an hour find that the pressure increases materially at every increase of speed. On this account, when there is any wind, it is an absolute necessity that every racer, when so engaged, either against other men or time, should lie on his machine as nearly horizontal as possible in order to reduce the friction to a minimum; and in order to be able, by the swaying of the body, to put more pressure on the pedals, the seat must be placed further back, as in this position crack riders (as A. G. H. says) prefer it. The only racing man I have seen who, when on the path racing, sat in an upright attitude, was Keen, and it is a question whether any rider would be able to cut the present records in such a position. A. G. H. next says that I advise the seat to be placed "centrally above crank shaft." My expression was "almost centrally above crank shaft," and by this I did not mean the centre of the seat was to be above the centre of the crank shaft, but the nose of the saddle, which A. G. H. might have found out by carefully reading the following paragraph to the one in which the expression quoted by him appeared, in which it says:—"The seat is placed only slightly behind the crank shaft." He could also have found out by raising a perpendicular through the crank shaft in Fig. 3 of the article, as he was so kind to do in the sketches which he forwarded, when he would have easily seen that it was the nose of the saddle that was intended to be over the centre of the crank shaft. For my benefit he kindly sent some advertisement cuttings of various machine makers, some good, some bad. Among the former was the advertisement of one of the best makers and designers in the trade. In this sketch A. G. H., with an ordinary pen, kindly draws a line (which is by no means vertical) to show how far back the nose of the saddle is from the centre of the crank shaft. In order to show that advertisements cannot be relied on as accurate drawings of what a manufacturer sells, I can only say that the sketch shown in Fig. 3 of WORK was taken from an almost new machine of the writer's by the same makers, and the nose of the saddle is just ½ in. behind the centre of the crank shaft. He then writes:—"The position recommended by your article is bad in the highest degree, as it throws the rider on to the *narrow part of saddle, causing perennial pressure;* in addition to which a good pace can only be maintained for a short time, and by great exertion. A rider, to travel easily and with a minimum of exertion, must sit well on the back part of the saddle, which must be well behind his work; he is thus enabled to push the pedals instead of stamping, also to use his ankles with good effect." Here he says that perennial pressure is caused by the rider being thrown on to the narrow part of the saddle. If, by perennial, he means constant, I cannot see why the pressure won't be perennial when he sits well back; I suppose he means to say that it will be more detrimental to the rider to rest on the front or narrow part of the saddle than on the broad part. This I quite agree with. I therefore maintain that my position of saddle will allow the rider to sit further back, and, therefore, with greater comfort. When the greatest exertion is needed, viz., climbing hills, then I am almost standing on the pedals, thus being relieved of almost all pressure from the saddle. When the work is light, as on a good level road, I can sit with ease on the broad part of the saddle. A good rider, when using his ankles to the best advantage, not only has to push the pedals over the highest part of the throw of crank, but he should likewise push them backwards when passing the lowest point. When sitting far back he is in the best position for performing the first of these actions, but he is in the worst as regards the performance of the backward push on the pedals, and he should be placed in such a position that when using his ankles he is able to push with the foot both when passing the top centre and also when passing the bottom. The word "stamping," used by A. G. H., is not quite clear; he does not surely mean to say that because a man sits well above his work he must necessarily give blows to the pedals on the same principle as the hammers in a quartz mill. He concludes this paragraph with the sentence, "I have tried both positions, and can travel faster and longer distances with less fatigue." If A. G. H. is so fond of destroying the meaning of phrases in other people's articles he should be more careful about his own letters. The meaning of this unfinished sentence I shall not make myself appear such a dunce as not to understand, but he might have finished it. I also have tried both positions, and find that I can go farther, and with less fatigue, when the seat is as shown in Fig. 3—that is, when in the forward position. He next writes: "Again, the advice that the seat and handles should be of the same height is absurd, as it is evident that the relative height of both depends on the reach of the rider." Here, again, A. G. H. jumps to a conclusion which, if he had shown one half the pains in understanding the article which he has shown in finding fault with it, he would have had less reason to complain of it. What I said was the pedals, handle bar, and seat, in all well-designed safeties are *adjustable* in a slot, and when the handle bar and seat are in their mid position as regards adjustability, they should be level. The reason of this was that in a *well-proportioned* man the hand when closed *comes* slightly *below* the seat, so that when the arms are extended outwards to grasp the handles they will be about level with the seat. If a rider should, therefore, be deformed by having his arms too long or too short, the seat and handles, being level when in their mid position, would be more easily adjustable to suit either case. He proceeds as follows: "If your paper is widely read, I am afraid the article will cause annoyance to budding cyclists, and should like to see another article by a competent authority on cycling." The Editor of WORK is generally ready to accept literary matter on approval. Probably A. G. H., who, from the way he writes, wishes to appear to be a great authority on racing matters, would oblige with an article in order to teach the novices how to become racers. He concludes with: "I enclose a few cuttings from the advertisements of well-known makers which you will notice are rather different to the model (?) machine of your writer's." As I mentioned before, the model (?) machine was a real one, and is much more reliable than a sketch, the accuracy of which can never be relied on, as the machines themselves are continually undergoing alterations, while the blocks from which the printing is done, if there is any likeness to the machine at all, are not altered.—P. B. H.

Palliasse.—R. W. (*Ruspidge*).—Unless you are wanting to make palliasses in large numbers, it is not necessary to have a box. The only object of a box is to allow the straw stuffing to be pressed closely and firmly, but you ought to be able to get the same result without. All you have to do is to lay the straw evenly and in sufficient quantity. There is no regulation pattern for the boxes; and when I tell you that a couple of boards made to sufficient size, either by jointing or otherwise, and kept at suitable distance apart, will do as well as anything, I do not think I need say more. The details you can easily arrange.—D. D.

Fret Wood Dealers.—E. A. T. (*Doncaster*).—It is quite impossible to give answers to questions in the issues immediately succeeding receipt of inquiry. A moment's reflection must have shown you the absurdity of expecting a reply in such a short time, and as you say an answer otherwise will be no use, I do not give it. This acknowledgment is sent in the hope that it may catch your eye, and explain to you how it is the information you want is not in "this week's issue."—D. D.

American Cloth.—C. W. (*Kensington*).—I am unable to tell you how to make American (or leather) cloth of the best quality, for the simple reason that manufacturers of a speciality do not usually divulge their methods. Even if you were to be told, it would be useless for you to attempt to make the cloth, as the best you could possibly make, without the necessary plant and experience, would be far worse than the commonest you could buy. I daresay you are not aware that one manufacturer enjoys a pre-eminent reputation for quality of this material; and as it is made in almost an endless variety of colour, I think you will be able to get what you want from any good upholsterer. Of course, if you get common cheap stuff, you must expect it to become sticky and objectionable in other ways. If you had stated for what purpose you want the cloth, I might have been able to suggest some preparation which you could make; but as you have, like too many inquirers, been so scanty in your information, I am unable to do more than treat your inquiry in a general way.—D. D.

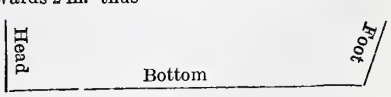
Pill Boxes.—MATCHWOOD.—As these require special machinery, they are not suitable things for an amateur to make in small quantities. You will save time and money by purchasing any you may require. The cost is a mere nothing.—D. D.

Plumbing.—J. P. (*Kingsland*).—Replying to your questions in the order in which you give them:—(1) Plumbers' metal or solder, when purchased at the shops or metal warehouses, does not require anything added to or mixed with it, as it is all ready for use. You can mix it yourself if you wish it; it is composed of lead two parts, tin one part, melted and mixed together, and run out into strips or ingots. (2) The material of which the wiping cloths, or "wipes," as the plumbers term them, are made is fustian or moleskin and bed ticking; some prefer one, and some the other; if the ticking is used, of course a greater number of thicknesses are required than if fustian were used; they are not soaked in tallow, but are rubbed with it each time of making a joint; they vary in size from 2 in. square and upwards. The way to make a saddle joint is to make a hole in one pipe and let the other into it—it must be a perfect fit, or the metal will run in and shake the pipe. The parts where the solder is not to go are then soiled with the usual mixture; next proceed as in making any other joint. You would find the Paquelin lamp, which I have several times spoken of in these columns, a great help to you, as you would, for the odd jobs that you have to do, be able to dispense in a great measure with the metal pot and irons.—R. A.

Bookcase.—J. P. (*Blackburn*).—An article describing the construction of a bookcase is in hand. Though not quite the style of thing you ask about, you will have no difficulty in understanding from the description how to make what you require. All you will have to do is to ignore the directions so far as they refer to the lower part. I am afraid you have not read WORK carefully, or you would not have said you have never seen "anything of the sort" in it.—D. D.

Staining.—R. A. DE P. (*South Kensington*).—I am afraid the reason for wood stained with your mixture not looking nice must be attributed to your want of experience rather than to any fault in the stain itself. I have carefully tested both of the samples you have sent, and while I find one is much clearer than the other, I find no serious objection with either. That which I take to be your own—it is, by the way, a pity you did not put on the bottles some indication of which was which—is rather too dark for ordinary purposes. If you reduce the strength by adding some more water, you will probably improve the appearance of your work, unless you want it very dark indeed. The other stain seems to be merely a solution of bichromate of potash, but I may be wrong in this assumption. Wherever it is thought desirable, proportions of ingredients are named; but, as a rule, it is better for the maker or user to know the contents, leaving him to vary proportions according to circumstances. One of the chief elements in staining and French polishing operations is judgment.—D. D.

Coffins.—J. B. (*Rawtenstall*).—The measure for a coffin is taken much as any other measures are obtained, from the crown of the head to the great toe for the length; for the width the measure is taken across the shoulders; but for a woman it is necessary to provide a wider coffin, owing to the greater breadth of the hips in the female figure: it is customary to add an inch to the shoulder measure; but J. B. must use his own judgment, always remembering that it is better to make the coffin too wide than too narrow; it gives great pain to the relatives if any difficulty occurs in the placing of the body of one they have loved in the coffin provided. The average-sized coffin may be taken at 5 ft. 6 in. long, and 17 in. broad at the shoulders; the sides of such a coffin should be 13 in. at the head and 11 in. broad at the foot: this gives a clear depth to the coffin of 12 in. and 10 in. respectively. J. B. had better make a set of patterns of the bottom, or half patterns will do. The head and foot are fixed on to the coffin bottom with nails driven through the bottom into the head and foot, which average 8 in. wide at the outside of head and 6½ in. wide at the outside of foot. Both head and foot must be sawn wider than above, and planed to the width and the angle required after fixing them on the bottom. I give these figures to help J. B. to set out his pattern, which, being preserved, will save a great deal of time; the distance of the shoulder line from the head is about ⅔ of the length, and I ought to say that the pattern is made the length of the coffin; the 2 in. lost by nailing on the head and foot is regained by making the foot splay outwards 2 in. thus—



Then nail sides on plane level, and lastly fit the lid. If J. B. wishes for help to make patterns, please ask again.—B. A. B.

Prince of Wales' Harp.—W. J. (*Belfast*).—In stringing the harp, use for the first three (the shortest) strings No. 7, next three No. 8, next three No. 9, next two No. 10, and last two No. 11 steel wire M. W. G. The tuning is a simple scale, commencing at C, and continuing upward to the limit of the harp. The lowest note having been tuned to the pitch required, tune No. 8 an octave above; then tune No. 5 a fifth above; then return to No. 2,

and tune that a fourth below No. 5; then No. 6 a fifth above No. 2; then No. 3 a fourth below No. 6; then No. 7 a fifth above No. 3; and, lastly, to complete the "diatonic" scale, tune No. 4 a fourth above No. 1. The remaining notes are tuned in octaves to Nos. 2, 3, 4, 5, and 6 respectively. If the fifths in the ascending scale are all tuned just a shade—flat "tempered," as it is called—the chords will sound smoother and much more pleasant to the ear.—R. F.

Piano Front Treatment.—NEMO.—A full fretwork front in a piano is a little old-fashioned, and you would certainly improve the appearance if you could form a small panel at each end, say of oak gilded all over. Any picture-frame maker would make it for you, and paint a bird resting on a spray of flowers on each; I have painted several myself, and have found them most effective. Then you could treat the centre in the way you name, when I think you would say it was most artistic. I do not think the design you mention would be suitable. If you wish to enlarge it, do it by means of squares (see front page of No. 14 of WORK).—T. E.

Stringing Square Piano.—H. A. C. (*Plaistow, E.*).—As I understand your letter, your square piano is a five octave, C to C; the pieces of whalebone you mention, I presume, are the dampers. You can repair the soundboard with some thin pine wood; fit the piece in, then glue a piece of linen underneath to support it. You will have to use care in stringing; see that it is sound where the ends of the strings are hitched. Start at treble end with No. 8 steel wire—put on twelve notes of this size; next take No. 9 steel wire—put on twelve notes of this; then No. 10 steel—eighteen notes. Now take brass music wire No. 10, and put on eight notes; No. 12, and put on four notes; No. 14, and put on four notes; No. 20, and put on four notes; this will complete it. You can obtain the wire from W. Hughes, 37, Drury Lane.—T. E.

How to Make a Piano.—KINGSLAND.—I thank you for your kind remarks, and I cannot understand how you leave off at E instead of A. Perhaps the best way to give you an answer will be for me to give you the notes for the seven octaves—[A, A sharp, B, C, C sharp, D, D sharp, E, F, F sharp, G, G sharp, A] [A sharp, B, C, C sharp, D, D sharp, E, F, F sharp, G, G sharp, A] [A sharp, B, C, C sharp, D, D sharp, E, F, F sharp, G, G sharp, A] [A sharp, B, C, C sharp, D, D sharp, E, F, F sharp, G, G sharp, A] [A sharp, B, C, C sharp, D, D sharp, E, F, F sharp, G, G sharp, A] [A sharp, B, C, C sharp, D, D sharp, E, F, F sharp, G, G sharp, A] [A sharp, B, C, C sharp, D, D sharp, E, F, F sharp, G, G sharp, A]. You will now see that there are eighty-five notes, commencing at A and ending with A as stated in the paper, each octave in brackets, and seven in number. If you could see a pianoforte instruction book, you would there find a representation of the keyboard, with each note marked. You can obtain an iron frame at the ironmonger's named in the paper, but you will not need one for the piano you are making.—T. E.

Rusty Piano Strings.—SALE MOOR.—The strings on your piano may be cleaned without removal by rubbing with a leather pad moistened slightly with paraffin and a little pumice powder; afterwards rub over with a leathern pad on which is a little lard, free from salt, and mixed with camphor to prevent a repetition of your trouble.—T. E.

Platinum Test.—B. S. (*Saddleworth*).—Platinum is proof against the attacks of simple acids, however strong they may be. It is only soluble in a mixture of nitric and muriatic acids. It is a white metal resembling in colour such metals as zinc, silver, or tin, or the alloy known as German silver and nickel silver. Tin is readily soluble in muriatic acid, and all the others will dissolve in nitric acid. If, therefore, you suspect a piece of metal sold to you as platinum, test it by applying a drop of nitric or of muriatic acid to some obscure part, and if the acid acts on the metal to dissolve or blacken it, you may be sure it is not platinum. Its weight will also help you to decide, as there are no others so heavy in proportion to the bulk.—G. E. B.

Small Dynamo.—W. J. C. (*London, W.*).—Instructions for making small dynamos are given in the series of articles on "Model Electric Lights," which are now appearing.—G. E. B.

Zither Strings.—W. J. J. (*Belfast*).—The strings for the zither consist of the five melody or finger-board strings and the twenty-six accompaniment strings. Of the first, Nos. 1 and 2 are No. 8 steel wire, No. 3 is 9 brass, and Nos. 4 and 5 are copper-covered on steel or silk. Of the accompaniment strings, Nos. 1, 3, 6, 8, and 11 are gut, and Nos. 2, 4, 5, 7, 9, 10, 12 to 26, are silk or steel-covered. The complete set costs about 6s. or more according to quality. The method of tuning is given in every tutor, and these, as well as strings and other fittings, may be procured of Messrs. Chilvers & Co., St. Stephen's, Norwich.—R. F.

Strings for Æolian Harp.—SCOT.—The most suitable strings for this are stout first or E violin strings, or fine second or D. But whichever are chosen, great care should be taken to have them all of exactly the same thickness and quality. In tuning they must be all of the same pitch, and the tension should be low, as when the harp is in use the fundamental or lowest note is not heard, but only the harmonics or overtones. The plan of making the sounding board sloping has this advantage: that the wind is concentrated upon the strings, and they consequently vibrate more readily. Of course the wind-board does not slope, so that the aperture presented to the wind is considerably larger than that on the inside of the window. Again, it is better to make the harp of the same length as the width of the window, so that when the sash is shut down upon it all the air that enters must pass over the strings. Violin papers are in hand.—R. F.

Æolian Harp Strings.—KILDONAN.—See above reply to SCOT.—R. F.

Wardrobe.—J. D. (*Belfast*).—As a preliminary to this reply I must inform you that it is entirely outside the regulations to send an answer by post, as you request. All requisite notice is taken of each communication for the purpose of benefiting the readers as a whole; and this desired result could hardly be attained by replying per post. You wish first to know whether the dimensions, 6 ft. by 4 ft. by 18 in., are suitable for application to a wardrobe. They are quite so, with the exception of the height, which I should advise you to have, at least, 6 ft. 6 in. I herewith give you a design, but it is not an uncommon pattern; I have not striven to give you anything out of the way, as you do not seem to desire it. As you have made a set of drawers (although you do not say whether an

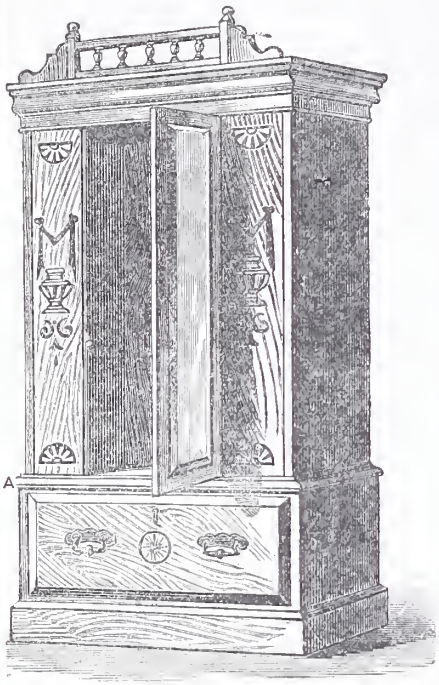


Fig. 1.

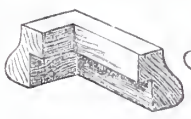


Fig. 2.

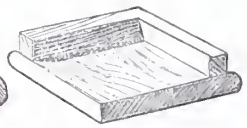


Fig. 3.

Wardrobe. Fig. 1.—Ordinary Pattern Wardrobe. Figs. 2 and 3.—Sections in connection with Bottom Carcase Top-board.

ordinary chest or merely a cabinet), I think much instruction will be superfluous; and to those to whom more than I give is necessary I should say, "Look through back numbers of Vol. II. and along the Index of Vol. I." The details previously given for the manipulation of wood are equally applicable in this instance as in any other. Wardrobes of this description are usually made in two carcases, their union being at A. The top board of the bottom carcase is moulded, and around the top of it is a rim (Fig. 3), into which the bottom of the top carcase will fit. Or you might make the carcase as a box, all edges being square, and mitre and glue a moulding (Fig. 2) round the top of it; the rebated portion only of which will come in direct contact with the carcase. Top and bottom carcases will each contain two side boards, top, bottom, and back board; and the former, in addition, two front boards, and both can be screwed together at A or left separate, as being more convenient for removal. Cornice and frieze together should be about 6 in. deep, the former being mitred up on front and sides—not at the back as well. Plinth will be about 4½ in. deep, and of ½ in., ⅝ in., or ¾ in. stuff, as thought best. I suppose you know that mouldings for cornice, etc., can be purchased? Read my article on "Combination Bedroom Suite," No. 26, Vol. I. (front page), for a method of putting together cornice and frieze and plinth; but don't pounce upon me concerning my advice for thickness of wood, for I have elsewhere endeavoured to explain my reasons for a difference of opinion in this direction. I hope that by telling you to use 1 in. stuff for sides, and ¾ in. for the remainder, the door stiles (which will be mortised and tenoned) being either ¾ in. or ⅞ in., I shall not bring further opposition upon my weary head. Previous articles will tell you how to make the door, which will be about 20 in. wide, with either a plain or bevelled mirror in it; drawers you say you can make. A bevel will enhance the appearance of the latter. Two boards, joined in the front, will complete the top carcase, and leave a roomy space for the insertion of a number of hat and coat pegs. The pattern of the pediment depends upon individual taste. Sometimes pieces are joined in the front of the bottom carcase (which, by the way, might be 13 in. deep) against the side boards to bring the sides of the drawers in a continuous line with the inside of the top side boards. Concerning wood, walnut is most extensively used among the men I am acquainted with. Ash, pine, and plain deal are also much utilised, and either painted entirely or decorated with stencilling or incising. It must rest with your taste and your purse as to what wood you use.—J. S.

Wax Flowers.—C. A. G. (*Loughborough*).—Wax flowers are made from sheets of prepared and coloured wax sold for the purpose. The petals are cut out with scissors (wetted to keep the wax from sticking to them) and rolled to the required curvature in the hollow of the hand with small globular-headed tools, called curling pins, made of wood, ivory, or wire with glass heads; these, too, are wetted before use. Tinting is done with dry colours, and brushes sold for the purpose. For stems, wire covered with cotton is used. To form a flower a loop is made at the end of the wire and covered with scraps of sheet wax as a foundation, to which the petals are attached by pressure. There are dodges for making leaves, such as punching them out with tin cutters, or squeezing them in plaster moulds taken from real foliage, but the really artistic method is to cut and mark them by hand, giving to each an individual character, as in Nature. The materials and appliances are not costly, and the keepers of fancy shops will have, or will get, them. There is scope for artistic taste in this work, but to excel in it demands much practice and delicacy of touch.—M. M.

Polishing Horns.—INQUIRER.—The natural roughnesses of the surface of the horns have first to be scraped off with glass, and the horn rubbed smooth; this can be done with Dutch rush, or with very fine sandpaper, or with water and powdered pumice-stone or bath brick dust, whichever may come to hand most readily. The actual polishing has then to be done, and for doing it there is also choice of means. Powdered charcoal and water may be applied on a felt pad, and afterwards either powdered rotten-stone or putty powder; the final gloss being given with soft chamois leather just moistened with olive oil, or with the naked palm of the hand and a little subnitrate of bismuth. Another way of polishing is with fine rotten-stone and oil only, applied with a chamois leather; then rubbing with leather and oil; and, lastly, with a clean, dry leather. A third method is (after the rotten-stone and oil) to rub with dry whiting on a soft, clean rag, and to finish with the palm of the hand slightly dusted over with whiting, or with a clean leather. Whichever way INQUIRER goes to work, he will find that the secret of getting a fine polish lies mainly in giving plenty of good hard rubbing.—M. M.

Repairing Indiarubber Gas-bags.—OXYGEN.—I must say I have had no experience with gas-bags, but I do not see why there should be any difficulty in making such small faults air-tight (they are only of the size of pins) with a solution of india-rubber. A solution might be made of half an ounce of rubber in three ounces of spirits of turpentine, and the holes filled with it.—M. M.

Detective Camera.—T. P. H. (*Liverpool*) must bear in mind that certain rules must be adhered to, however rough and ready the instrument is, if it is expected to do good work. The best method of proceeding, or one that will give the best result with the least trouble, is to procure a cheap ¼ plate camera, say, for instance, a Lancaster ¼ plate with lens, and half a dozen double dark slides. One only is supplied with the camera, but if you have constructive ability equal to the task, five more might be made, and the whole enclosed in a small box after adjusting the focus for objects beyond, say 12 ft. distance. An aperture at one end of box will permit the lens to act, and may be opened or closed by a shutter on the outside actuated by an elastic band, the slides of course used in the ordinary manner. The exterior of the box may be made to look like a brown-paper parcel. It will not take a vast amount of ingenuity to make a very workable apparatus. Messrs. Taylor, of Slate St. Works, Lancaster, supply lenses, made expressly for this purpose, but any quick acting lens with good depth of definition will do.—D.

Gaiting Wheels.—A. P. (*Hardy's Gate*).—To gait any kind of wheels which revolve upon arms, whether hand, larry, or heavy cart wheels, so as to allow them to knock and run sweet, we proceed as follows after we have planed and trued the bed and got it ready for fixing the arms, preparatory to giving them "hook." In the first place we will suppose that we are fixing arms in a new bed for a pair of 6-in. tire cart wheels. We get the straight-edge across the felloes at the front of the wheel, then measure the space between the face of the spoke on the nave and the straightedge, which will be, if the wheels are well dished, 4¼ in.; keep the straightedge in the same position, and measure

the space at the other end of the same spoke near the felloe—whatever this measurement may be it must be deducted from the first measurement; we will suppose it is 2½ in., therefore it leaves 2 in. Now the secret lies in allowing a small ¼ in. hook off every inch measurement in the dish of the wheel, so that in this case it will be a very little under, or a small ½ in. Therefore, when the string is stretched tight across the arms, and in the centre, and through the lynch-pin holes, the measurement of the arms should be, when fitted in the bed right, from the top of the shoulder to the string, a small ½ in. if the wheels have a 2 in. dish. I do not know of any books or journals published upon wheelwrighting or railway waggon building published in England, but there are several published upon coach-building, both in London and Paris. In America there are monthly journals published, namely, *The Hub*, *Carriage Monthly*, and *The Wheelwright and Blacksmith*. I believe they are published in New York, but as I have not seen any I am unable to give the address and price of the same.—W. P.

The Length of Felloes.—W. H. O. (*Stanton*).—To ascertain the length of felloes for a wheel, however large or small, we describe a circle ½ in. higher than the height of the wheel; we next describe an inner circle 2 or 2½ in. (whatever the thickness of the felloes may be) distant from the outer circle. If there are fourteen spokes, we divide this circle into seven equal parts, each arc representing a felloe. If there are twelve spokes to each wheel, we divide into six parts, etc., two spokes to each felloe. A piece of board should be fixed so that one of these arcs is described upon it when dividing the circle into parts; each part must be of equal length, or the felloe joint would have the wrong bevel, a most important point in wheeling. When the pattern is sawn out, the size of the wheel should be painted upon it to show at a glance the height the wheel would be if six or seven of these felloe patterns were placed in a circle. The reason why ½ in. is added to the height is because the wheel, when hooped and dressed off, will revert back to the original measurement or height of the wheel you want, besides ensuring a perfectly round wheel.—W. P.

Improvement by Patentee in a Patented Article.—H. S. R. P. (*Tunbridge Wells*).—As the alteration is so trifling, cannot our correspondent amend his specification? The form of application to amend (to be got at a post office) costs up to sealing, £1 10s.; after sealing, £3.—C. C. C.

Fixing Labels on Tin.—STICKPHAST (*Beccles*) would, perhaps, find Le Page's carriage glue answer. It will fix lighter materials to iron.—S. W.

Article in Pipeclay.—C. H. C. (*Cheltenham*) might make his query direct to the firm which he names.—M. M.

Advice as to Trade.—B. R. G. (*Dorking*).—A communication awaits B. R. G. under the care of the Editor of WORK.

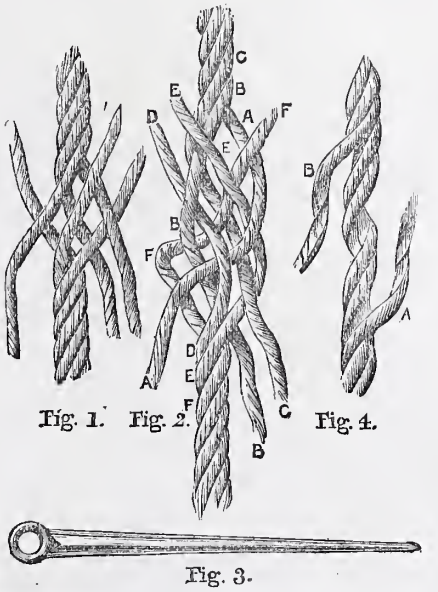
Subjects in WORK.—J. C. H. (*Custom House*).—An article on a "Kitchen Dresser" will soon appear. I will endeavour to meet your requirements, but at the same time your watchword should be "Excelsior," and you should strive to tread in the higher walks of carpentry.—ED.

Use of "Patent."—If FAIRPLAY will refer to the Patents, Designs, and Trade Marks Act, 1883 (46847 Vict., ch. 57), he will there find in part 5, section 105, "Offences"—that (1) "Any person who represents that any article sold by him is a *patented* article, when *no patent has been granted for the same*, . . . shall be liable for *every offence* on summary conviction to a fine not exceeding five pounds. (2) Any person shall be deemed, for the purposes of this enactment, to represent that an article is patented if he *sells* the article with the word 'patent' or 'patented,' or any word or words expressing or implying that a patent has been obtained for the article stamped, engraved, or impressed on or otherwise applied to the article." This Act, with the usual failing of most Acts of Parliament, does not say who may, or is to, put the provisions of the Act in force, or whether it is to be done by the Patent Office on the matter being properly brought to their notice with proper proofs of the actual sale of the article improperly marked satisfactorily proved, or whether an individual may put it into operation on his own account. It seems to us if FAIRPLAY is in a position to prove what he states in a sufficient manner, it will be his duty to place the facts before the Commissioners, and see if they are prepared to carry out their powers for the benefit of the public—which it is evidently their duty to do—and then we should learn what is to be done. So far as we know, this question has not yet arisen, consequently there is no precedent to guide us.—C. E.

Bench Screw and Fly-wheel.—A. K. (*Glasgow*).—(1) The bench screw described by you is very unsuitable for cabinet work; if able, get an instantaneous grip vice (about 15s.); if not, put a piece of wood, equal in thickness to that you wish to plane, the other side of the screw. Cabinet makers use two screws to their benches as a rule. If A. K. had on guide G a few holes, and a peg to fit, it would help him. (2) A lathe fly-wheel may be from 24 in. to 30 in. in diameter; get an iron one if possible.—B. A. B.

Cabinet Making Lessons.—LEDGER.—I have wood-working classes in the winter months at Hampstead, but these are now over, and it is very unlikely that you will obtain any lessons from such people as you indicate. Certainly you ought to try an advertisement in WORK. Private lessons are expensive.—B. A. B.

Wire Rope Splice.—R. G. (*Leamside*).—There are two kinds of splices, the short and the long. The first is used when bulge or bunch is of no consequence, and when there is but moderate stress; the second when uniformity of diameter is requisite and no diminution in strength. There is no difference in the manner of making splices in hempen or wire ropes, except that a longer splice is made in the latter than in the former. To make a short splice, unlay the strands, three or six as the case may be, for a length of several inches, say from six to twelve—dependent on the size of rope and amount of security desired. Open them out and place them together in alternate positions, as shown in Fig. 1. This is called "marrying" the ends. After this, each strand is passed over and under the next strands in succession, three, or four, or half a dozen times in succession. I have tried to show the interlacing of the opposed sets of strands once (Fig. 2) before the rope is pulled taut, but am afraid it will not be very clear. The strands are greased, and a way made between the strands in the rope by thrusting in a marlinespike (Fig. 3)



Wire Rope Splicing. Fig. 1.—Marrying Ends of Strands. Fig. 2. — Interlacing of Strands. Fig. 3.—Marlinespike. Fig. 4.—Long Splice.

of iron. They are pulled as tight as possible and then rolled between boards or under foot, so that the increase in size shall not be excessive. To make the long splice, unlay the strands in the ends of the ropes to be united for a considerable distance, and lay the one set of strands A in the groove left by the unlaying of the other set B (Fig. 4). After a sufficient length has been so treated by the unwinding and unlaying of all the strands in succession, the ends are united by thrusting them through openings made by the marlinespike, as in ordinary splicing, and the union then, though of considerable length, is scarcely perceptible. The rope is held in its socket by means of pins passing through the iron from side to side.—J.

Wood Carving.—R. J. E. M. (*Athlone*).—I am somewhat at a loss how to advise you about following the art of wood carving as a means of livelihood, for so much depends on yourself and your prospects otherwise. If you are content with moderate means, no doubt you can make a living by carving if your work is fairly good; but, as in kindred arts, you must remember that only the few "make money." At present, no doubt, the occupation is a very pleasant one, for you are following it *en amateur*, but have you considered what it would be if you were forced to grind at it daily? Now you can please yourself what you carve, but pursuing it as a business you would find you have to please your customers rather than yourself, and they will not always think as you do. You will be hurried in time, be beaten down in price, and meet with the thousand and one little annoyances which harass every one in business. Therefore I say, if you are getting on fairly well in your present occupation, do not throw it up for the sake of becoming a carver. Of course, if you "have got no work to do" the case is different, and then there can be no harm in endeavouring to go ahead as a carver. I do not say all this to damp your enthusiasm, but rather to recommend caution before you take such a serious step as beginning another occupation at your time of life, for though you are not very old, yet it may be supposed you are not at school, and that you have done something towards learning a business or profession. Further—and in saying so I do not at all wish to disparage your work—although you like carving, and may be really a clever carver for an amateur, that you could earn a livelihood at the work is doubtful: a skilful amateur is often but an indifferent worker when compared with even a poor professional. However, if you are really determined to turn your attention seriously to wood carving, and wish to achieve success at it, you should study design, and practise drawing. Unless you can draw you will never become a first-rate carver, though you may become a fair journeyman, a mechanic, but not an artist. Design must be studied, for though you may, indeed must, derive inspiration from nature, you must learn to interpret nature. It sounds very fine to talk about following nature and its teachings, but what does this mean? Simply nothing unless the student is able to adapt the teachings to his own special requirements. In the carver's case these are the necessity of rendering and adapting nature's forms—not copying them—in wood with the aid of sharp steel. However, I daresay I have said enough about the artistic aspect, and something of the prosaic may help you further. It is not necessary that you should study for seven years at schools of art before you could have a chance of earning a livelihood, if you are at all capable of doing so. Naturally, the more time you could spend at study the better, but I think you would do better by getting under some practical carver and working with him. Of course I have not seen your actual work. If I had, I might be able to advise you more to the point. I do not know whether the design you send is your own composition, but if it is, it shows you have some talent which only requires developing. Perhaps if you were to send a specimen frame to Messrs. Urquhart & Adamson, Bold Street, Liverpool, they might be willing to show it in their "Artists' Own" Exhibition; and if they do not, after seeing the work, think that it is suitable, you will have the satisfaction of knowing that it is deficient in some quality. As a rule carving looks better unpolished, but the best polish, and how to apply it, depends so much on the work, that I cannot answer this portion of your letter fully, especially as so much space has been devoted to the foregoing. Why not apply to Herkomer direct?—D. D.

Tobacco Plant.—R. W. M. (*Kildare*) asks for hints as to the management of a crop of tobacco, complaining that it is so hot as to blister the tongue. Years ago, in the West Indies, I grew a quantity of tobacco, and the plan I then adopted, under advice from other planters, was, as soon as the leaves had grown to full size, and before they commence to turn brown or "rusty" (when they are useless), pull them off the plants, lay them upon a flat flag, one upon another, sprinkle them with a little saltpetre dissolved in water between each leaf, and place another flag with a weight upon it over the top of the pile. I used, of course, to sun them first till they were just crisp and make piles of them close together in the above manner, leaving them until fermentation had just set in. If left too long they turn black, if not long enough they are yellow and pale; you should carefully watch, as they heat like a haystack. Stop the sweating the moment fermentation fairly commences throughout. Then dry the leaves separately in the sun, turning them over till they are quite brittle. They are then fit for cigar making, or for steeping in water to take the full strength out of them, and to have them moist enough to cut into "shag" or "birdseye." For the former, take all the principal veins or leaf stalks out; for the latter, leave all the veins in. Before cutting up, all water should be pressed out, leaving the leaves just limp, and when cut it may be still further dried on hot plates. Sailors take the dry leaves, sprinkle rum and molasses mixed with a little water over them, and roll them very tightly with strips of canvas first, and afterwards with strong twine or thin cord with a "Spanish windlass," and put these rolls away for a time. West Indian negroes twist the leaves dry without other preparation into a rope about an inch and a quarter thick, which is termed "jackass rope," which they cut up in slices and rub between their hands as they require to fill their pipes. At best, home-grown tobacco has a flat taste, and not the aroma of tobacco as sold ready cut by manufacturers; it varies a great deal also in the curing as above described, and is, in my opinion, preferable for making cigars rather than for smoking either in pipes or cigarettes. The cigars, however, are flavourless, if not smoked the day they are made, unless they are kept a couple of years to get again into condition; but I do not think any cigar is ever so good as the day it is made. I recommend R. W. M. to cure his crop and send it to some respectable manufacturer to be cut to his order, if he desires to obtain the full flavour without the bitterness.—J. W. H.

Vellum Making.—PRACTICAL will find a short account of the processes of vellum making given at page 397, No. 25, Vol. I. of WORK. All the questions which he asks, as to tools, unhairing, stretching, thinning, finishing, etc., are briefly answered there.—S. W.

Model Cutter.—W. W. T. (*Shettleston*).—The following measurements are for an ordinary 3 ft. cutter yacht; if the boat is intended for racing, the beam must be lessened and the depth increased. Beam, 8½ in.; width at taffrail, 4 in.; depth amidships, including keel, 9¼ in.; depth at sternpost, 10 in.; length between sternpost and taffrail, 5 in.

The spars should be of the following measurements: Mainmast above deck, 21 in., tapering from ⅞ in. to ½ in.; topmast, 19½ in., tapering from ⅝ in. to ⅜ in.; main boom, 28½ in., ¾ in. thick in the middle tapering to ½ in. at each end; main gaff, 22¼ in., tapering from ½ in. to ⅜ in. If a gaff is used with the topsail it should be 21¼ in. long and ¼ in. thick, slightly tapered at each end. After the false wooden keel is screwed firmly on from inside, the following is the best method of fixing the keel:—Get two pieces of wood about 2 in. wide, and fasten them with glue or brads along the sides of the false keel, then stop up the ends of the groove thus made, and you will have a little channel or trough along the false keel, wherein you can pour your melted lead. The stern part of the hull should be slightly tilted before the lead is poured in, as the stern should always draw more water than the bows. After the lead is poured evenly into the trough the boards can be taken off, and the lead keel filed smooth and screwed on to the wooden keel. The tools absolutely necessary for constructing a boat can be brought down to a saw, plane, a chisel, a couple of gouges, and a jack-knife; but to turn out a good boat you should have most of a carpenter's ordinary tools, and also a variety of wood worker's rasps and files, and a few carver's chisels. I am afraid that if you are thinking of buying the tools especially to build your model, you will find it a very expensive matter.—G. J. E.

Chuck for Lathe.—J. H. (*Nottingham*).—As you have succeeded in making the chuck for holding the ordinary bits as used in the carpenter's brace, it is scarcely needful for me to give directions how to make the chuck. J. H. finds, as most of us have found who have tried the same experiment, that ordinary boring bits will not run true. The fact is they are merely forged as near as possible, and the only way to succeed is to mark with a centre-punch or with a drill-mark a dot on chuck, and carefully file every bit *separately* to the chuck, and mark the bit with a similar mark, so that the hit can be replaced in the same way when required. —B. A. B.

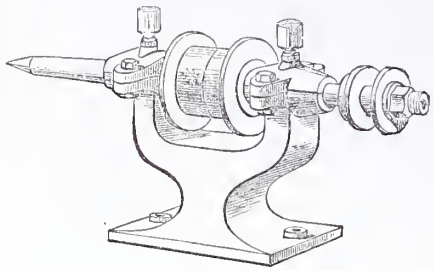
Photo Rim Mounts in Brass.—W. J. V. (*Abingdon*).—You will be able to obtain the rims you inquire for at almost any general photographic dealer's. Better try Fallowfield's, Charing Cross Road, or Marion's, 23, Soho Square, who generally keep them in stock.—D.

Electric Alarm Bells for Trains.—SCOT.—There is no difficulty whatever in establishing communication between the passengers and guards of a train by means of electric alarums. It might be done in the way you mention, but I do not see anything new in your proposed arrangement. The able electricians on the managing staffs of our railways are fully alive to the importance of this subject, and are quite prepared to meet the demand should it ever arise. Villains, such as you describe, can as easily tamper with an electric as with a mechanical communicating system. The difficulty lies in not having any means of communicating with the guard on some trains, and it is on these that such outrages are committed.—G. E. B.

Address of American Inventor.—J. B. B. (*Sutton*) asks: "Can you or any reader of WORK kindly supply me with the full address of Mr. W. J. Norton, Pittsburgh, U.S.A., the inventor of a new chemical light? I have sent several letters but they have all been returned, as there are five different Pittsburghs in the United States." Have you addressed any of your letters to Pittsburgh, Pennsylvania? This would be the most likely place, but it is quite possible there may be several persons of the same name there, and you might as well address it to Mr. Norton, Birmingham, with as good a chance of finding the right man. We give your letter publicity in WORK on the chance of it meeting the eye of Mr. Norton or some one of his friends. This is all we can do for you.—G. E. B.

Suction Pipe and Electric Machine.—J. N. B. The corresponding staff of WORK get some queer letters and questions from their correspondents, and they always try to understand the wants and wishes of the writers. But we must draw the line of forbearance somewhere, and we do this at riddles. As an example of the riddles sent us we give your first question:—"How must I make a suction pipe something similar to this one, and in what height can it be made to act?" Seeing that your sketch shows a cistern of water with the delivery pipe bent up by the outside of the cistern and curved over the top, I really cannot understand what you mean, or what you want to do. You must please put your thoughts in order before writing them on paper, and tell us plainly what you wish to have done. In your second question you ask: "What power will it take to drive an electric machine of about two lights?" This is another vague question. The answer will depend upon the candle power of the lights, and this you have not given. Your last request is most enigmatical, "Please answer by post." Now, as you have not seen fit to give us the least idea of your residence, and there are some thousands of B's in the United Kingdom, we must give up this riddle too. It is bad enough when correspondents expect us to give our time to answering their questions, and then make them a present of the postage; but when one expects us to find him out among many thousands bearing the same name, and send a prepaid letter to him in reply to two vague queries, the limit of forbearance is reached.—G. E. B.

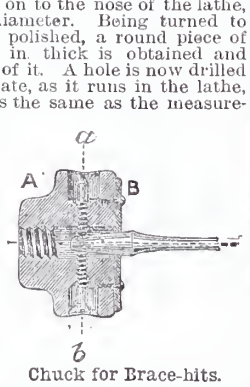
Brass Burnishing.—YOUNG BRASS FINISHER.—You are quite right in your surmise that a deal of brass burnishing, or rather polishing, is done by means of a revolving wire brush; the process is termed scratch-brushing. The brushes revolve at a high speed on either a lathe or an appliance specially made for the purpose. If you have a lathe, all you have to do is to get a spindle about 1 ft. or 18 in. long, cut a thread on it for a good distance, and fit two backnuts on it to clamp the brushes together; fit one end in a dog chuck, and let the back centre support the other end. I send you a sketch of a proper polishing head, so that you may see exactly what it is like, should you



Polishing Head.

care to attempt to make one. The brushes, of course, you would not be able to make. You can get them from any wire brush manufacturer: Pemberton's, of Worcester, or Messrs. Riddell and Co., 142, Trongate, Glasgow, for instance. But, in conclusion, let me say that I do not think you will find it pay to make up gas fittings from the rough yourself, as there would be many other appliances needed besides scratch-brushes, etc.—R. A.

Chuck for Holding Brace-bits.—J. H. (*Nottingham*).—You wish to know how to do this, having tried without success. There is an extremely simple way which you will find very easy. A is a piece of hard wood—the harder the better; it is screwed so as to go on to the nose of the lathe, and may be 3 in. in diameter. Being turned to shape, smoothed, and polished, a round piece of plate iron (B) about ⅛ in. thick is obtained and screwed upon the front of it. A hole is now drilled in the centre of this plate, as it runs in the lathe, the diameter of which is the same as the measurement over the flats of the square on the bits—at their large end—and this hole must be filed out with a square file till the bits will go in, as in the figure, being careful to take the same amount out of each of the four corners. The iron plate may then have its edge turned and polished. The next thing is to mark a line round the body of the chuck at *a b*; divide this into



Chuck for Brace-bits.

four for the four wood screws, which must be placed so that their points will bear upon the flats of the bits close to the small end. The holes are enlarged as seen in the figure so that the screw heads may sink *below the surface*, as their heads would be very dangerous to the hands when in rapid revolution. These four screws are easily adjusted, so as to bring the point or end of the bit perfectly true; and, as bits are not all alike, the screws can be adjusted to suit any bit, which they will hold quite firmly.—F. A. M.

Resistance Coils in Dynamos.—ELECTRICIAN.—Resistance coils are employed on dynamos to check the flow of current in the outer circuit and divert more of it to the F. M. coils. In a shunt wound machine, a resistance put into the outer circuit would check the flow of current there, and send more by way of the shunt into the coils of the machine. Resistance coils are employed in plating dynamos to prevent "burning" of the work being plated.—G. E. B.

Small Electric Lamps.—W. H. S. (*Brockley*).—Small electric lamps of 2½, 5, or 10 c.-p. can be obtained from any dealer in electrical sundries. I have frequently given addresses of these in reply to letters of other correspondents. Instructions on how to make a battery for lighting a small lamp to be used in a photographer's dark room, will be found on pages 415 and 781, Vol. I., of WORK. The cost of lamp would be about 5s., and the battery 15s., about £1 altogether.—G. E. B.

Battery.—W. N. (*Birmingham*).—I do not recognise your battery by your description of it, as I cannot understand the part played by the tinfoil in the cell. However, as you have a carbon element suspended in a zinc-lined cell, it is evidently a single fluid battery of some sort. As you only require it to ring an electric bell, first well wash all the inside parts by soaking them and rinsing them in several changes of warm water. Recharge the cells with 2 oz. of sal-ammoniac and ½ oz. of chlorate of potash in each cell, then fill up with water. If you like to use the muslin envelope again, make a mixture of the above-named salts, spread on a piece of muslin, and wrap this around each carbon. This will allow the salts to dissolve slowly and will filter out any dirt there may be in them.—G. E. B.

Transfer to Glass.—NEMO A. (*Attercliffe*).—I am glad to hear that you find WORK helpful, but think it would be much more so if when sending a query to "Shop" you were to enter more into particulars, and stated plainly the nature of your work, and the exact difficulties you experience. With your letter before me, I do not know what kind of glass decoration you propose to execute, or whether you ask merely for suggestions as to colouring from an artistic point of view, or require direction as to the ingredients of the colours. At present I assume that the former will suit you, and therefore suggest that the iris flowers be of the richest yellow consistent with transparency shaded with a darker tone of the same colour, the seed vessels being tipped with rich brown. The stalks pale green shaded with semi-transparent green—*i.e.*, same colour darkened with brown. The leaves rich green, the lights being as vivid and transparent as possible, and while the lower portions should be shaded rather heavily at the base by the use of brown, the shading may be carried upwards, using less of the latter pigment, and finally merging into darker green than the groundwork of the leaves.—OPIFEX.

"Foliate."—F. S. (*Kidderminster*) objects to the use of the word "foliate" on page 316, No. 72, and asks me to "look at the dictionary definition," and then see whether I have made the right use of the word, adding the sententious advice, "be correct." In the paragraph referred to, I meant to convey that two portions of the ironwork should be so shaped and placed that together they should present the appearance of a *foliated* scroll—*i.e.*, a scroll "formed like leaves" (dictionary); in other words, that the curves should partake of the nature of a conventional *foliation*—*i.e.*, "leaves in the act of *foliating*" (dictionary); but inasmuch as space in the columns of WORK is precious, I used the word "foliate" to express myself. I certainly did not mean any reader "to beat" the particular portions of the bracket "into thin plates," and to anyone at all familiar with the technical language applicable to the subject, my meaning is plain, and therefore—notwithstanding F. S.'s stricture—correct.—OPIFEX.

Blind Rollers.—J. McK. (*Lisburn*).—I am surprised that you should find any difficulty in obtaining Hartshorn's patent blind rollers, as they are now in almost universal use. Noting your address, I should advise you to write to any house-furnishing firm in Belfast, or to Messrs. Millar and Beatty, 14, Grafton Street, Dublin.—OPIFEX.

Polishing Pebbles.—E. C. (*St. Leonard's-on-Sea*).—From the form of the question, I conclude a few simple directions for polishing the surface of pebbles are required; and that the cutting of them into halves, or slices (such as for microscopical slides), is not required, as the requisites for this include an expensive machine costing about £10 or £12, such as is used by lapidaries, and although pebbles may sometimes be split with a cold chisel and hammer, sections cannot be done without a machine. We will proceed, then, upon the assumption that only the simplest means consistent with getting a fair result are at hand. Having found a pebble which you think would look well when polished—and here let me say that every stone found will not repay the labour bestowed upon it, but some splendid stones may be found upon Hastings beach; I have seen some with beautiful markings when polished that were found there—the first thing is to grind upon a stone with water so as to get a flat surface; a grindstone with someone to turn for you is best, but if this is not available, use a flat piece of sandstone, or even the stone sink if the "powers that be" will allow it. If the pebble is large enough, it may be held in the hand during the grinding operations; if not, it must be cemented to a piece of wood, with a cement composed of pitch, resin, and beeswax. When a level surface has been obtained, it must be rubbed upon a water-of-Ayr stone, to take out the scratches left by the rough stone. It ought now, when allowed to dry, to present a smooth, dull surface; if not, it must be rubbed until it does; it is then ready for the polishing process, the others being only preparatory. Cover two boards with leather, oil slightly, and dust on flour emery; rub the pebble upon this, and when it begins to take a little polish, finish off on the other board, only dress it with putty powder (oxide of tin) instead of emery, or colcothar may be used with equally good result, and has the advantage of being much cheaper than putty powder. I hope these few hints may prove useful; but if there is anything I have not made perfectly plain, I hope you will write again. I ought, perhaps, to say that you may find one part of the pebble will show much finer markings than another part, so it is best to wet it and examine closely, and, of course, polish the best. If you would like to see some pebbles that have been polished, I could give you an address in Hastings if you write me through the Editor.—W. E. D., JR.

Graph and Copying Apparatus.—A. J. W. (*Manor Park*).—I like the litho-copier of Fordham and Smith, Wormwood Street, E.C., the best of anything I have seen of the kind.—J. W. H.

TEST THEM FREE OF CHARGE.

WHAT WE ARE PREPARED TO DO.

WE ARE PREPARED TO SUPPLY 1,000,000 of the GENERAL PUBLIC with Samples of FRAZER'S SULPHUR TABLETS, gratis and post free.

WE ARE PREPARED TO PAY POSTAGE thereon (1,000,000 at 1d.), value £4,166 13s. 4d.

A WORD OF ADVICE.

Don't write for the samples simply because we offer them free of charge, nor because your neighbour does. Read our advertisement through to the end, and then decide whether you or yours need or would be benefited by the use of Frazer's Sulphur Tablets. We do not pose as philanthropists. This is a business offer. We have an article that we know from severe tests and from results achieved will sell on its merits, if seen, tasted, and tested. Sulphur is the oldest, the best, and safest remedy for the blood, for the skin, for the complexion, for rheumatism, and for constipation. Frazer's Sulphur Tablets are composed of sulphur incorporated with cream of tartar and other curative ingredients. They are much more efficacious than sulphur in milk or treacle. This has been proved time and again. They are liked. Men favour them, women hail them as a boon, and children think them as pleasant to eat as confectionery. They benefit all, and are as efficacious and curative as they are safe and agreeable.

WHY DO WE GIVE THE SAMPLES?

This is what people ask us. We reply, Because those who write for the samples afterwards buy packets of Frazer's Sulphur Tablets by post from us, or obtain them from chemists, stores, or medicine vendors. People likewise recommend and keep the Tablets by them. The consequence is that we sell several hundred dozen packets weekly, and the sale is rapidly growing. This is trade by merit. The public have shown discrimination, and that they can appreciate merit, and it was in firm reliance that this would be the case that we were led to incur this risk.

DO I NEED THEM?

If you have Rheumatism, Yes. They will kill the decomposed and poisonous excess of uric acid in the blood, causing the disease.

If you have Constipation, Yes. They are a gentle, safe, and simple laxative, as suitable for Children (in smaller doses) as for adults.

If you have Hæmorrhoids, Yes. They relieve the congestion of venous blood at the affected parts, and afford relief.

If you have Ulcers, Scrofula, Scurvy, or other Impurities of the Blood, Yes. They neutralise the blood poisons causing the diseases, and expel them out of the system.

If you have Skin Disease or Eruption, Yes. They have a specific curative effect on all such, as they open the pores from internally, and free them from obstruction and disease taint. They likewise "scotch" where they do not kill the disease principle from the blood which causes Eczema and other diseases.

TEST THEM FREE OF CHARGE.

TEST THEM FREE OF CHARGE.

Write us a letter or post-card, naming "Work," and we will send you samples of Frazer's Sulphur Tablets gratis and post free. They are for internal use for the blood, skin, complexion, rheumatism, and constipation. They are put up in packets, price 1s. 1½d. (post free, 1s. 3d.), and are for sale by most Chemists and Medicine Vendors. Sole Proprietors—Frazer & Co., No. 11, Ludgate Square, London, E.C.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

SANDOW'S famous Trainer, Attila, **writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."**

NEVER FAILS to give immediate Relief and finally to Cure all cases of *Muscular* and *Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,* etc. Also most efficacious in *Bronchitis* and *Throat* and *Chest Affections.*

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes: "Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

From all Chemists, 1s. 1½d. *and* 2s. 9d. *per Bottle, or* 3d. *extra for postage, from*

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A Work on the "Home Use of Pumiline" sent free on application.

MONTHLY, 4d.

CASSELL'S TIME TABLES.

SEND 3d. IN STAMPS

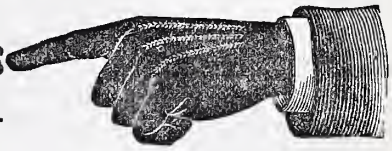
FOR LIST OF

SECOND-HAND ENGINES

(Gas or Steam),

AMATEUR TOOLS, &c.

Cash or Easy Terms.



FULL CATALOGUE, 6d.

BRITANNIA CO., 100, Houndsditch, London.

All letters—BRITANNIA WORKS, COLCHESTER.

Post Free.

Cassell's Classified Catalogue.

Bovril.

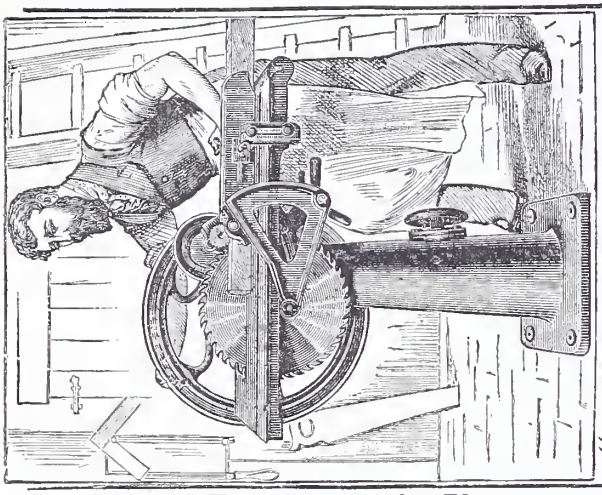
Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.



"THE LEVITON"
New Patent Circular Saw Bench for Hand Power.
Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches
LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

DISEASE EXTERMINATED from the System, and every form of Nervous, Muscular, or Organic WEAKNESS speedily overcome, without Poisonous Drugs or Quack Medicines.

Invalids should know that there is positively no Nerve Tonic and Health Restorative agent on earth so valuable and harmless as Nature's own remedy, "ELECTRICITY."

MR. C. B. HARNESS,
President of the British Association of Medical Electricians,

Confidently recommends all Sufferers from RHEUMATIC and NERVOUS AFFECTIONS, LIVER and KIDNEY DISEASES, LADIES' AILMENTS, or any form of Local or General Debility, to wear his Patent

ELECTROPATHIC BELT.

Thousands of Testimonials.

WRITE FOR COPIES.

HARNESS' ELECTROPATHIC BELTS
Sole Proprietors: The Medical Battery Co., Ltd., 52, Oxford Street, London, W.

ALL who wish to be **Healthy** and **Strong** permanently should wear one of these comfortable Appliances.

They are guaranteed to produce a mild, soothing, invigorating, imperceptible current of Electricity which speedily vitalises every Nerve, Muscle, and Organ of the Body.

They Prevent and Cure all NERVOUS AFFECTIONS, and are invaluable in cases of RHEUMATISM.

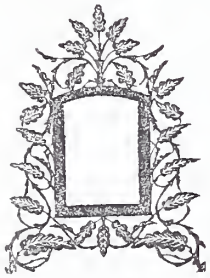
Sufferers should call without delay, and inspect the ***Thousands of Testimonials*** received from all classes of society.

CONSULTATION FREE *of Charge, personally or by letter, on all matters relating to Health and the application of Curative Electricity, Massage, and Swedish Mechanical Exercises. If you cannot call, write for Descriptive Pamphlet and Private Advice Form.*

Note Address—THE MEDICAL BATTERY CO., Ltd.,
52, OXFORD ST., LONDON, W.
(Corner of Rathbone Place),
All Communications treated as STRICTLY PRIVATE & CONFIDENTIAL.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.



The enormous sale and general satisfaction which our Goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS
At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our ***New Catalogue*** of all Requisites, with instructions. Acknowledged the most ***Complete and Cheapest*** List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

AMATEUR PHOTOGRAPHY.—J. H. SKINNER & CO., *W Department, East Dereham, Norfolk.*

J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description.

CHEAP SETS FOR BEGINNERS.

3/6 The Eclipse Camera Set. 3/6
Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6
Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution, Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6
Including Polished Mahogany Camera, with Folding Tail-board, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at 20 per cent. to 50 per cent. discount to clear. Send post card for Sale List.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having ***Dissolved Partnership***, are offering their ***Enormous Stock***, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). ***An Archimedian Drill***, with brass handle and Three Bits, will be ***SENT GRATIS*** with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, ***EAST DEREHAM, NORFOLK.***

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 80.] SATURDAY, SEPTEMBER 27, 1890. [PRICE ONE PENNY.

A JAPANESE BIRD-CAGE.

BY PALGRAVE MORRISON.

EVERAL correspondents of VORK have asked for a design f a Japanese bird-cage. One equested a model of a Chinese r Japanese house to adapt. s that was not feasible, I have ere taken details from the celerated "Mangwa" of the great rtist, Hokuai, and endeavoured to make them erve the purose required. How to onstruct t, except o far as he diaram explains itelf, I cannot say, for am sorry ny ignorance of the Japanese language makes it impossible for me to ranscribe what have no doubt re clear instructions, and intelligible enough if I ould only ead them, ut this I annot do, as I have already tried o explain. The working details given in he aforesaid ketches proved also too elaborate to comprehend. Like he old woman who understood the "Pilgrim's Progress" itself, and hoped some day to understand the explanation of the allegory supplied by a thoughtful compiler at the end of the book, I yet live in hopes of doing so.

Yet, although but a bungling mechanic, I think, with the hints of this sketch, I could construct a bird-cage after its plan. But I have no bird, nor do I wish to possess one; and pleasant though it would be to make one cage just to prove it could be done (even as the conscientious actor blacked himself all over to play Othello), my time is, I regret to say, otherwise allotted.

I know I should (remembering the solitary bird-cage I once made) use thin knitting needles in place of wire. This mode of procedure will be found to save a great deal of trouble in the way of straightening and cutting wire to length. Remembering also Mr. Aspinall's advertisement, and the lady of his show-card who is dabbing at something between a cucumber frame and a birdcage, I

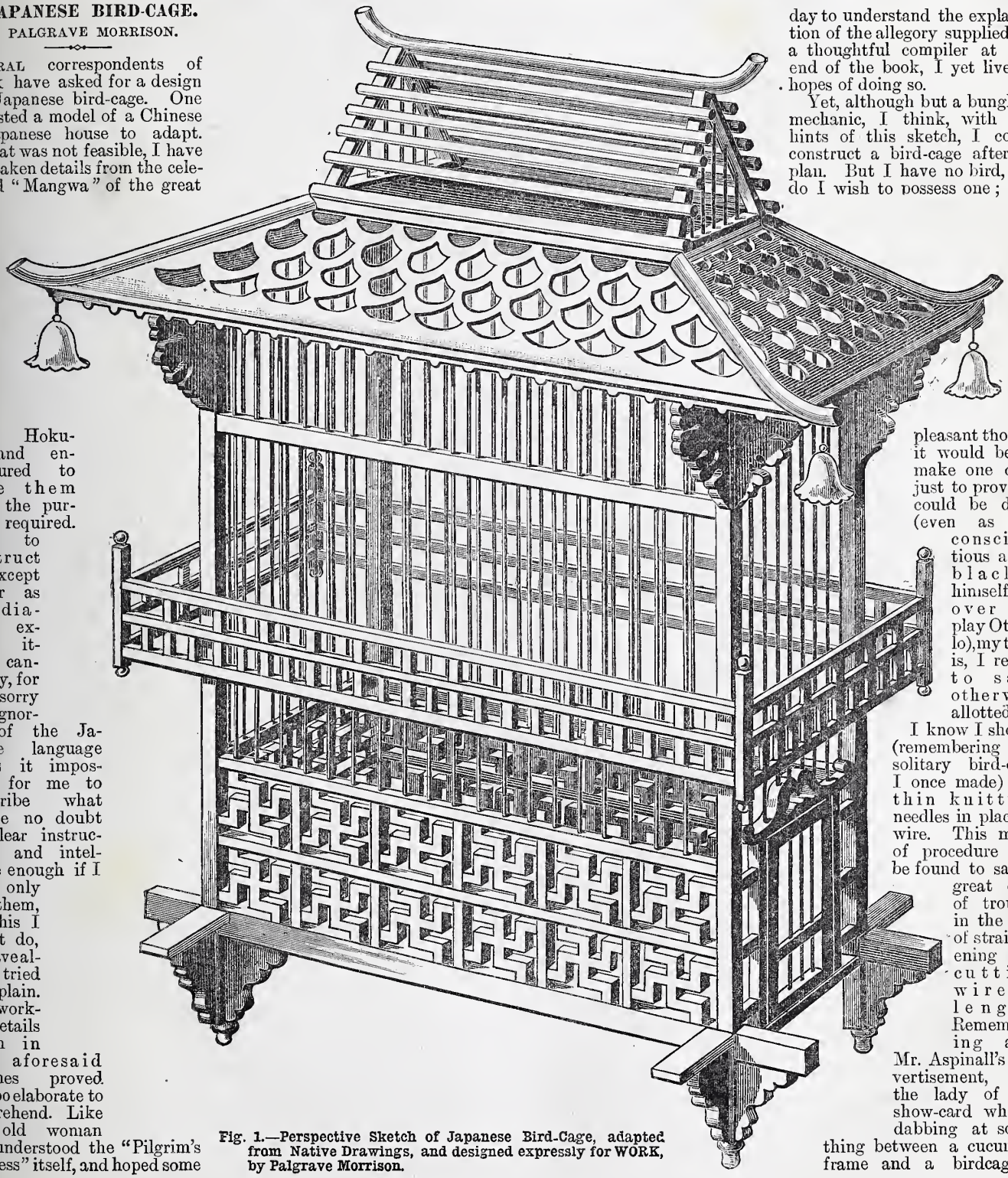


Fig. 1.—Perspective Sketch of Japanese Bird-Cage, adapted from Native Drawings, and designed expressly for WORK, by Palgrave Morrison.

should try to dab also, and be happy if I could strike a visitor "unafraid with amazement," as the aforesaid pictorial anecdote shows us. I should also hinge the bottom of my cage for cleaning purposes, and make arrangements for supply of seed and water, and brackets to support the balcony, all forgotten in the sketch.

Its perspective is very shaky. An attempt to copy the curious perspective of the otherwise clever Japs, has resulted in a compromise that I am aware is not "English as she is drawed," nor "Japanese as she is sketched"; but it does, I hope, convey the general effect. And a tame right angle is kept in every house that may be trusted to prevent the worker from the eccentric angles depicted.

The roof is intended to be fret-cut in thin wood for the lower part, with rods as shown for the high-pitched gable. Fretwork is used for the pattern that surrounds these sides of the cage at foot. The balcony may be either joinery or fret-cut—preferably the former.

The size must be a matter of personal taste. The usual size is after all not such vague advice as the "historic lump of chalk," for a square cage to hold one bird, presupposing that it is the fidgety canary, rarely varies many inches.

Why the bells hang at the corners, and what they are made of, I don't know; but they were in one of the books, so I put them in; I hope it is all right. As the cage has a look as if it tried to be bamboo, but failed, perhaps a colour the shade of bamboo might be fit for its decoration. Bright sealing-wax red, with white bars, would look clean, and not less like genuine Japanese than most imitations. As any amateur who makes it must needs be a person with some cunning in his fingers, I do not think detailed drawings are needful, for the Japanese details refer to a full-size house; and although purists might insist that a model should be made the same way, to mortise a piece of wood of small section is not always the best joint. As a rule the columns of "Shop" are open to further explanation, but I do not think its publishers have a fount of Japanese type; and as I have said all I know about it here, there is little use promising to supply any other details elsewhere. So it must suffice to repeat the statement that it is Japanese—at least, stolen from Japanese sources; that it looks something like a bird-cage; and that if it cannot be constructed as the drawing shows, it is too late to blame anybody, for Hokusai died half a century ago; and if a man cannot be blamed who lived so long since, and so many thousand miles away, one might as well invent genuine details oneself, as be made responsible for other people's errors. To be sure, I may have misunderstood his drawings, and mixed them badly; but good or bad, the Japanese bird-cage had to be done, and here it is. Like the celebrated receipt for Chinese metaphysics, "Look up in an encyclopædia the articles on 'China' and 'Metaphysics,' and mix them," I have looked up "Bird-cage" and "Japanese," and mixed them, as you see.

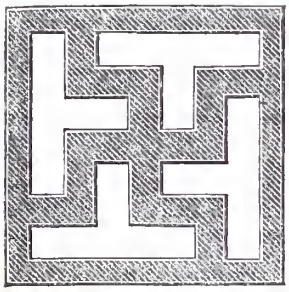


Fig. 2.—Detail of Fretwork.

A PLAIN CABINET BOOKCASE.

BY DAVID ADAMSON.

Bookcase of Wood from Packing-Cases—Shaping Ends of Recess—Projections at Top—Pieces composing Top—Treatment—Bearers for Drawers—Division between Drawers.

As I have referred to wood from packing-cases being suitable material for this cheap furniture, it may be as well, in order to prevent any misunderstanding, to say here that for this bookcase in its original form as shown, the necessary length for the ends cannot be got from this source. New wood, or at any rate planks sufficiently long, will have to be used, and it will be just as well for them to be of full inch stuff. Perhaps if they are made of ordinary 1¼ in. stuff, which will not be more than 1 in. "down," or when finished, it will be better. The boards should be selected, or at any rate two of them, a little wider than the depth from back to front of the upper cupboard, in order to save any unnecessary jointing. The extra width referred to is, of course, to allow for waste in cleaning up the edges. There will be no difficulty in obtaining boards sufficiently wide, and if another one of the same width be got, both the ends can be made from the three pieces. The two first referred to must, of course, be the full length of the ends, of which they will form the back portions. The third piece need not be longer than the height of the wider portions of the ends, as it will be assumed that by ripping it down the middle the required depth from back to front of these can be got with only one joint. By using a little method it will thus at once be seen that each end is formed of two pieces, needing only one joint to connect them. Without attention to such an apparently unimportant detail, or, rather let it be said, without the necessary forethought enabling the worker to determine how to use his stuff to the best advantage without waste of time, two or three joints might have been requisite to get the entire width or depth. If a word of caution to the novice may be given, it is this: never be in a hurry to commence any piece of furniture, but spend a little time in consideration of the various parts, and determine how the material available may be worked up without either unnecessary labour or waste in the shape of odd bits, or, as they are often called in the workshop, short ends. Though these are, strictly speaking, not waste, for they can be used up for small parts, they have a decided tendency to increase in altogether disproportionate quantity unless sharply looked after. Every cabinet-maker knows that to his cost; and addressing myself in this remark specially to the young artisan, *i.e.*, the professional worker, I would wish to impress on him the necessity of avoiding waste if he wants to advance himself.

By making the ends as suggested, the whole of the edges of the long boards can be planed up—or, to use a more technical word, "shot"—without more waste than is necessary to clean them. The "shaping" by the ends of the recess is merely a semicircle, the lower edge of which is 3 ft. 6 in. from the bottom of the piece. To set it out, open the compasses to 3½ in., measure 3 ft. 6 in. from the bottom end of the board, then place one leg of the compasses 3½ in. further, as near the front edge of the wood as convenient, and mark the line with the other. The waste can be removed with the bow saw. The shorter or front pieces of the ends, being 3 ft. 6 in. long, will then only have to be glued on carefully, all edges, of course, having being trued previously, and with a little additional cleaning up these parts are completed.

No reference, it will be noticed, has been made to the small projections at the top and bottom of the ends, as something will be said about them in due course.

We have now to consider the pieces by which the ends are connected. Without reckoning the parts which form the plinth and cornice, these will be five in number, all of exactly the same length, but differing in width according to places they are to occupy. The top piece, which we may call A, will be the same width as the ends; the next, B, forming the bottom of the upper part, will be a trifle narrower, for the open recess is fitted with a back which is nailed on behind this piece and the next lower one, and not between them. To arrive at the exact width of B it will therefore be only necessary to deduct the thickness of the backing-board or panel, for which it will not be necessary to use 1 in. stuff, as thinner will do equally well, from the width of the ends. The third piece, C, forming the top of the lower portion, will also be narrower to the same extent than the bottom of the cupboard E, which will be as wide as the ends at this part. As, however, the back of the bookcase will be "scribed," as it is called—*i.e.*, cut away to fit the skirting-board which is found in most rooms—it may here be suggested that it will save some trouble if allowance be made for doing this by making the back edge of the bottom so far forward that it will clear the skirting-board. Of course, this will only be practicable if the position the bookcase is to occupy when finished can be ascertained beforehand, but, as it may fairly be supposed that such a piece of furniture will only be for the maker's own use, the probability is that there will not be much difficulty in ascertaining the thickness of the skirting-board. Perhaps it will be better also, in such a case, to scribe the ends before making up the work, though naturally, in the course of ordinary business, the ends are generally fitted after the thing has been made. In some constructions scribing is not necessary, but in a bookcase made as this one is, it will be seen that unless the space for the skirting-board is cut away, the backs of the ends, etc., could not be close against the wall. There is certainly an alternative, but one which is not always convenient, viz., cutting away and removing a piece of the skirting-board from the wall where the bookcase is to stand. By the way, the skirting-board will have to be removed if the bookcase is to fit closely in a recess—not necessarily at the back, but certainly at the ends. But as the object is not so much just now to give instructions about fitting up in position as to tell how to make the bookcase, nothing more need be said.

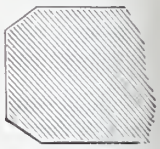


Fig. 4.—Chamfer on Edge.

The front edges of all these parts are bevelled or chamfered—not stop-chamfered, mind—as the ends of the job form the stops. An ordinary plane run along to remove the edges will do all that is necessary. The bevel should not be too wide, and will look best at an angle of 45°, as shown in Fig. 4, where the perpendicular line represents the front edge of the end. From this it will be seen that the flat edges of the shelves are level with the fronts of the ends.

As I have before pointed out, absolute

squareness in ends and edges of all parts of this furniture is necessary, so too much care cannot be taken, not only in working the pieces up, but in arranging them. Mark out on the ends the exact position for the shelves, or, as they should rather be called, the tops and bottoms, and do not grudge any time that may be so bestowed. The quality of the work will be improved. I am aware that to many a novice this may be hard advice, almost like telling them to perform the impossible; but to prevent them experiencing disappointment with results, it is only right that they should be cautioned against the faults they are most apt to make. By free use of the square, not only in setting out but in testing, combined with patience and common sense, many blemishes may be avoided.

It will be most convenient to fix the boards A and E in first. They will be about 5 in. from the top and bottom respectively of the ends. It is, I suppose, almost unnecessary to remind anyone that nails will be used to fasten them, as enough was said in the opening chapter about the simple forms of construction adopted. Though nails alone might be used, it will be as well to glue in a few blocks above the top and below the bottom, where, as we shall see later on, they will not be observable. They will stiffen the structure, even although they may not be actually necessary. The piece C is fastened in with nails only, with a distance of three or four inches between each of them. As seen in Figs. 2, 3, page 362, it is fixed about an inch below the upper end of the wider portion. This is better than having them flush, as the projection forms a kind of protecting rail, to prevent books, etc., being knocked off, and the appearance is also improved.

The bottom of the upper cupboard is fixed in the same way, at, as has been indicated, a height of 9 in. above the top of the lower one.

We have still to attend to the bearer, or bottom of the space within which the drawers run. Like the others, it may go right to the back; but if it stops short three or four inches of the full width that might be used, it will not much matter. Of course, instead of using this board D, the drawer bearers, etc., may be constructed in the usual manner; but to say that they must be, and to give the necessary directions, would—as the simple construction mentioned will serve every purpose—be beyond the range of these chapters. Perhaps with regard to the width of this piece of wood—or bearer, to give it a technical name—it may be as well to direct attention to the fact that it is no use having a lock to the cupboard below, or taking any precautions against removal of contents from the back, if the drawer bearer is only narrow. It must be a certain width, or it will not hold the drawers firmly; but five or six inches would, probably, be enough for this. Such a narrow bearer would, therefore, be sufficient if all people were honest. Unfortunately, they are not; nor is the predatory lodging-house cat quite an extinct animal. No matter how carefully the cupboard might be locked, if the bearer is narrow, it is only necessary to remove the drawer to be able to insert a hand and get at any of the contents of the cupboard which may be within reach. How cats manage I can't say, for no one has ever actually seen them at this work; but as much of the cheaper kind of furniture is made with narrow bearers, most of the space behind, being open instead of closed, as it should be, by a board, the hint may be worth something to those who can't imagine what becomes of, etc. etc. Many mysterious disappearances which happen from sideboard cupboards and similar places may be explained by this very simple means. False keys are cumbersome and altogether unnecessary contrivances when the drawer bearer is narrow. The distance of the bearer below the top will, of course, be determined by the width of the drawer front, which we may take as $4\frac{1}{2}$ in., giving the drawer an inside depth of about 4 in.

The division between the two drawers may either be a piece of wood extending only three or four inches from the front, or it may go right to the back. In either case the grain of the wood must be upright. If it extends a good way back, it will serve as a guide to the drawers, and prevent them being forced inwards; but otherwise the desired object can be attained by gluing or nailing a strip of wood the same thickness as the division on to the bearer-board; and as the face of the division will be flush with the front edges of the top and bearer, there will be a small break above and below it, owing to the chamfer. Were this allowed to remain, it would not look well; so the spaces should be filled up with pieces of wood neatly glued in. If the case is either painted or ebonised, the inserted pieces will not be observable; and finished otherwise, they will be almost imperceptible.

THE MANUFACTURE OF TINNED STEEL.

BY CHARLES F. HOWARD.

OF late years great advancement and improvement have been made in the manufacture of tin.

An improved method has been discovered whereby a better class of tin is made by substituting a foundation of steel for the usual one of iron. The advantages of steel over iron are many. Tinned iron requires very careful manipulation in the making up, the grain having to be considered; whereas in tinned steel this need not be looked to, there being no grain.

A few days ago I had an opportunity of visiting one of the largest tin works in Wales. My friend, who had offered to initiate me into some of the mysteries of this special system of tin-making, met me at the gates of the works at 7.10 p.m. The night shift had just started; the timekeeper or watchman not having left his little lodge, after checking them in. We passed in with a "good evening," receiving a "good evening, gentlemen," in return.

We were then in a large yard, and my friend remarked: "I will now show you the process from the very beginning." He pointed out an immense heap of pig iron, which, he said, was their raw material. The pig iron is put into a furnace and worked on by gases, the heat thus obtained being intense.

I approached to within about five yards, when a man, called a puddler, opened a sliding door, and I tried to look in, but I might as well have tried to look into the summer sun. The molten mass was in a white heat. The man laughed when I shrank from the intense glare, and, taking a pair of blue spectacles from his own eyes, handed them to me and bade me look again. With these glasses on I could look well into the furnace, and saw the metal bubbling as if it were water boiling.

From this puddling furnace the metal is run into a gigantic ladle capable of holding six or eight tons. The ladle is supported on a trolley and driven along a railroad by gear, which is worked by hand. The ladle runs over a pit about six feet in depth, where a number of moulds are placed in readiness for the heated metal. The metal is poured from the ladle into these moulds, which form it into ingots or blooms of steel weighing about half a ton each; the process of the puddling and the working of the gases having converted it into steel.

When cold, the steel is taken from the moulds and placed on a trolley running on a very narrow gauge tramway and quickly removed to another shop.

It is then placed in a furnace and heated to a white heat. I was interested to see how they would get this large piece of metal out of the furnace. It was a difficulty soon overcome. Two men with long levers quickly had it out, much as a baker takes his loaves from the oven; a trolley, called a "bogey," being run close to the furnace door, the bloom of steel is levered on to it and conveyed to an immense steam-hammer, a few blows from which soon reduce the steel to a bar about 6 in. by 5 in., which is cut into pieces 2 ft. in length. Two men proceed with one of the pieces, still hot, to the rolling mills, and here it is rolled into a bar 7 in. wide, $\frac{1}{2}$ or $\frac{5}{8}$ in. thick, and perhaps 16 ft. in length. During this process small streams of water are played on the metal, which has by this time assumed a red colour, the action of the water loosening the scale caused by the rolling, and which falls off when the bar is turned over every time it goes through the mill. It is allowed to cool, and then sheared off into lengths suitable to the size and number of sheets required.

It is then carried to another shop, which is fitted up with rolling mills and shears, placed in a line in the centre of the shop, and worked by one engine; and in this department it is rolled by one machine after another, at the last mill being doubled three times, making eight thicknesses. The whole is sheared round the edges, making eight sheets about 2 ft. square, and then placed on a bench, where girls are employed to detach the sheets, which have, consequent on the process of rolling, become tightly pressed together.

The sheets are carefully sorted; if marked or showing the slightest flaw, they are placed aside to be used for purposes other than tinned sheets. The sound sheets, now about the thickness of brown paper, are packed in metal boxes, placed in a slow furnace, and subjected to a steady heat for twelve hours. This is called annealing.

They are afterwards placed in baths of vitriol, this process removing any small pieces of scale, or dirt in any form; and after two immersions in acid and one in water, the sheets are ready to receive their coat of tin.

We have to visit another shop to witness this process, which is one of great interest. A workman taking a sheet of the steel and placing it between two rollers, it is carried downwards into a bath of molten tin. When it reappears, after passing two other rollers, it has the appearance of burnished silver.

However, it is not yet finished. Another workman takes it with a pair of tongs as it comes up and places it between two more rollers, where the process is repeated. After the second dip it is called double-blocked tin. On coming from this it is dipped into a bath of palm oil and then thrown into a heap of sawdust. A girl, whose hands are

protected with gloves, takes the sheet and rubs off the oil, and passes it to a second heap of sawdust, from which it is taken and placed in a rack. Two girls are now employed polishing them with sheepskin, which is the finishing process of the manufacture.

The result of all this labour is a highly burnished sheet of tin, which only has to be packed to be ready for deliverance to the manufacturers of the best class of tinned ware.

PRACTICAL DETAILS OF BOOK-BINDING.

BY GILBERT CLARKSON.

Lining the Backs—Covering—Finishing—Lettering.

Before covering a book with leather or cloth, the back must be lined. Leather-bound books should have head-bands glued to the head and tail. Head-bands are manufactured in cotton and silk. For extra bindings, silk should be used, which fills the place once occupied by hand-wrought head-bands. After putting on the head-bands, line the back with good stout paper. Magazine covers can be utilised for this purpose. Proceed thus to line an "open back":—Put the book in the lying press with the back up, glue the back and lay on the paper with the edge about ¼ in. from the left-hand side, bring it over to the right, rub it down with the folder, fold the paper, and bring it over to the left; the ¼ in. of the bare back of the book will be sufficient to hold it; fold it again, and glue the paper already on the back; carry it over to the right again, and cut it off neatly. There will now be one ply of paper fast to the book, and two plies forming the back with an open space between them.

A piece of calico or gauze is used for lining cloth books. Cut it broader than the back, so that about 1 in. may come on to each side of the book. Glue the back of the book, put on the cloth and rub well down, glue again, and line with paper from joint to joint.

It is usual to put bands on the back of leather-bound books. They may be flat, round, or bevelled. Flat bands are made with two or three plies of paper glued together and cut into strips. Round bands are simply cord. Bevelled bands are made from scraps of leather glued together and cut narrow at the top and broad at the bottom. Flat bands are best for calf work; the others are more suitable for morocco bindings.

To put on the bands, measure the back into equal compartments, leaving a little more space at the tail. Affix the bands to the compass marks with glue, and when they are dry pare them carefully at the ends with a sharp knife.

The material which is to form the cover of the book, should be cut a little larger than the book to allow for turning in, and pared round the edges. Before pasting calf covers, damp them well on the dressed side of the leather with clear water. Great care must be taken with calf, as it is liable to get stained. Morocco and roan should not be wetted, as it would destroy the grain. The manipulation for all leathers is much the same in every case. The cover is well pasted and drawn on the book as tightly as possible, rubbed down with the hand first, and afterwards with the folder. The head and tail are first turned in, then the fore-edge, the corners cut with the scissors, and afterwards pared with the knife, and set neatly with the thumb-nail. The setting of the heads is very important to the beauty of the binding. A little cap is formed with the leather over the head-band. The double fold of the leather is drawn up a little at this point, and with the folder it is laid down flat over the head-band. The book is put upon its end on the bench, and the folder is rubbed round the back until the leather is nice and square. It is best to give the book a nip at the joint in the lying press between smooth boards. This will ensure the leather sticking to the joint, and at the same time make it smooth and neat.

Half-bound books are treated in the same manner, only, as the term implies, having back and corners of leather. The sides, which may be of paper or cloth, are put on with glue, and when all is dry, the end papers are pasted down and the work finished in the same way as in whole binding. But, as this is part of the "finishing" process, I will leave it for the present.

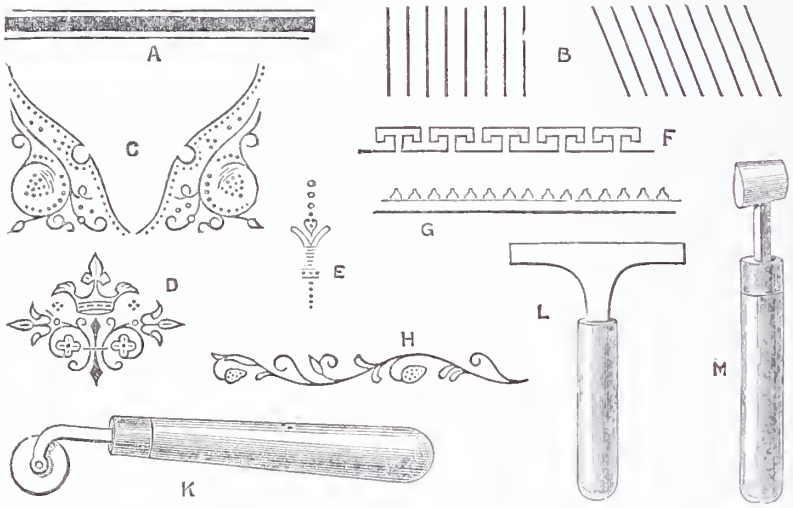


Fig. 25.—Finisher's Tools—A, Narrow-Broad-Narrow; B, Bar Roll; C, Corners; D, Centre; E, Sprig; F, Greek Roll; G, Cat Tooth; H, Roll or Pallet; K, Roll; L, Pallet; M, Polisher.

I have now gone over that part of the science of bookbinding which, in the trade, goes by the term of "forwarding," and have arrived at the finishing stage. I have been trying all through to impress upon my readers, as I passed from stage to stage, the necessity of being careful in the various operations.

Finishing requires not only careful attention in every detail, but a considerable amount of taste and talent; taste to form a true estimate of what will harmonise with the nature of the work and add to the beauty of the binding, and talent to execute the designs in the most complete manner.

In my remarks upon this branch of the art, I will be as brief as possible. I fear that I have already taken up too much space in this valuable journal, which we must remember is not for *a* trade, but for all professions. I will therefore only give a general sketch of the *modus operandi* of finishing, preferring to leave more artistic matters until some future time.

When a finisher gets a book into his hand, the first thing he does is to look it all over with a critical eye, and if he finds any defects in the forwarding he should point them out. Having arranged everything to his satisfaction, he takes his band-stick (a piece of hard wood about 10 in. by 1 in. by ½ in. planed square) and rubs the leather close into the sides of the bands, providing there are bands in the book. This done, he will, if the book is bound in calf, cut a small piece of thin leather of a colour which will harmonise with the colour of the cover of the book, pare it neatly, and paste in the compartment where the title is to appear.

Morocco and roan binding seldom have coloured titles, so they are passed in the operation of "piecing," as it is termed.

The book should next be trimmed, *i.e.*, all divergencies from the straight which have been left by the forwarder in the cover should be pared evenly by the finisher. Backs, corners, sides, and insides, should be treated in this manner, for nothing looks so bad in a finished book as great lumps of leather showing below the cloth or paper of the sides or insides. Continuing the work of preparation for finishing, the board should be opened, one of the end papers torn out (back and front) and laid aside for lining the boards afterwards, and the joints scraped to take away any little pieces of paste or glue that may have lodged there. The end paper which is to be pasted to the board should be trimmed at the sides, so that it will be at equal distances all round from the edge of the board. Attention to these little matters, although they may seem trivial, will go a long way in adding to the beauty of the finished volume.

All leather-bound books are washed with paste-water, *i.e.*, clear water with a little paste mixed in it. This replaces the vellum size used in former days.

Calf, because of its great porosity, requires to be well rubbed with paste before washing. Paste the back with the brush, and rub the paste well into the leather with the folder, taking care not to rub *too* hard. Sometimes a little oxalic acid is added to the paste-water, which helps to clear the lighter colours of leather. The workman will have to use discretion in this matter, as the acid will destroy some colours.

When the books have become thoroughly dry after washing, the parts where the gilding is to be applied are glaired. Glaire is the whites of eggs beaten up until they have become as thin as water. Most leathers require two coats of glaire; the first must be allowed to dry before the second is applied. Cloth is only glaired once.

There is a preparation called albumen, which I do not like, taking the place of glaire. It does well enough for blocking cloth work, but for finishing leather, especially extra work, it is best to use glaire that has once been fresh hen eggs. When both coats of glaire have become perfectly dry, the gold is cut on the cushion and lifted with cotton wool and laid on

where required. For laying on calf, hog's lard is used (a little bit on cotton wool rubbed gently over the glaired parts); for morocco, roan, and cloth, olive oil is used. Both oil and lard should be used sparingly, for they are likely to leave a nasty stain which nothing will remove. The tools, which are of brass, with wooden handles, are placed upon a gas-stove and heated to the proper degree of heat, when they are taken up one by one and impressed upon the top of the gold. The heat causes the gold to adhere, and the impression of the tool, whether it be a line or a flower, is left upon the cover. (Fig. 25.)

Lettering is executed in the same manner. After the tooling is completed, the surplus gold is wiped off with a cloth, called the "gold rag," kept for this purpose alone. Any particles of gold still adhering to the leather are cleaned off with indiarubber. Calf is polished, after lettering and tooling, on the glaired parts. The portion of the cover which has not been gilded is washed with clear water, which removes any glaire or finger-marks which may have got on while the operation of gilding was being proceeded with, and blind-tooled according to style or fancy.

At this point, the sides are put on for half-bound books. The inside of the board is lined with the end paper laid aside for that purpose. The other end paper is pasted to the board; care should be taken to make it stick at the joint. The boards are left open to dry. When sufficiently dry, the boards are closed, and if the book has marble edges, they are burnished with a tooth-shaped burnisher. A sheet of tin or zinc is placed inside and outside each board, and the book placed in the standing press, and the press screwed up more or less tightly, calf allowing of more pressure than morocco. Instead of tins for the outside of morocco books, boards covered with flannel are used to preserve the grain of the leather. When the books are taken out of the press they are polished up and looked over for any defects or finger-marks, which on being put right, the finishing touch is given with the brush, and the book is handed over to the foreman for inspection.

As I have already stated, I have only given a general idea of finishing, and I have not touched upon blocking.

These matters, taken by themselves, are quite sufficient for a series of articles. There is so much that is artistic in finishing, not only in tooling beautiful designs upon the covers, but also in the various methods of enhancing the leather — such as colouring, sprinkling, marbling, tree marbling, gold marbling, transferring landscapes, inlaying, and many other operations—the mere mention of which would make an article sufficiently long for these pages.

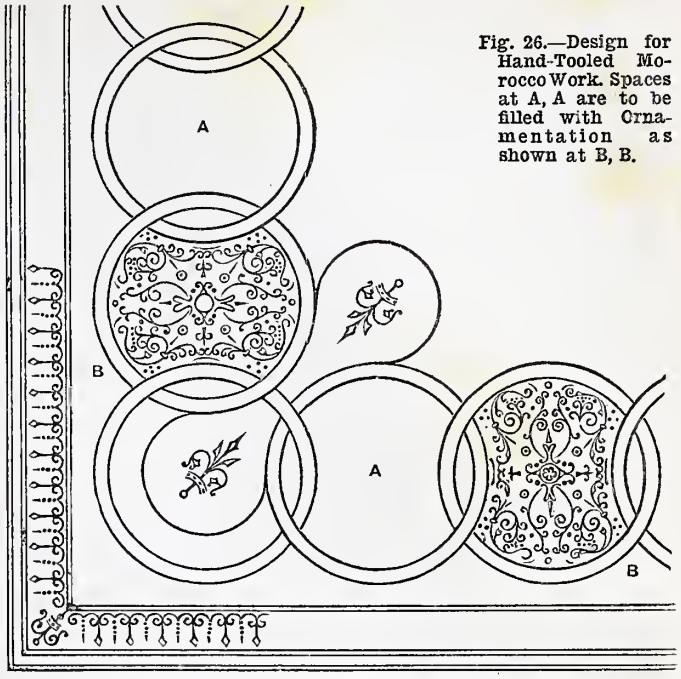


Fig. 26.—Design for Hand-Tooled Morocco Work. Spaces at A, A are to be filled with Ornamentation as shown at B, B.

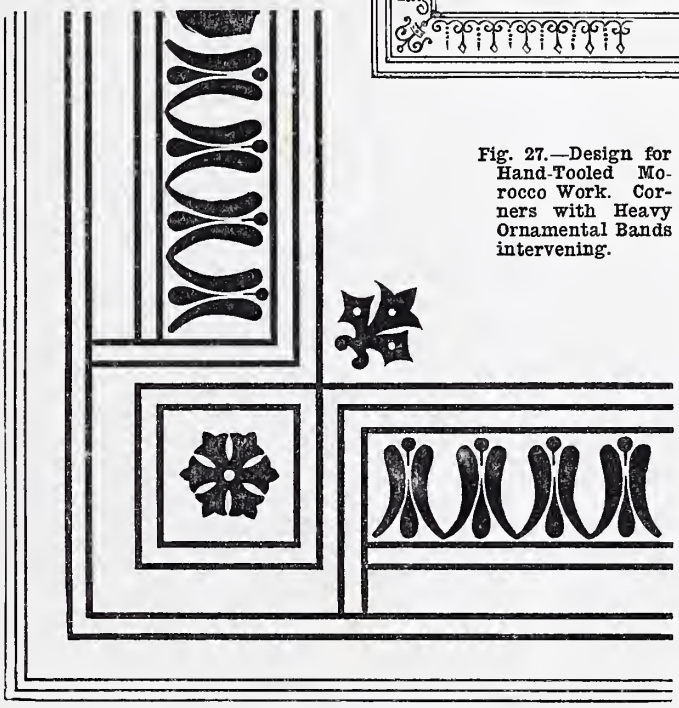


Fig. 27.—Design for Hand-Tooled Morocco Work. Corners with Heavy Ornamental Bands intervening.

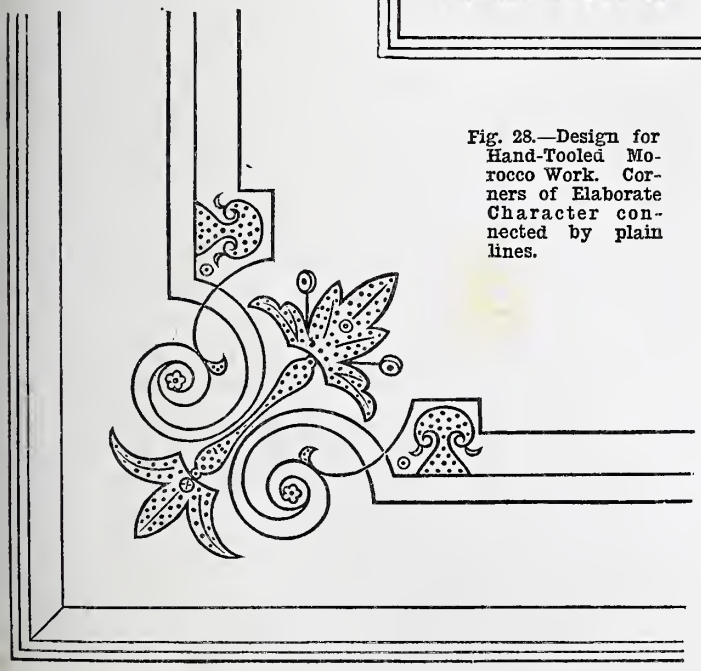


Fig. 28.—Design for Hand-Tooled Morocco Work. Corners of Elaborate Character connected by plain lines.

I here give three designs for hand-tooled morroco work in Figs. 26, 27, and 28. They are not *the* best which I have in my collection. I selected them because they were comparatively easy for me to copy with the pencil from the rubbings.

We are very jealous of our rubbings, and like to keep them in a safe place.

In taking leave of letter-press binding, I would like to say that I will endeavour to prepare another series of articles on "Finishing and Blocking" if a place can be found for them. In the meantime, any question sent to me will be carefully considered and answered in "Shop."

SAFETY GUN-SLING HOOK.

BY THE INVENTOR, JOHN C. KING.

WITH the present shooting season we may expect the usual numerous gun accidents to bring sorrow to families as it has done so recurrently ever since guns were invented. These catastrophes may be averted in the matter of carrying loaded guns when getting over fences, or carrying them when not beating for game, and certainly enable better shooting by the hand not being fatigued by bearing the weight of the gun.

As the contrivance is quite simple, and cheaply made by any person handy with common small tools, the illustration may be a guide to the manner of making, aided by a statement of a few details.

Two straps and a hip-strap with hook constitute the outfit. A belt for the waist is one strap, and a cross-belt the other. Cloak straps will serve, and for the cross-belt is the right thing, as this belt should be light, and fit loosely over the left shoulder across the breast and back, down to the waist-belt, at the hip-strap on the right side; which hip-strap may be hung on the waist-belt here, or on to the cross-belt, dispensing with a waist-belt altogether. In this way I have carried guns climbing steep ground or descending difficult gaps, and have often gone up and down ladders, having both hands free; in fact, I have climbed trees with the gun thus hung to me.

In use, at times, I forgot that I was the bearer of a gun: it rides so lightly, and out

of the way, with the stock by your right hip, and the barrel at your back, the muzzle pointing up from the left shoulder.

For horseback it is safe and handy; at all paces and jumps, here the waist-belt is useful, though not indispensable. As the whole merit of the contrivance is in the hook and its shape, to prevent the gun from jumping up and getting released from the hook, its illustration will explain it and the knack of lifting the gun off the "hook" where it hangs by the trigger-guard—or any such loop; if without a trigger-guard—is soon acquired by the sportsman. The illustration affords a sketch, half full size, of the hook as riveted on to the hip-strap. This strap is folded double, so as to hold it on to the cross-belt.

It will be asserted, and admitted, that a hook has been used to carry a gun, but the hook to be effective must have a special form: this is shown at the projection at A, which prevents the gun being tipped, dragged, or jolted off the hook at B. The only release is by placing the thumb of the right hand on the top of the hook C, at the same time as the gun is grasped by the fingers at the neck of the stock, and turned so that the trigger bow or hoop is lifted clear of the projection A. This can be done in an instant, walking, running, or at a gallop on horseback.

Safety Gun-Sling Hook: side view.

The barrel of the gun is simply retained by the loose cross-belt as it rests against the sportsman's back, so that in the release from the cross-belt, the arm that holds the gun after its release from the hook has only to be dropped straight down by the side, and the gun comes from under the cross-belt ready for raising to the shoulder with one hand's use only.

Having carried rifles and carbines in all the many various ways adopted from time to time in the service, and knowing some to be awkward, I confidently recommend this plan for sporting guns.

How about the trigger touching the under side of the hook? will be asked. The trigger-guard is too wide to rise up on the hook to allow the trigger to touch the hook; the dotted lines D represent a section of the guard which the contraction of the hook at A prevents the guard rising.

Where can they be bought? will be one of the earliest questions. There are none made for sale. A pattern one—the hip-strap and hook—is at the service of any one disposed to make one themselves, or have one made. As in these matters all particulars are serviceable, and those who use guns are mostly more or less expert in metal working and strap cutting, the way to make is now detailed. The cloak-strap you can buy. The hook pattern you take to any brass or nickel foundry; or to make sure of the work being right, to a brass-finisher of the right sort, as Mr. Faultless, the Plater, Great St. Andrew's Street, Seven Dials, S.W. He will supply you in the rough from your own pattern, or he will finish it for you; and as he is a leather worker as well, he will mount it on the hip-strap as it should be mounted if wished, or any other harness plater would do it. In most towns there are several of these shops to be found.

In making presents to gentlemen, ladies are often uncertain what to select: slippers, cigar-cases, etc., have been hard run as presents; but a "safety gun-sling hook" would be a distinctly useful thing, and perhaps might be the means of saving the life of a brother, father, or friend, if given to one or other of them, and used by them.

One of the hooks that has seen many years hard service is at the office of WORK, and patterns may be freely taken from it by anyone applying to the Editor if the illustration is not sufficiently clear.

A CANVAS CANOE.

BY J. B. FERGUSON.

As directions for building canoes in wood have been given in WORK, perhaps some of its readers may like to learn how to make a canvas canoe. I have made seven or eight of the kind I am about to describe for myself and several of my friends. They were all made of a light framework of yellow pine, covered with stout calico, which was made watertight with linseed oil and paint.

A canoe of this description offers many advantages over a wooden canoe. It is very easily made by an amateur, requires very few tools, and will not take so long to make as a wooden one, will cost much less, and, what is of great importance in a canoe, is very light, and can be easily lifted about by one person, whereas a wooden canoe would require three or four. They are very durable; one I have now has been in use for three seasons. A canoe is different from a boat, being taken out of the water when not in use, and kept under shelter. If a hole does get knocked in it, it can be easily patched. All the wood is put together with screws, so that, if necessary, they can be unscrewed and covered again with calico. In any case, I think it very desirable that amateurs should attempt this kind of canoe before making a wooden one, and, if he fails, he will not have wasted so much money as he would have spent in making a wooden one.

The drawings had better be explained first. Fig. 1 gives the elevation of the canoe, showing the distance apart of the ribs—viz., one foot centre to centre and two feet from the bow and stern. Fig. 2 shows the plan looking down upon the canoe. The widths are all here shown. The inner line is the curve the canoe would assume if cut through at the dotted line shown in Fig. 1. Fig. 3 shows the method of fixing the stem and stern-post (which are both alike) to the keel. The fillet (B S) at the back is screwed to the posts, and forms rebates, into which the ribands fit on each side. The ribands are not shown, but it will be understood that they run from bow to stern, and are screwed to the ribs. At the bow and stern the gunwale is on a level with the deck piece, and screwed to it, as shown in Fig. 11; and the deck pieces (D F) and other gunwale (G) at this point are 12 in. above the top of the keel, but in the centre of the canoe (Figs. 4 and 7) it is only 9 in. This makes the bow and stern of the canoe higher than the centre body, and is known as the sheer. In this case, the sheer at bow and stern is made, for simplicity, the same, but the bow generally has the most sheer. Figs. 4, 5, 6, 7, 8, and 9 show the shape of the ribs (R) after being steamed; also the position of the ribands, R N S, gunwale, and the height of it at the different points. Fig. 10 is a section of the stem or stern-post (S) and the back post (B S), showing the method of fixing the ribands. Fig. 11 shows how to fix the gunwale to the deck piece. The remaining figure shows the shape and size of the paddle.

The materials used were:—Elm for the ribs, ash for the stem and stern-post. The rest of the wood was yellow pine. All the wood was joined together with brass screws, of a size suited to the wood they have to unite. The whole of the framework is covered with unbleached calico. The materials I used were all of the very best kind, and the cost was under 25s., and, with care, would cost only 18s. or 20s.

The amateur, before starting, should carefully examine the drawings, and get to thoroughly understand them. I will now describe how to proceed making the canoe.

The keel is to be prepared first. See that it is perfectly straight. Cut it 12 ft. long, $\frac{7}{8}$ in. thick, 2 in. deep, and plane smooth. Then taper the ends to $\frac{3}{4}$ in. thick and $1\frac{1}{2}$ in. deep, so as to fit the stem and stern-post. (See Fig. 3.) Next bevel the keel both sides, so that it is $\frac{7}{8}$ in. at the upper surface and $\frac{1}{2}$ in. at the under. (See Fig. 4.) Then cut 4 in. rebates at the end (Fig. 3).

The stem and stern-posts are now to be cut 2 in. wide to the curve shown, out of a $\frac{3}{4}$ in. ash board, then planed so as to be $\frac{3}{8}$ in. thick on the front edge. Corresponding rebates may now be cut in the end to fit those in the keel. The stem and stern-post and keel may now be screwed together, after testing the joint and seeing that they are all in one plane, otherwise your work will be out of truth. The joint should be painted with white lead before screwing, so as to be watertight.

The false keel may now be prepared. Cut it 12 ft. 8 in. long, $\frac{7}{8}$ in. wide, and $\frac{1}{2}$ in. deep. Then cut notches on its upper surface $\frac{1}{4}$ in. deep and $\frac{3}{8}$ in. wide, into which the ribs about to be described are to be screwed, from the under surface. There are eleven notches to be cut (Fig. 2), the middle one in the centre of the keel, and the others 1 ft. centre to centre from this one.

At this point you should prepare for steaming the ribs, to give the canoe the proper shape. Cut out the shape for your moulds full size on paper exactly as shown in the Figs. 4 to 9. The best way to get those shapes would be as follows:—Take Fig. 4 for example. Draw a centre line, and then two lines at right angles to this, and 9 in. apart. The upper one will be the gunwale edge, and the lower the top of the keel. Then mark off on each side of the keel 1 ft. 1 in. for the width of the canoe, and draw a curve the same as that shown, and then mark it on a flat surface, such as a boarded floor. Next draw a line parallel to this $\frac{3}{4}$ in. from it—viz., $\frac{1}{4}$ in. for the ribands and $\frac{1}{2}$ in. for the ribs. Now cut pieces of wood $\frac{1}{2}$ in. thick and to go along the inner line. Treat all your other sections the same as you have done this. You will also require another mould for the back post to the stem and stern. This curve will follow that at the back of the stem and stern.

Having laid down your moulds, you will next require about fourteen strips of elm, $\frac{3}{8}$ in. by $\frac{1}{2}$ in. Get an iron pipe, and plug up one end, fill this with water, and put it over the fire, with the ribs inside, to steam—or, more correctly, to boil—and stop up the other end with a rag. After they have

been steaming for two or three hours, take them out quickly, and, while you bend them closely round the mould, get a friend to drive temporary nails to keep them in position. Allow them to remain thus for a few days. Before removing them from the mould, mark where the centre line comes, so that you will know where to screw them; and also mark where the upper point of the gunwales comes to. They may now be taken off, but tie their ends with string to keep them in position. You will find that you will require two of each ribs, except No. 6, which is the centre rib. Fig. 1 will explain this.

You may now screw the ribs to the false keel by screwing from the under side of the keel and letting the ribs rest in the notches before mentioned. Take particular care that you place the right ribs in the proper place for it. It would be advisable to ticket them as they leave the mould, and place corresponding marks on the false keel. Then lay the false keel upon the keel, and bore holes with the bradawl between each division of the ribs. Now remove the false keel. Take your calico now, and lay its centre line along the keel, stretching it from end to end, not *too* tightly, and tack with ½ in. copper tacks at the ends. Then tack round the holes made in the keel at the top, to make it watertight. Now lay down your false keel, and screw through the holes already made with 1¾ in. brass screws. The calico I used was unbleached, 40 in. wide. It took about 7½ yards, double width, at about 1s. 3d. per yard. Before stretching the calico on the canoe, it is a good plan to wring it out in water and let it dry.

The gunwale may now be prepared. Let it be about 16 ft. long and 1 in. by ½ in., and screw it to the rebate made for it in the upper part of the ribs. Now cut out of a piece of ¾ in. wood the shape shown in Figs. 7 and 8, and fix them in position where shown in plan—viz., at shape 4 and 7. These pieces form the front and back of the well respectively.

At this point you had better stretch a piece of string tightly from bow to stern, to see that you work true, and take care that the centre of the front and back of the canoe come on this string.

The deck pieces have now to be put in: they are 1¼ in. by ¾ in. Screw the front deck piece to the bow or stern-post and the front of well, and the back deck piece to the stern-post and the back of the well, taking care that you have fixed the proper height for it on the posts.

The back posts (Fig. 3) may be screwed to stem and stern, letting them reach up to the under side of the deck piece, so as to form a rest for it. After the deck pieces are placed in position, the gunwale may be cut and screwed to the deck piece. (Fig. 11.) The gunwales should be both placed into position together and marked for cutting, because it will be found that, if they are done separately, it will put your work out of centre. It will thus be seen that, if your work is not true before fixing the gunwales, they should be made to get it so.

The ribands will be the next consideration. These should be nearly 16 in. long and ½ in. by ¼ in. thick, planed smooth, and take the sharp-edge off their outer sides with sand-paper, so that it will not cut the calico. The same remark applies to the gunwale and the upper part of the deck piece.

To get the positions of your ribands, divide the distance on each rib from the under side of the gunwale to the keel. The centre will be the point for your third rib. Then place the other four at equal distances on each side of this one. Screw the ribands to the ribs with ½ in. brass thin screws. I ought here to say that all screws should be well countersunk, so as to prevent them making holes in the calico. The ends of the ribands where they fit into the stem and stern-post will require to be thinned a little, so as to make a neat joint.

The framing for the well-hole is next put together, ¾ in. and 2½ in. deep. (Figs. 7 and 8.) The ends of the side pieces to the well are prolonged so as to rest upon the back and front of the well. (Figs. 1 and 2.) Fit the pieces in position, but don't screw up.

The whole of the work should now be sand-papered, dusted, and given two coats of good oil paint. While the paint is drying, you may prepare your paddle. Let this be of light yellow pine. The chief thing in a paddle is that it should be as light as possible. In the end of the paddle stick, which is 6 ft. long, cut a slot 6 in. by ¼ in. to receive the blades; then cut your paddle to an oval shape of 1½ in. by 1¼ in. at the middle, tapering to 1⅛ in. by ⅞ in. to within about 8½ in. of the end. The stick should have its full thickness at 6 in. from the end of the slot, and be tapered a little along towards the ends. Cut the blades out of ¼ in. stuff, and plane them to ⅛ in. at the edges, and then screw them into position with three screws at each end.

If you think it can bear it, the paddle may be made lighter than this. It is liable to give at the ends of the slots, and a piece of copper wire may with advantage be twisted round at the point.

The paddle may be sized and varnished, except about 1 ft. 3 in. on each side of the centre, where you will grasp it. This part should be merely oiled.

A rest for the back will be required next. Get two strips ½ in. by 3 in. wide, and 1 ft. 6 in. long, and join them with two ledges, allowing a space of about 2 in. for the spine to fit into. You should also prepare the floor board, ¼ in. thick, but don't fix it until the calico is tacked on. When the paint is dry, you can prepare to stretch your calico. After laying it on, you should have tied it neatly to the keel, to keep it clean. Commence at the centre of the canoe, and stretch it tightly, pulling towards the gunwale and along the ends, doing this at intervals of about every 9 in. or 12 in., leaving about 18 in. of the bow and stern untacked until you have finished tacking it to the stem and stern-post. Now go back along the gunwale and tack about 1 in. apart until you get all the wrinkles out, driving your tacks into the top of the gunwale. Great care should be taken in tacking to the stem and stern-posts so as to get the joint watertight. Cut the calico approximate to the shape and pull it towards the ends, and turn it inwards, so as to get a good edge outside, tacking at intervals of about 4 in., and, if done to your satisfaction, tack at much closer intervals, placing the tacks almost side by side. Before putting on the top, you had better paint the joint on the inside, so as to fill up any small hole unnoticed.

The calico for the ends may now be put on. Cut it roughly to the shape, and tack temporals around, stretching tightly, and pulling all wrinkles out. Finish by tacking about 1 in. or so apart. The calico should be tacked to the front and back of the well on the inside.

You may now screw your floor board down. Make this very secure, as it will strengthen the ribs very much, and keep them stiff.

To the under side of the side framing of the well tack strips of calico, stretching tightly; then place your framing in position, and screw it down. Also place pieces of wood (two on each side will be sufficient) from the under side of the framing to the gunwale, so as to stiffen the well. You may now finish tacking the calico to the gunwale along the sides of the well. I hope I have made it clear how to stretch the calico. It is very difficult to describe, but the thing to be aimed at is to get all wrinkles out, and this is best done by tacking temporarily first and then going over again and completing it.

You may now give the calico a coat of raw linseed oil. Don't apply it with a brush, but rub it in with a flannel. After this is dry, give it another coat of the same, and then paint it to your taste. Some use boiled oil instead of raw. This dries much quicker, but some think it makes the calico stiff and liable to crack.

To two canoes that I made I gave a priming coat, and then painted them a light yellow with a coat of varnish, which I thought looked very nice. An apron will be required to go over your legs while paddling. It may be made water-proof with oil.

Great care should be taken that no dirt gets inside the canoe, as it is apt to get between the ribands and the calico and wear holes. A very good plan would be to enclose the well all round with calico, and then, in case of an upset, you would be much safer.

The canoe I have at present I keep in a box, with a covering over the canoe to keep out the dust; but a box is not absolutely necessary if you could put it in a yard near the water. In that case, a covering would be quite sufficient to keep out the dust.

They are very good sea-boats, and not by any means the dangerous things people think them. I am living at Swansea, and have often been to the Mumbles about five miles along the coast, and visited Oxwich and other places in them. A large amount of baggage can be carried on board, which would be put either in front or behind.

The amateur need not be afraid at any apparent difficulty in making them. If he will proceed in the order I have described he will find everything simple, and will be rewarded by having a very good sea boat, and I wish him much pleasure in "paddling his own canoe."

As autumn has now fairly commenced, and amateur workmen are now forsaking outdoor amusements of all kinds and returning to their workshops, the time seems to be well fitting for descriptions of such articles as a "Canvas Canoe." It has been given now that no one who is fond of the water and aspires to be his own boat builder may complain that sufficient time has not been given him to build and equip his boat before the genial spring gives him another opportunity of taking his pleasure on sea or river. The diagrams, in all probability, will be thought small by many readers. That they are so it is impossible to deny, but against this it may be urged that they are so clear and definite that there will be no difficulty in enlarging them to full-size working drawings, especially as dimensions are given as a guide to the draughtsman. And with these concluding remarks, I will leave the reader to the work of building if he choose to undertake it.

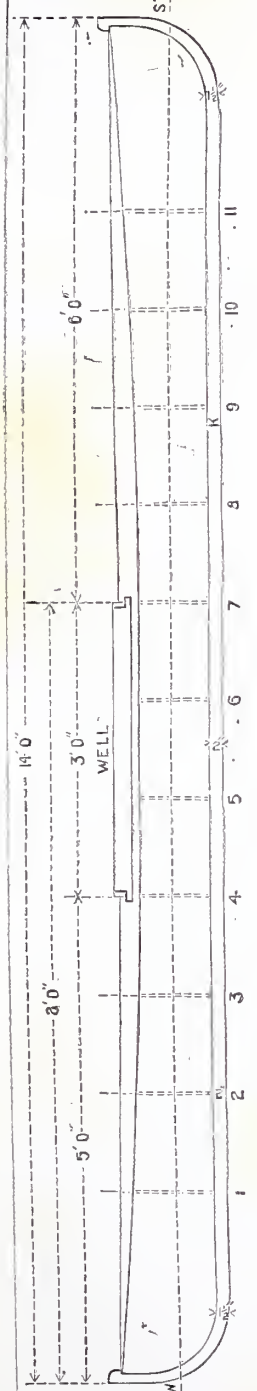


Fig. 1.—Elevation of Canvas Canoe.

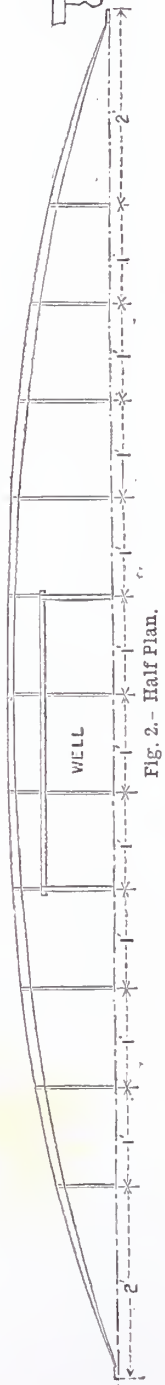


Fig. 2.—Half Plan.

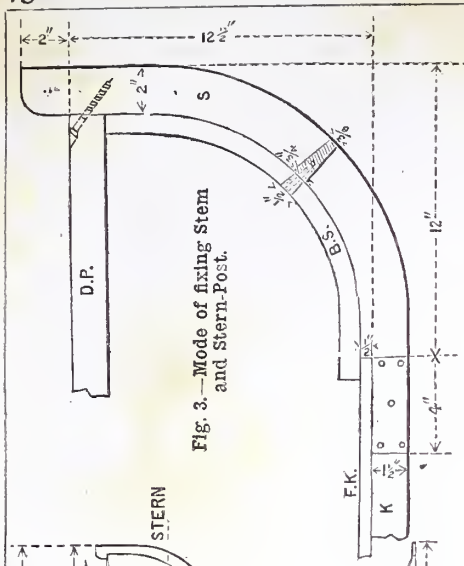


Fig. 3.—Mode of fixing Stem and Stern-Post.

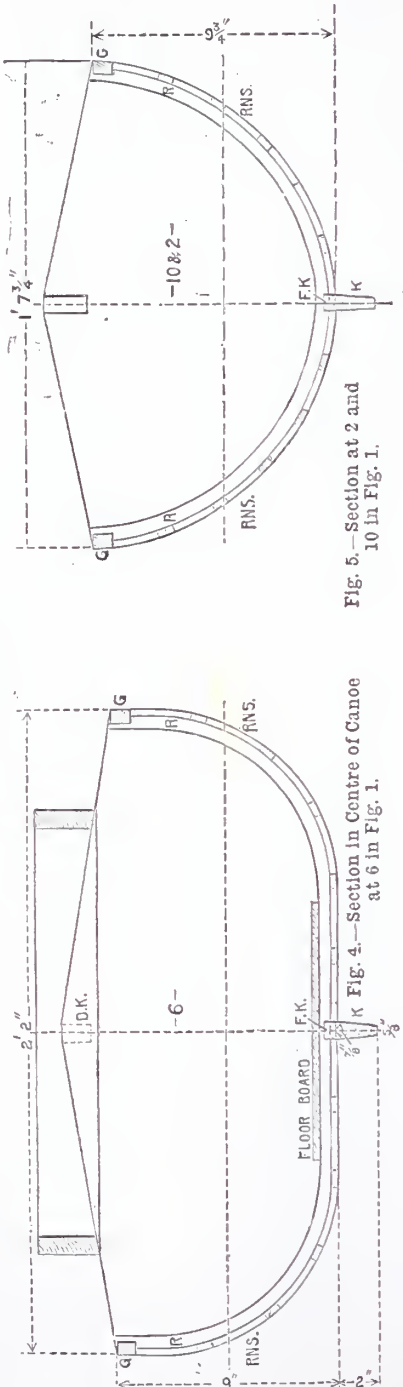


Fig. 4.—Section in Centre of Canoe at 6 in Fig. 1.

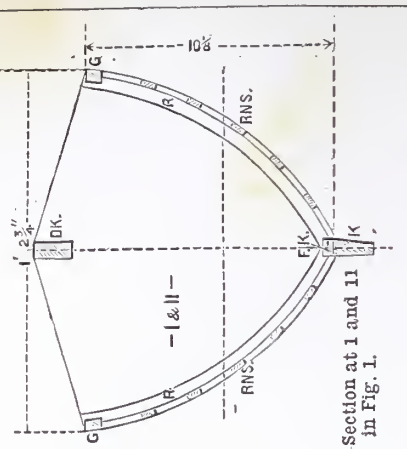


Fig. 6.—Section at 1 and 11 in Fig. 1.

Fig. 5.—Section at 2 and 10 in Fig. 1.

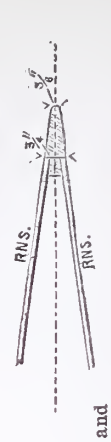


Fig. 10.—Section of Stem and Stern-Post, and Back Post.

Fig. 12.—Diagram of Paddle.

Fig. 11.—Mode of fixing Gunwale to Deck Piece.

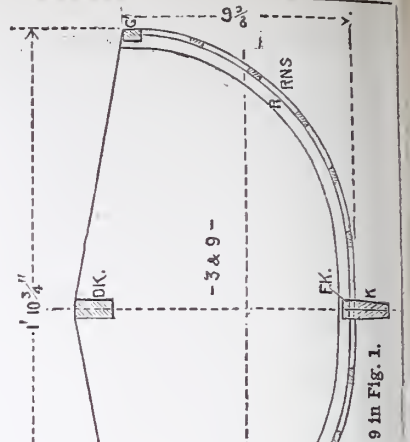


Fig. 9.—Section at 3 and 9 in Fig. 1.

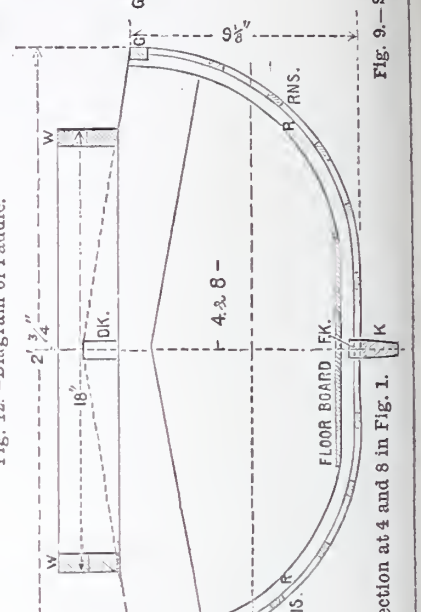


Fig. 8.—Section at 4 and 8 in Fig. 1.

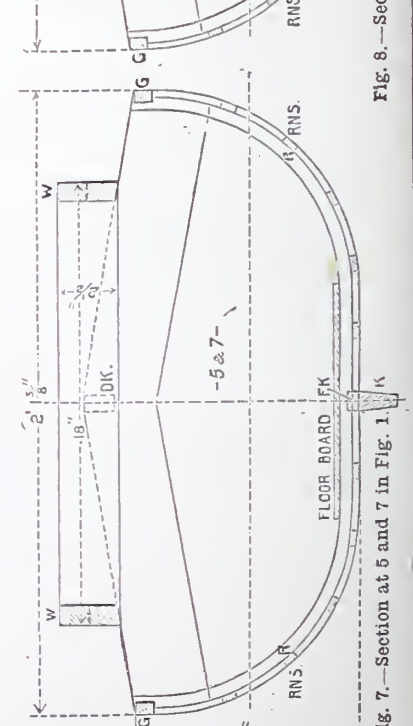


Fig. 7.—Section at 5 and 7 in Fig. 1.

HOW TO MAKE A PAINTER'S EASEL.

BY D. DENNING.

It would be a strange thing if among the thousands of readers of Work there were not some whose artistic instinct impels them to paint pictures—I had almost said works of art; but those who make these are hardly likely to wish for directions how to make an easel. No; those to whom the following hints are likely to be useful, are those who wish to do a bit of canvas-daubing—or, may be, paper-staining—to beguile themselves during their leisure hours, and, perhaps—who knows?—in future years become the leaders of picturesque art. Well, if any readers are ambitious enough to aspire to seeing the magic letters R.A., or even A.R.A., after their names, they will be none the less likely from the fact that they made their first easel themselves. Still, I must confess that I hope a great many more young artists than are ever likely to join the forty will be inclined to make their own easels.

That these indispensable articles of the studio vary in construction very considerably is, of course, understood; and, possibly, the easel shown in the illustration (Fig. 1) may not seem half complicated enough to suit the taste of those who do not care for simple appliances, but would prefer to make something more difficult. May I just suggest that their opportunity will come by-and-by, when they get the canvas in hand, and meantime ask them to remember that a good picture may be made on a very commonplace easel? *Apropos* of this, I was much struck one day last summer when accompanying my friend Peter Ghent, the Conway Valley artist, whose "counterfeit presentments" of whitewashed cottages glow with the dazzle of summer sunlight, to notice the simplicity of his sketching easel. Of this, by the way, I made a sketch and took particulars, for the benefit of readers who want a good, light easel for out-of-door work. Just now, however, what I want to say is this: If a man like the aforesaid P. G. uses a common, rough little easel, there is no reason why the one now described should be blamed if the work done on it is not quite up to Royal Academy excellence. Not that this is always very high. Perhaps some inquisitive individual may want to know why I describe this easel in preference to the one just referred to. If so, let me say that I have a liking for this one. It stands by me as an old friend; so old that, after raising my pen to consider how many years I have had it, I am almost afraid to say. It almost takes one back into ancient history. I think it was made in the year of the "Seven Days' War," but it is as sound as ever, and much more handsome in appearance, for has it not been honoured with a coat of enamel paint, which hides its, till lately, somewhat dirty surface? It is, in fact, promoted to the dignity of a drawing-room easel, whereon stands a picture completed and framed, with just a little bit of cunningly arranged drapery to hide its nakedness. But why mention this? For no other reason than to suggest to those who don't want to make an easel to paint on that they may make one to serve as a stand to fill up an odd corner and support a picture. By altering sizes, even a small table easel, or one to hold a photograph, may be made in the same manner as the one described. Nor is there any necessity why the humble pine must be used for such a fancy article. For use as a painter's easel, pine will do well enough; but if ornament be the primary consideration, some choicer material may as well be used. Even painted pine, however, is not to be despised. Whatever the wood, three pieces, each 6 ft. long by 2 in. wide, of 1 in. stuff, will be required. From one piece cut a length of about 1 ft. This short piece will form the centre-piece near the top, and to it is hinged the leg which extends backwards. The two other pieces, of course, form the front legs, against which the canvas rests. Now, to provide for the backward slope of the centre leg—which, it will be observed, is hinged in front—due allowance must be made by cutting the contiguous ends of the centre portion on the bevel, as shown in section, Fig. 2. Naturally, the wider the bevel, the more

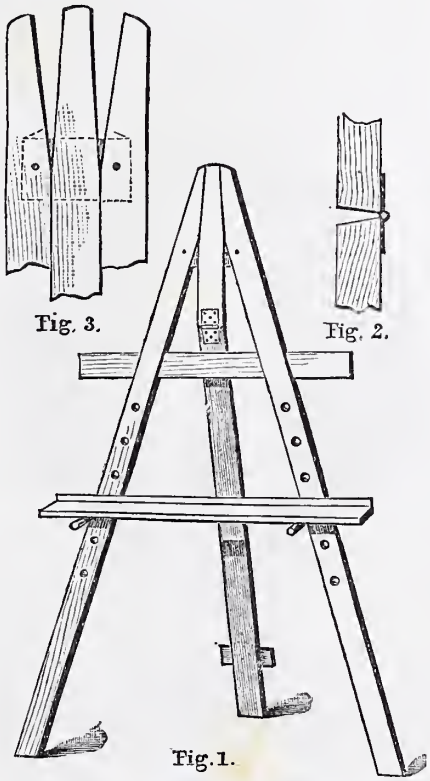


Fig. 1.—The Easel complete. Fig. 2.—Joint of Centre Leg. Fig. 3.—Hinged Attachment of Top.

the centre leg can be thrown backwards, and the consequent slope of the easel in front be increased. It is, however, unnecessary to have the bevel too great, and the proportion shown in the diagram (Fig. 2) will do very well.

The outward slope of the front legs from top to bottom must also be arranged for by tapering off the short centre-piece on both edges, and one edge of each of the outer pieces, for a corresponding length of, say, 7 in. The exact amount of taper is not important, but if it is arranged so that the extreme measurement across from leg to leg when they are splayed is about 2 ft. 6 in., every purpose will be served. The degree of taper can easily be got by actual trial when making the easel, or from either a full-sized drawing, or from one to scale.

Presuming this to have been satisfactorily done, the foot-long centre-piece must be hinged to the outer pieces; and to explain this, the diagram (Fig. 3) must be referred to. The dotted lines represent a thin ($\frac{1}{4}$ in.) piece of wood which passes through the centre-piece, in which a mortise is cut for the purpose. It projects about $1\frac{1}{2}$ in. on each side, and for the reception of these projections, corresponding mortises are cut in the outer, or front, legs. These mortises, it will be noted, must be cut wider (as indicated by the thick dotted lines) than the tenons or projections which fit into them, otherwise it would be impossible to fold the easel.

If now a wire pin be run through at the points shown, it will be found that a very convenient hinge for a folding easel has been formed. To attach the centre leg to the top part, a plain "back flap" hinge is all that is needed.

To give rigidity to the easel when opened out, a hook and eye should be fastened at the back near the top. The hook, of course, is screwed to one of the outer portions, and the eye to the other, so that the easel cannot collapse sideways. Some attention should be paid to getting the hook and eye fixed at exactly the right distance apart, which, it seems almost unnecessary to say, is just as much as will allow them to be used when the easel is unfolded.

The principal part of the easel is now made, but the arrangement for supporting the picture—or, rather, the canvas—has still to be considered. It is, however, so simple that directions may almost be regarded as superfluous, for it is only necessary to bore half-inch holes through the front legs and fit a couple of pegs to them. The holes may conveniently be 4 in. apart, and the pegs about the same length.

It will occasionally be found convenient to use a small tray or ledge on these pegs, and the easel can hardly be considered complete without one. Any piece of $\frac{3}{4}$ in. stuff of suitable length and width—say, 2 ft. by 3 in.—will do to form this of, and if provided with a low guard or rim, bradded on, it will be all the better.

A thin piece of wood will also be noticed running through both outer pieces and projecting beyond them. It is merely a piece of $\frac{1}{4}$ in. stuff about $1\frac{1}{2}$ in. wide, and is useful as a rest for the mahl stick, as well as serving other obvious purposes.

So far the easel is complete when opened; but to keep the three legs together when closed, the short tenon seen near the bottom is useful. It is very similar to the hinge-piece at the top; the principal difference being that it need not be so large, and that it fits tightly into the mortises in the sides.

Our easel may now be regarded as complete, and ready for either indoor or out-of-door purposes. When not in use, it can be folded up and put away in a corner, while its size (6 ft. by 6 in. by 1 in.) renders it sufficiently portable when sketching from nature. As the loose pieces may be considered inconvenient when carrying the easel, it may be suggested that a hole—or, rather, a couple of holes—through them, corresponding with others in the easel, will enable, by means of the pegs, the whole to be formed into one package.

Now a hint to those who are beginners in out-of-door work how to steady the easel on a windy day. Just tie one end of a piece of string anywhere near the top of the easel—say, by the hinge in the middle piece—and to the other end, hanging down to near the ground, fasten a weight. A good-sized stone will do as well as anything. Then, "when the stormy winds do blow," the artist may sit at work, if not as comfortably, at least as secure from upset as in his studio—provided always that his canvas has been properly secured, and that it is not too large for the weight.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

70.—Slatter and Watkins' Improved Inlet Double Check Gas Regulators.

Any machine or appliance that can exercise a complete, and therefore, from the consumer's point of view, wholesome control over the consumption of gas is a thing that ought to be welcomed and adopted in every dwelling-house

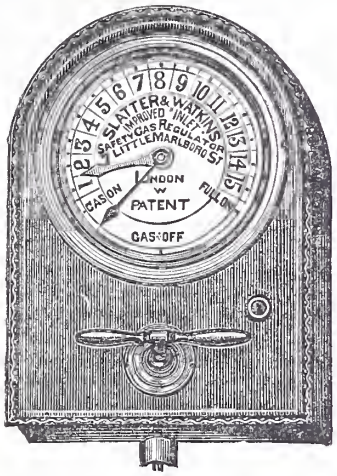


Fig. 1.—Front: closed.

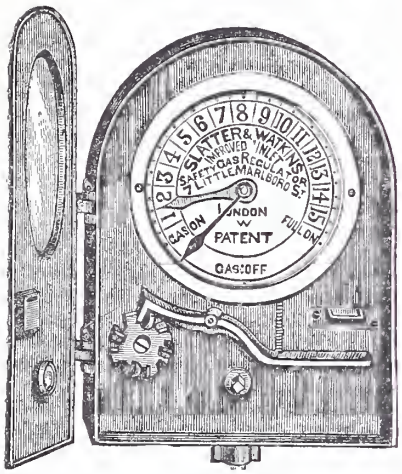


Fig. 2.—Front: open.
Inlet Safety Double Check Gas Regulator.

or establishment where gas is burnt, whether on a small scale or on a large. My unhappy experience of lighting by gas has been that the consumption is always on the *crescendo* scale, and that do what I will to be careful, the returns and charges for gas burnt in any particular year indicate a progressive increase on those for the year before. I always preserve the cards on which the examiners of the particular Gas Light Company from which I draw my supply enter the results of their inquisition, and note with anything but pleasure the manner in which leeway seems to be made up whenever any apparently generous concession has been made to the consumers in the form of a reduction in the price per 1,000 cubic feet of gas. Indeed, if gas companies give with one hand, they certainly take with the other, and the taking bears such preponderance over the giving as to quench entirely any feeling of gratitude for the gift on the part of its recipients. How it is all managed I do not know, and I will forbear from offering any theory of my own in explanation. I am glad to learn from Messrs. Slatter & Watkins, gas engineers, 7, Little Marlborough Street, Regent Street, London, that they have invented and patented, and manufacture and supply, a means of controlling the supply of gas in their "Improved Inlet Double Check Gas Regulators," which are sold in five sizes suitable for various sizes of mains, from £3 10s. to £6 10s. The object in view in the adoption and use of this invention is to enable consumers to have full control of the supply *before* the gas enters the meter, and thus to check the pressure and admit only such quantity of gas as may be at the time required. In the accompanying illustrations, Fig. 1 shows the regulator with the front closed, and Fig. 2 with the front open. In Figs. 1 and 2 the dial above shows the means of regulating the supply, and in Fig. 2, in which the front is unlocked and open, a stop action, consisting of a lever acting on a notched wheel, is shown below the dial, and by this the owner of the house and, presumably, the man who pays for the gas is enabled to prevent *employés* turning on more gas than is required either by means of the key

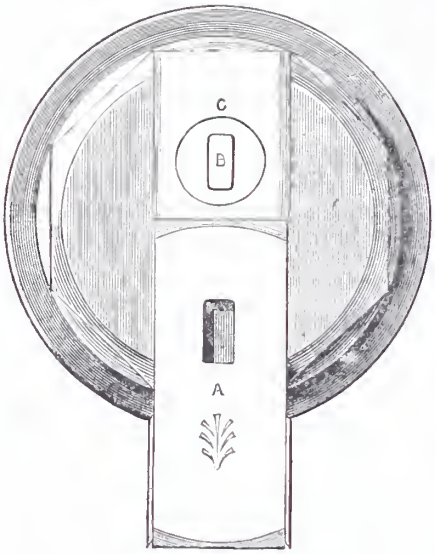


Fig. 3.—Linney's Cap for Carriage Axles — A, Sliding Plate; B, Stud on Spring; C, Plug containing Stud and Spring.

or by tampering at the meter. It will be noticed that the portion of the circle on the dial between the points "Gas on" and "Full on" is divided into sixteen parts, showing a wide range for regulation. The broad shaded hand shows to what extent the entrance of gas into the meter is regulated by the lever and notched wheel below the dial shown in Fig. 2, and the black hand, whether the gas is on or off, and this hand is actuated by the key shown *in situ* in Fig. 1. The stop hand, it will be noticed, is set in the engravings on the line midway between 1 and 2, or, in other words, to 1½ divisions, and the stop hand being thus fixed, it is impossible to move the black hand beyond it and thus obtain a greater pressure of gas. In this, then, lies the check on the consumption, and the "double check" consists in the fact than when the householder has regulated the stop action, he has only to lock the door and put the key in his pocket, and so prevent any alteration of the stop hand until he is pleased to alter it himself. As the apparatus can be placed in any part of the premises, the owner has full control over the supply from the room where the regulator is fixed, no matter where the gas meter may be situated.

71.—Linney's Cap for Carriage Axles.

Mr. Alfred M. Linney, Bedworth, Nuneaton, sends a model of an Improved Box or Cap for Carriage Axles that he has recently invented and made, and provisionally protected. Some idea of the cap and its utility may be gathered from the accompanying illustration of it in plan, given in Fig. 3. I will take it for granted that the reader is acquainted with the ordinary cap or box that covers and hides from view each end of the axle on which the wheels turn, Collinge's Patent being the form most used for carriages. This is screwed into a tube or collar, and when it is necessary to oil the axle the cap is removed and screwed up again by means of a wrench. A broad, dovetail groove about ⅛ inch deep is cut in the top of the cap, and in this groove a sliding plate A moves, which is stopped from moving beyond a certain length, and therefore from being taken off and lost, by a pin that moves in a groove cut in the direction of its length in the under side. A slot is cut in this plate, and when in its proper position the spring B rises from the plug C and enters the slot, rising a little above it. When the plate A is withdrawn as shown in Fig. 3, the plug C can be removed and oil poured in through the hole occupied by the plug for the purpose of oiling the axle. Thus oiling is at all times easily effected without unscrewing the whole box with the wrench. Mr. Linney urges that the use of his cap causes "a great saving of labour, time, and expense as regards oil, which often runs half away before the cap is screwed on, besides the trouble which is avoided of often having to hunt for a lost spanner." Further he says: "It would be an especial boon to large cab proprietors, 'bus companies, bread companies,

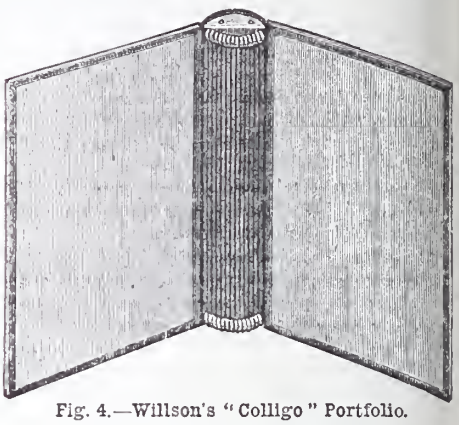


Fig. 4.—Willson's "Colligo" Portfolio.

etc. I have taken it to several large carriage manufacturers in Birmingham and the Midlands: they all say it is a capital thing, but they won't have anything to do with it as it would injure their business by preventing various tradesmen, merchants, and others sending their vehicles to be oiled rather than be at the trouble of doing it themselves. What it requires is for some good company to ask for them to be put on their carriages, etc.; the makers would then be compelled to make them."

72.—Two Magazine Cases.

Under this heading I must group two cases for serials, the one manufactured and sold by Messrs. Walter Brampton & Co., 24, Masshouse Lane, Birmingham, known as "The Automatic Spring Letter Case," and the other, the "Colligo" Portfolio, made by Messrs. E. J. Willson and Son, 21, St. Bride St., Ludgate Circus, London, E.C. In the former the numbers of a publication are held by a strong spring which forms the back, and which acts as a clip along the back edge of the magazines, holding them firmly in place by a strong pressure. The numbers are released by pressing on the front edge of the upper board of the case. The "Colligo" Portfolio shown in Fig. 4 has a curved back made of wood with brass clamps at each end, in which fifty-two elastics or strings are firmly fastened. The advantages possessed by this portfolio are that it opens flatter than a bound book; that there is no piercing or mutilation of serials; no margin taken up in filing, and the contents of each page can be read to the very edge. Any paper can be removed without interfering with the others. A case for Work costs 2s. 4d., or with gold-lettered title, 2s. 10d.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

In consequence of the great pressure upon the "Shop" columns of Work, *contributors are requested to be brief and concise in all future questions and replies.*

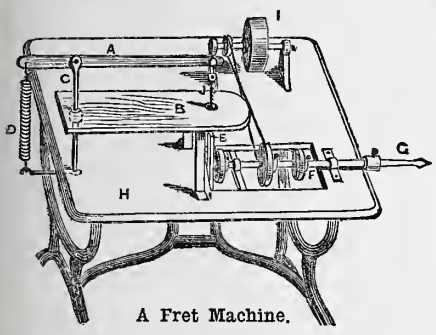
In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Macpherson's Foochow Enamel. — Messrs. Donald Macpherson & Co. (*Knott Mill, Manchester*), referring to my notice of their excellent enamel paints in page 370, write:—"We must ask you to correct the statement that we are more or less successful imitators of Mr. Aspinall. We do not wish to say anything about imitation, except that as 'Foochow Enamel' was before the public at least two years previous to Mr. Aspinall's manufacture, *we*, at least, are not imitators."—I stand corrected, and correct with pleasure, the mistake of attributing priority of existence to the younger—brother, may I say? being due to the fact that I became acquainted with the junior enamel first, and thus arrived, perhaps too hastily, at the conclusion that it was the senior. Both are good—so good that I may re-echo Captain Macheath, and say, "How happy could I be with either, were t'other dear charmer away;" and hope I may never be in the position of the ass of the mediæval schoolmen, who took pleasure in supposing that if the said animal were placed exactly midway between two bundles of hay of precisely the same weight and excellence of aroma and flavour, he or she, whether Jack or Jenny, as the case might be, would never be able to determine which to attack first, and so would perish of hunger in the midst of plenty. I am afraid the schoolmen had the best claim to the name by which *Equus asinus* is known in the vulgar tongue.—Ed.

Freezing Liquids (Correction). — F. B. C. writes:—"In my reply to Inquirer (*Yeovil*), the 'minus' sign should have been printed before each temperature given, as -7°, -10°, etc."

A Fret Machine.—G. C. (*Huddersfield*) writes:—"I send you a rough sketch of a fret machine which I consider a good one. First, I got an old sewing machine top with treadle wheel, etc. Now I will describe the parts I put to it of my own make as well as I can. A is a piece of hard wood 20 in. long—a lever I call it; B is a piece of oak board for the fret table independent of the machine top; C is a piece of ½ round iron screwed at one end as far as 8½ in., so that it will hold to both tables; the other end is a joint with a hole through for A to work in; D is a spring fixed to A and machine top; E is a wood slide cut like a carriage slide on a lathe; F is a steel shaft with three wheels, two for hands to run in, and the other is like a face plate with stud in to work in iron slide fast to E wood slide, which is fastened to sewing machine top; the other



A Fret Machine.

end of shaft F is a hole for a number of drills, which can be taken out at will; G is for drills; H is sewing machine stand; I is a shaft running into two pivot screws with collar and nut to screw off glazier, or small grindstone, or a small circular saw at will; J is the saw which passes through B table. I have seen all your various machines in your valuable paper, and none of them are bad ones, but some are better than others; mine does not make any more noise than a sewing machine, and it runs very quickly with having a small pulley on shaft; when not using the saw you loose the screw in the face plate; with stud in you get all the power for drill or grindstone, which you like. It does its work up to the mark. It works perfectly upright stroke with saw. I saw wood with it an inch in thickness. I hope you will put it in your paper for the benefit of your readers. You can sketch it off better than I have drawn it here, but I think any one will understand it. It cost me 18s. altogether: machine with treadle 5s.; the other parts various prices, amounting to the above sum."

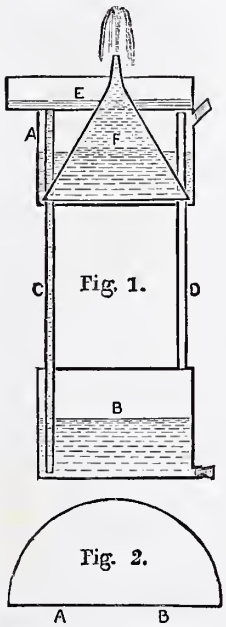
Folding Chair.—W. C. W. (*Chiswick*) writes:—"In G. le B.'s drawing of folding chair, No. 58, Vol. II., 'Shop,' is there not a mistake? or how is the chair held together? The arm is shown as in Fig. 1; should it not be as in Fig. 2?

Fig. 1.—Arm as shown.

Fig. 2.—Arm as it should be.

and then I should not trust it much unless strengthened with a metal plate. If any reader should require it, I shall be happy to give sketch and dimensions of chair to fold flat and avoid the curved arms cut across the grain. I take in Work regularly and read it eagerly, as there is much information in it valuable to amateurs."

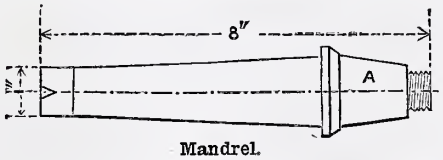
Self-acting Fountain. — F. H. (*Streatham, S.W.*) writes:—"The fountain described in No. 69 of Work, page 265, is very well to look at, but constructed as Mr. G. Maynard Walker has drawn it in Figs. 1 and 3 it would, in my opinion, be a failure. A fountain can be made on Hero's plan, and I myself have made several; but I have found from experience, to make them work with certainty, the part marked F, in Figs. 2 and 3, on page 265, should be made the shape of a funnel. I need not give here full instructions for making a similar fountain, for Mr. G. Maynard Walker has given very plain instructions on page 266, so I will proceed with describing how to make the part marked F in the drawing below. With a pair of compasses, the diameter of A as radius, describe the half of a circle on a sheet of tin or zinc; cut it out and bend it round until A and B, Fig. 2, meet; then bend it till it slips easily into A, Fig. 1. The bottom of the funnel should be ⅛ less in diameter than the bottom of A. Solder the joint A B, place it again into A, and mark from the bottom the place for the tubes C and D; solder C and D into F; pass C and D through the bottom of A, and adjust it so that F is about $\frac{1}{16}$ in. above the bottom of A. The tops of C and D can now be filed their right height: C going through the bottom of E, D about $\frac{1}{16}$ away from the bottom of E. A pin hole can now be made in the top of F. If F is not long enough to reach the desired height, file the top off and solder a small piece of bent brass on the top, making a small hole in the top. I hope I have made all clear, and you will find with this arrangement the fountain will work well. To start it working, A should be filled with water, the plug fixed, and a little water poured into E; the fountain will start working at once."



Self-acting Fountain.

Fig. 1.—Section of a Self-acting Fountain.
Fig. 2.—Shape of F in Fig. 1 before it is bent and soldered.

Cost of Mandrel.—J. T. (*Walworth*) writes, in reference to a previous communication on this subject (page 159):—"The subjoined is a drawing of the



Mandrel.

mandrel which the Britannia Company wanted 30s. to make. The part A was to be case-hardened, that was all. I may be wrong, but I still think the price rather tall."

Cheap Clocks (Erratum).—A. B. C. (*Parkstone*) writes:—"In Work, Vol. II., No. 75, page 373, column 2, paragraph 3 from bottom, please put full stop after 'think.' Last line but one from bottom to read thus:—'From these you can get all you require, I should think. One is maker, the other importer.'"

Umbrella Stand.—W. C. W. (*Chiswick*) writes:—"Enclosed I send you rough sketch of umbrella stand which I have just finished, thinking it may be useful to some 'workers,' as it is easily made and effective when finished. As near as I know how, I have drawn to scale ¾ in. to a foot. The wood is pitch pine. The flooring, not shown in the drawing, is ⅞ in. stuff laid on to battens screwed to the uprights, the top of it flush with the top of skirting, also ⅞ in. stuff. The dotted lines show position of zinc trays made with a flange ⌉⌊⌈ and let into the flooring. The rails and skirting are stop-chamfered and fastened with round-headed brass

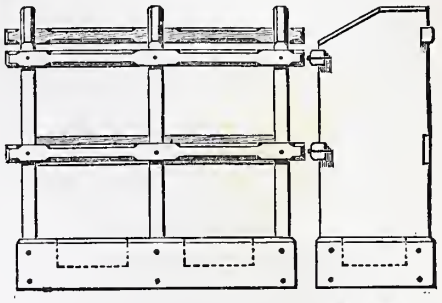


Fig. 1. Fig. 2.
Umbrella Stand.

screws. When nicely cleaned up, well papered, and with one coat of gold size, a good rub down with a bit of cloth, powdered pumice, and water; then one or two coats of good pale varnish, or carriage varnish, if procurable; no one like myself (a veritable tyro) need be ashamed of it. Of course by running up a back a convenient hat stand can be made to it."

II.—Questions Answered by Editor and Staff.

Metal Cages, etc.—F. J. B. (*Bristol*).—For cages, wire work of every description, and materials for same, try Messrs. Cicero & Co., Clerkenwell Road, E.C. They will be able to supply you with everything you want good and cheap.—R. A.

Discoloration of Plaster Casts.—Sculptor.—The yellowish-green discoloration complained of, which is so apt to appear, especially on the prominent parts of casts, after drying, is doubtless owing to sulphur (plaster, be it remembered, is formed of sulphate of lime); this the moisture brings with it to the surface, and evaporating, deposits it there. The remedy is to dry the cast with its *back* to a fire. The moisture is then drawn out and the sulphur deposited where it will not be noticed.—M. M.

Cycles.—C. W. (*Kilburn*).—You will get every kind of materials and fittings for bicycles at an exceedingly cheap rate from the St. George's Cycle Company, 298, Upper Street, Islington, London. They will send catalogues, showing several patterns of safeties and tricycles, and they sell sets of stampings, tubes, and other fittings complete for any one of the patterns shown in their lists. This is about the cheapest house in the trade for reliable articles. Another good firm, but somewhat dearer in some things, is W. A. Lloyd & Co., Clyde Works, Weaman Street, Birmingham. For fittings, such as bearings and pedals, the best firm is W. Bown, 308, Summer Lane, Birmingham. His goods are not the cheapest in the market, but they are by a long way the cheapest in the end.—A. S. P.

Phonograph. — Anxious Phono.—Full directions for making the phonograph will be published as soon as space can be found, so you must try and have patience till then.—W. D.

Cold Lacquer.—G. F. (*Sheffield*).—If you want to lacquer your bedstead cold, the ordinary lacquer will not do. I should use either the silico transparent enamel, sold by the Silico Enamel Company, 97, Hampstead Road, London, N.W., or the transparent lacquer sold by Adams (late Abrahams), Photo Warehouse, Aldersgate Street, London, E.C.—R. A.

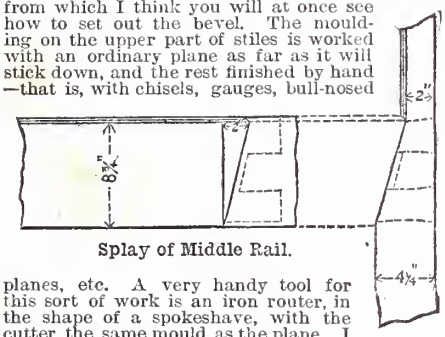
Brass Cleaning, etc.—Smada.—I find by referring to the index of Vol. I. of Work (which, by the way, if querists would procure and examine, they would save themselves, in many instances, much trouble and waiting) that information on brass finishing is given on pages of Work, 366, 430, 542, 620, and on lacquering on pages 525, 572, and 779. If these do not give you all the information you require, write and specify requirements, and we will help you farther.—R. A.

Engineering Books.—A. G. (*St. Albans*).—You do not say what branch of the trade you require information on. At haphazard I therefore mention the following:—"The Complete Practical Machinist," by Joshua Rose, 12s. 6d.: Spon. "The Work Manager's Handbook," Hutton, 15s.: Lockwood. "A Text Book on Steam and Steam Engines," Jamieson, 7s. 6d.: Griffin. "The Mechanics of Machinery," Kennedy, 10s. 6d.: Macmillan.—J.

Cycle Cement.—The address you ask for is Brown Brothers (late Snell & Brown), The Cycleries, 7, Great Eastern Street, London, E.C.—A. S. P.

Fountain.—CHOPSTICK.—The simplest way out of your difficulty of getting six gallons of water back to the top of garden wall from whence it had supplied a fountain, would be to let the waste run into a portable cistern holding rather more than the other—which would be out of the way at the foot of the dwarf wall, as per your sketch; you will then require to rig up a framework over your wall cistern to attach a pulley wheel thereto capable of bearing a weight of about 60 lbs.; now, by attaching a strong line to your waste tank and hauling thereon, it is easily lifted to the required height; you could also readily attach some projection to the moving tank that would cause it to tip up at the required height and empty into the supply tank. If the job is in an exposed situation you might probably use a small windmill and pump. Another feasible plan would be to let the waste water run into a strong tank connected by a pipe from nearly the bottom to the top of supply tank, and connected by a flexible pipe to a strong pair of bellows; by turning off the inlet of waste and using the bellows (with clack valve) the water would be forced up in a few minutes. In any case it means some kind of energy exerted equal at least to the force expended by the fall of water from the wall to the fountain. You see it is the old story of Humpty, Dumpty, sat on a wall, etc., and nothing will set him up again but work.—C. M. W.

Sash Door.—J. A. N. (*Portsmouth*).—In making a sash door, or any kind of diminished stile framing, the bevel is generally roughly cut first, and after the stile is mortised the exact bevel is marked with a scribing knife, and the superfluous wood carefully taken off with a sharp paring chisel, and, if necessary, finished with a bull nosed plane. Some men who make these doors by piece-work cut the bevel at once with a fine panel saw, and I have seen very nice jobs turned out this way. But, of course, you cannot do this, although it is advisable, even in your case, to cut as near as you dare the first time. I have given a little sketch from which I think you will at once see how to set out the bevel. The moulding on the upper part of stiles is worked with an ordinary plane as far as it will stick down, and the rest finished by hand—that is, with chisels, gauges, bull-nosed



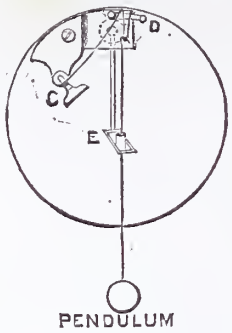
Splay of Middle Rail.

planes, etc. A very handy tool for this sort of work is an iron router, in the shape of a spokeshave, with the cutter the same mould as the plane. I do not know of a book devoted entirely to sash making, but any standard work on joinery treats more or less of this subject. If at any time any difficulty occurs to you, I shall be only too pleased through the medium of WORK to put it right; always bearing in mind that the more explicit your questions are the more definite your answers will be.—E. D.

Band Saw Brazing.—G. W. (*Snodland*).—I would advise you to get No. 36, Vol. I. of WORK, if you have not got it, and see remarks on band saw brazing on page 571, which I think are very simple and clear. G. W. should first file the ends of saw the length of two or two and a half teeth, so that when they lap over each other they may be about the thickness or a very little thicker than the other part of saw. Now place the saw in position for brazing, then damp the ends with water, or even your own spittle will do; then take some borax, and beat it into a powder with a hammer; with the borax mix a little coarse brass spelter; put a small quantity between the ends of saw, or where they lap; close a pair of bright hot tongs on it until you see the spelter run; remove the tongs, and close tightly a pair of black hot tongs for a minute or so; remove it, and lightly file the joint to the thickness of saw. If you wish to improve the look of the braze, rub it a little with emery cloth. As G. W. has had nothing to do with band saws, I would call his attention to remarks on "Band Saw Machines and Band Saws" (No. 35, page 556, Vol. I. of WORK); also to my reply in No. 39, page 622, to which the signature F. C. (*Leytonstone*) is attached.—A. R.

Black Stone.—BLACK STONE.—I am sorry to be unable to give any satisfactory information regarding the black stone of the engine turner, engraver, and diamond setter. I am, however, informed by a practical man from Clerkenwell, that the black stone is identical with the touchstone of the gold jewellery assayer. If such is the case, which may or may not be, I have no means of substantiating. "Touchstone was originally brought from Lydia, in Asia Minor, and consists of a coarse-grained quartz saturated with bituminous matter." "Touchstone, a hard black stone, occasionally used in assaying, of a peculiar bituminous quality, obtained from Lydia, in Asia Minor." The above paragraphs are extracts from an old encyclopædia, and if the two stones can be identified I think that will settle the question. Perhaps some other correspondent will favour us with his views of the subject, making his communication as brief as possible, as there is enormous pressure on the space devoted to "Shop."—N. M.

Clock Repairs.—P. W. (*Ashton-under-Lyne*).—From your query and sketch, the clock is a French one with silk suspension, which is broken. Take a silk thread, tie a knot in one end, pass it through the hole in the stud D, nearest the plate, passing it *down* from above; then thread it *up* through the hole nearest end of stud; now pass it through the hole in the stud C, and tie a knot, leaving about half an inch free; now draw the loop down that is formed by passing the thread through the two holes in the stud D, and hang your pendulum on it. To regulate, turn the milled-headed stud to the right, screwing the pendulum up; to make it go slower, let the pendulum down. I usually put the silk long enough to let the top of the piece of brass on the pendulum that fits in the crutch E be even with the crutch. Then regulate by driving it up by turning the milled stud.—A. B. C.



Clock Back Plate and Parts.

Watch Repairs.—R. M. (*London, S.W.*).—The watch chain may be repaired if not broken in too many pieces, or any of them gone; if so, it will be better and cheaper to get a new one, which may be had from the tool shops for about 2s. The pin in the lever—if it is the lever—is simply a brass one, which you can easily replace by filing up a piece of brass wire and nicely burnishing it to make it smooth and hard; push out the old piece by the point of a needle from above, and put in new one from below, or where the pallets are; give it a tap with a small hammer, and cut off the top to about the thickness of the lever, and smooth off nicely so that there shall be no burr left on. If it is the pin (ruby pin) in the roller, take it off (the roller), put it on the point of a needle, and make slightly warm; then push out the stump with a needle point. If you have no ruby pins by you, a very good substitute may be made from a bit of gold or even brass wire, filed up nice and round and true, and burnished hard and smooth. Push it in from the back part; cut it off long enough to come down through the lever, and round off the end. *Cases.*—Unless the lever movement is a thorough good one, I don't think it would be worth the expense of fitting a face and case to it, which would probably cost 25s. to 30s., according to weight and style. *Verge Case.*—I do not know where a common case could be got for the above, or what the cost would be; if it were mine, and it was worth anything at all, or had any history, I should make a small imitation grandfather case, or something of that style, and make a mantelshelf timepiece of it. From your sketch I should say it was a stop arrangement. A long pin goes through the plate at A, and when the lever is moved it catches in the fourth wheel and stops the train till thrown out by pressing back the lever.—A. B. C.

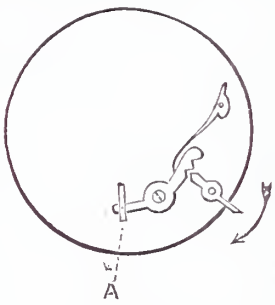


Plate of Watch.

How to Pivot a Watch.—O. L. (*Bristol*).—A very simple question it may seem, but not easy to answer: how to pivot a watch and a list of all the tools required and their cost. Well, to begin, there are the turns, 8s. or 10s., or a lathe, £5 or £6—one or other you must have. Next come screw ferrules, wax ferrules, and spring ferrules, prices from 6d. to 1s. 6d.; gut and hair bows, 6d. or so; arbors, 3s. to 6s. per set; gravers, about 4d. each; oblong, square, and oval polishers, files and burnishers, price from a few pence to 1s. or 1s. 6d.; callipers, gauges, and height tools, and, in fact, so many others of one sort and another, that if you mean to finish a watch you would require a regular kit, but your question is so indefinite that I cannot advise you further than above without knowing what more you intend doing; if you mean simply to put in a pinion, then a pair of turns, a bow, a screw ferrule, and a graver, with a pinion gauge to measure the size, length, etc., you would find sufficient. If this is not what you require, write again, and give more particulars.—A. B. C.

Wet Walls.—GATESHEAD.—If the dampness appears first near the floor, and rises upwards, it is no doubt caused by the absence of a damp-resisting course. If the dampness is on the inner or partition walls as well as the outside walls, the only remedy will be the insertion of a damp course; but if on the outer walls only, it may be caused by the earth outside being above the level of the floor, in which case the earth should be lowered six inches below the floor, and the wall thus uncovered should be plastered with Portland cement. If the tops of the walls are damp, it may be from the roof or spouts and down-pipes leaking; these should be examined and put right. Or the walls may be built of porous stone, which allows wet to penetrate. In this case it should be plastered with cement outside, and when dry painted, or the joints in the wall might be pointed with cement, and the wall painted over with Morse's colourless solution for damp walls. If sea sand has been used it would account for the dampness and the effects of this are said to be incurable, but you might give it a coat or two of the above named solution, which is highly recommended. Another method which is sometimes adopted is to fix battens about 1 in. thick and 16 in. apart against the interior of the walls, and lath and plaster upon them, leaving a cavity between the lathing and the outer walls. When done in this manner, a small hole should be left at the top and bottom of each space, between the battens to allow the air to circulate through them. It might save expense if you used Willesden waterproof paper, nailed on the battens, instead of lath and plaster. It is most probable that the dampness is caused by one or more of the above causes, and the most effectual remedy will be at the outside of the walls rather than the inside.—M.

Top-jointing Tool.—NO NAME.—The first essential, in order to have a saw in perfect working trim, is that the teeth may be uniform in length. Making them so is, in my country, called "ranging," but I believe "top-jointing" is the proper term. The tool of which I give a sketch differs, I think, from

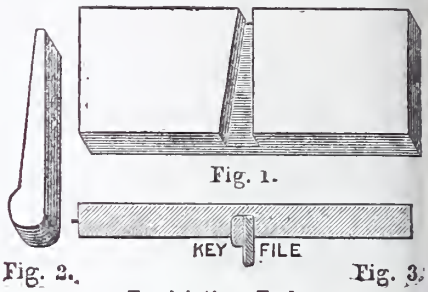


Fig. 1.

Fig. 2. Fig. 3.

Top-jointing Tool.

those usually recommended, and for the benefit of amateur readers—professionals, of course, know of it already—I give a short description. Procure a small block of beech, say 7 in. by 4 in. by 1 in.; cut out the tapered groove, as shown in Fig. 1, to the depth of about ½ in.; one side of this groove must be at right angles to the sides of the block. Make the key (Fig. 2), which is to secure a flat "mill" file in position, as represented at Fig. 3, and you have the handiest contrivance for the purpose in view.—OPIFEX.

Copying Processes.—J. C. M. (*Bristol*).—I have a receipt which, although I have not tried it myself, is given me as very good for making a "graph," or surface capable of taking a printable original for circulars, etc. Gelatine, 10 oz.; indiarubber, 1 oz.; oxalic acid, 1 oz.; glycerine, ¼ pint; water, ½ pint. I am told that the difficulty is to dissolve the indiarubber, but think that if the gelatine, glycerine, and oxalic acid are heated together, and the indiarubber be cut very small and gradually stirred in before adding the water, they should blend well together. The best apparatus, and, I should say, a far cheaper one to buy than to make, is Fordham & Smith's litho copying apparatus (Wormwood Street, London, E.C.), which gives splendid results in any colour of ink; each plate can be washed out, and gives six originals; plates only cost 1s. each (*i.e.*, about 2d. per circular), and will give off 100 to 150 copies, or 750 copies of six different (or even the same original) writings. No pressure is required—merely rubbing the hand over the back of the paper being quite sufficient to print a full, clear, bright impression in black or coloured, permanent or copyable printing ink as the case may be. If J. C. M. writes to the above address, he will receive all particulars per return.—J. W. H.

Life-saving Apparatus.—C. B. (*Sheffield*).—Nothing I can suggest is better than the life-buoy, as supplied to ships for the purpose you mention. Your idea of a bag of indiarubber in a loose net would not answer, as it would be very cumbersome, and if not inflated beforehand would be useless, as there would not then be time to do so. Its weight, if made sufficiently strong to resist the force of the waves, would be very considerable, and therefore the expense would also be great, and if made light and portable it would be sure to burst.—J. W. H.

Photographic Developer.—CONSTANT READER.—You cannot do better than carefully study some elementary work on photography, many such are published. To be a good photographer a considerable amount of knowledge and practice is required.

s not done by hop, skip, and jump, as CONSTANT READER seems to imagine. As a preliminary to aining that desirable end, it is necessary to know e names and qualities of the apparatus and emicals used. To reply to the questions asked out solutions and crystals is impossible with any ount of accuracy; appearance and colour are ry indefinite guides by themselves—in fact, none all. The assumption is that they consist of the ual chemicals photographers use; but the only ng that CONSTANT READER can do is, in the st place, to learn something about the art, either m books or by being taught by some one already illed in the matter.—D.

Glass Calculator.—G. M. (*Clapham*).—I have en a glass calculator upon cardboard to hang on the wall about the size you name, and which, hink, is what you inquire about, but, like the one u saw, it is very old; however, I will give you the dress which is on the card, and hope you may cceed in getting one; but whether the firm is ill at that address I cannot say: The Lic. Vit. d Hotel Keepers' Glass and Supply Company, mited, 25, Great Queen Street, Lincoln's Inn elds; or at 112, Southampton Row, Russell uare. I hope you may succeed.—W. E. D., JR.

Stationery Holder. — J. M. (*Dundalk*). — uriously enough I have had two letters handed me (yours and one from E. M., *Peterhead*) at the me time, both requesting the same particulars, iz., whether I would supply full-size designs of e stationery holder I gave in the supplement to o. 66, Vol. II., page 228, my price for such, and hat wood is most suitable to make it with. To e first question I must say I am always willing to pply full-size working drawings of any of my ticles, stationery holder included, should any ifficulty arise in reproducing the miniature ketches given. Concerning the second query, I annot quote any of my prices here, as that action ould amount to a free advertisement; and it is ly earnest desire not to be found contriving to ain such an end. I have taken advantage of the nvelope you have enclosed to write to you personally. It is unusual for us to reply by post, but n your case, by doing so, I am not withholding ny particular information of service to other eaders.—J. S.

Waterproofing.—S. T. (*Rupert Street*).—We do ot know how you can avoid the smell you complain of; evidently the substitution of the material roposed for the beeswax used will not do it. We hink we shall be able to show you that before long he difficulties you complain of will be found to ave vanished, and that a useful, valuable, and onvenient means of overcoming the present ifficulties will be readily obtainable. We do not now the materials used or the mode of manufacture, it being a secret. The subject has occupied the inventor for many years.—C. E.

Designing an Aquarium.—Q. B. (*Wheatley*).—If I were about to design an aquarium and aviary combined I should leave out entirely the "four urned mahogany pillars" you speak of, as the use of wood in connection with water necessitates a somewhat heavy and clumsy kind of fitting in order o secure sufficient strength to resist the pressure. If you must use up these pillars I would use only wo of them to make up a neat and substantial aquarium of small dimensions at first, say, 24 in. long, 12 in. wide, and 14 in. deep, thus using four lengths of pillar 14 in. each; these will require to be rebated to receive the glass sides; this is best done at a saw mill, with a circular saw, cut in a full ½ in. You will get the maximum strength of frame with the lightest material by making the top and bottom frame in the form of Oxford frames (without rebates); these being fitted to the pillars upon the lines of the rebates of the pillars, will allow the glass sides to be fitted so that no water will touch the woodwork when the glass is cemented in and well set. A self-fitting bottom is easily made by pouring in a batter of Roman cement, to about ¾ in. above the bottom frame—having previously fastened, say, three cross ties underneath the frame flush with the bottom. When the cement is set hard and thoroughly dry, the interior joints must be varnished with copal varnish; four turned knobs for the top corners would give a neat finish. If you require more write again.—C. M. W.

Heat from Stove Pipe.—W. P. (*Southport*).—There is a kind of hair felt used for covering boilers, cisterns, and hot-water pipes, to prevent loss of heat by radiation, but I think the great heat from a stove pipe would char this and cause an unpleasant smell. The only other article that I know of is Bell's asbestos non-conducting composition; it is stated to be free from any substance that will injure metal, and to be of such a nature as to adhere without bands for years; it is sold in sacks, 15s. and 25s. per cwt., and is mixed and applied like plaster. But could you not manage so as to have all the pipe outside the room, or use a smaller stove?—A. R.

Frame Mitre.—NEMO.—There is a very useful mitre-cutting machine made and patented by Booth Brothers, Dublin. The usual tools used by frame makers are a cutting block, shooting bleck and plane, vice, hammer, bradawls, glue-pot, and tenon saw. You can buy the tools of any respectable tool maker at reasonable cost.—G. R.

Overmantel.—IMPROVER.—The cry nowadays is: "Don't give us anything requiring much labour," which, as a truism, can be applied to almost every trade. I have specially prepared the design herewith given for you, and have purposely avoided what by some would be termed an overflow of elaboration; but at the same time I have endeavoured to avoid plainness. I think that better effects can be obtained by a judicious use of variously shaped shelves, than by having each and every shelf of one particular pattern; and I have had slight proof that my notions are not far wrong, as I am constantly supplying new designs of this class of goods to master workmen, and find that the articles made accordingly meet with a readier sale than those in which the shelves are all of one character. The break canopy, or, more strictly speaking, the double canopy, will make a difference in the appearance of the job to the usual run of overmantels. The general practice is to have the uprights and cross rails about ¾ in. thick, and 1½ in. wide. All will be rabbeted at the back as in section, Fig. 6, to receive the glass and wood panels, which, as perhaps you know, will be secured in place by thin backboards. The joints will be mortises and tenons, which I have explained by Fig. 8, although it is probable that you know what the meaning of the term is. You will find it necessary to cut away some portion in front of the ends of the cross rails, which you will understand whilst working. For the half-round bracket shelves, a large turned ornament cut in halves will give you what you require. The top shelf at each side will be as in Fig. 3, and a dowelled column will connect the two. If you should happen to be ignorant of what a dowel is, read my article "Combined Music Stand, etc.," No. 35, Vol. I., pages 552 and 553. The front pair of pillars will also be dowelled into the shelf above them. At the extreme top of the framework the rail will be a rather wide one, and against it will abut the canopy top, a plan of which, and the way to mitre up the cornice, is shown in Fig. 2. All the shelves will be screwed on from the back of the job. They need not be very thick. The bottom rail will not be so wide as the remainder but will be thicker, so that the front of it may be moulded (Fig. 7). The sizes you had better work out for yourself, taking the length of your mantelpiece as a guide. I do not know of a list exclusively of joiners work.—J. S.

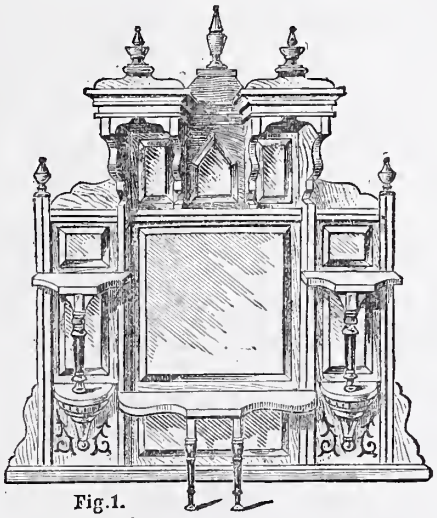


Fig. 1.

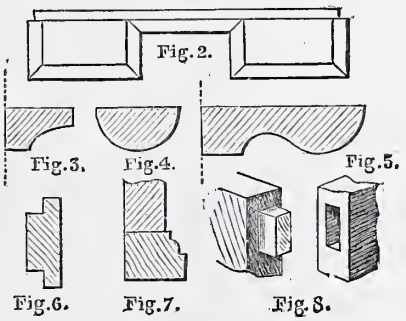


Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8.

Overmantel.

Fig. 1.—Overmantel complete. Fig. 2.—Plan of Canopy, showing Mitres of Cornice. Fig. 3.—Half Plan of Top Shelves. Fig. 4.—Full Plan of Bracket Shelves. Fig. 5.—Half Plan of Long Shelf. Fig. 6.—Section of Uprights and Cross Rails. Fig. 7.—Section of Bottom Rail. Fig. 8.—Joints (Mortises and Tenons) used for connecting Uprights, etc.

Binding. — H. C. (*Notting Hill*).—It is rather difficult to give you the required information in "Shop," for the simple reason that space cannot be spared for giving lengthy articles, and to give all that you require would constitute an article of no small dimensions. However, I will do what I can under the circumstances. To prepare your books for sewing in the manner adopted by the trade, they will require to be refolded, *i.e.*, every sheet will have to be taken and folded, carefully placing the pages exactly over each other. Take, for instance, the first number of WORK and lay it open upon the bench or table before you with the pages 8 and 9 uppermost. Lift up two sheets (I am presuming that the number has been cut) by the corner, and hold them up to the light, and place pages 10 and 11 exactly over each other; when this is done place them upon the table again, holding them tightly all the time, and place page 9 upon page 8, and draw the folder down the fold at the back and lay aside. Lift up the other sheets and place page 14 upon 15 as before and fold. Now turn this last part over upon the table with the front uppermost, and take the part folded first and laid aside, and place it inside, taking care to have pages 4 and 5 lying evenly upon each other. As the advertisement page at the back seems to have been an eyesore to some folks, it could be removed at this stage by cutting it off and pasting the second page carefully along the back and placing it upon the third page. But as this advertisement is paged with the book it will be best to allow it to remain. Personally, I do not think that it detracts from the value of the book in any way, though my taste in this respect may seem a little abnormal; the advertisements, although they may not add to the embellishment of the book, certainly add to the usefulness of such a book as WORK. The whole book is refolded as instructed, and rolled, beaten, or pressed, according to circumstances. Afterwards it is placed in the lying press between two wooden boards and five or seven grooves cut in the back with a saw, three or five for the bands, and two for the catching stitches. Three of five bands are now to be set upon the bench according to the style of binding (see WORK, Vol. II., page 43, for handy bench), and commence at the bottom of the sheet, after having placed it upon the bench with the grooves close up to the bands, and sew with good thread, bringing the needle out at the top side of the bands and putting it in again at the under side when the top has been reached; place another sheet and go down again to the bottom and fasten up, and so on until the entire book has been sewn. I hope these instructions will help H. C. This operation is more fully explained in the articles which are now appearing. What an amount of satisfaction our Editor must derive from your assurance that you are satisfied with WORK!—G. C.

Transfers for Slides.—S. C. W. (*Marsden, Huddersfield*) writes in reply to A. E. B. (*Cromer*) (see page 309, Vol. II.):—"J. Barnard & Son, 19, Berners Street, W., have some very good chromo-printed pictures for making slides at 3s. the dozen. I can recommend them."

Glass and China Painting.—C. M. (*West Brighton*).—In asking for a few particulars of glass and china painting, you do not say if you wish to paint in permanent colours, nor what you understand by "ordinary paints"—house paint, or oil, or water colours as used for painting pictures. Supposing you mean oil colours in tubes, you *can* paint upon glass and pottery with these, but you cannot use the articles afterwards: they must be kept for decorative purposes; if well executed, they look very nice, and just now glass frames for holding photographs and screens fitted with glass are sold to be painted in oils; mirrors are also painted that way, and many use oil colours for painting upon china plates; but proper colours are sold for this purpose, called, "ceramic colours," and if you wished to paint plates which would be used and washed—such, for instance, as a dessert service—these *must* be employed, as after the plate is painted it is sent to be fired: that is, heated in a kiln, until the colours are fused; they are then permanent, and will last as long as the plate itself; and even when the piece is only used for a decorative purpose, it is much better to employ ceramic colours, as there is a delicacy and beauty belonging to them which cannot be obtained with other paints. You would require for this work a few bottles of china colours (Hancock's Worcester Ceramic Colours I can strongly recommend from personal use), brushes (camel-hair and water-colour sables), palette knife, and a few other things. If you think of taking it up, I should be glad to give you a list of the things required, and also of the most suitable colours, if you let me know in what direction your task lies: *i.e.*, landscape, flower, or figure painting. Your chief difficulty will be to judge the colours properly, as they change in the firing, some very much. Your best plan would be to procure a white tile; divide this into a certain number of squares, fill up the first few squares with your different colours, then mix the primary colours together, then different combinations, until you fill the tile, writing the name of each colour or colours under each one; send it to be fired, then when you are painting you can have this before you, and judge how your colours will look when finished. It is impossible to give full instructions in "Shop" for china painting, but if a sufficient number were interested, I should be glad to write an article upon the subject, with the Editor's permission; in the meantime, if you are in any difficulty, or there are any other matters you wish to know, write again, and I shall be pleased to explain to the best of my ability. I may say Hancock's new colours only require mixing with water; these I prefer, as in my experience they are not so liable to blister in the firing; with turpentine, fat oil, spirits of tar, etc., great care has to be exercised. A great part of the above will apply to glass painting of a permanent nature, such as is generally known as stained glass, but to describe it would require as long an article as upon china painting.—W. E. D., JR.

Silicine Glass Paints.—C. E. H. O. (*York*).—Silicine materials may be obtained from F. Bölian, 21, Featherstone Street, City Road, London, E.C., or from A. R. Hicks, 23, Upperhead Row, Leeds.

Canvas for Canoe.—T. D. (*Inverness*).—I would suggest that No. 1 canvas would be the best quality to use for a canoe, as from its strength it takes paint and wears better than any other quality. It is somewhat stiff, but when in place and given three coats of paint, will wear and last well. I have seen several canoes built with this canvas for a covering. —L. Y.

Regilding Frames.—A. S. (*Wolverhampton*).—Take your picture out of the frame and begin thus (of course, assuming it is an English gold frame):—Take a basin of lukewarm water and wash it well, taking special care that all dirt is removed from the deep ornamental parts; give it two coats of thin whiting and size, and when dry a coat of red gilders' clay, as the colour helps to give the gold a more brilliant colour. Then spread evenly a coat of gilders' oil of gold size, and let it lay for about twelve hours, when it is ready to apply the gold leaf. Then take your book of gold and blow leaves upon a gilder's cushion, as many as you please or require for the work; then with a tip pick the leaf up and place upon the frame in position, dabbing into the ornaments with cotton wool. When entirely covered, let it lay for a few hours to thoroughly get dry; then brush off with soft brush the superfluous gold, and size over with clear vellum size and let it dry, when your frame is ready to receive the picture.—G. R.

Taking out a Patent.—A. C. (*Peterborough*) wishes to know how to proceed in patenting his invention. He should get No. 35 of WORK, and read the article "Taking out a Patent" (Vol. I., page 545). If there are then any points on which he may still be in doubt, I shall be happy to do my best to solve them for him in "Shop."—C. C. C.

Shoe Cement and Burnish.—Ordinary writing ink is used to stain the bottoms of boots. Two or three coats may be applied; afterwards polish with warm irons and heel-ball till the requisite gloss is obtained. Sand's cement is used for repairing uppers. The cement may be had from the leather-sellers in twopenny bottles, or from J. H. Cooper, 35, Caledonian Road, King's Cross, London. The piece to be put on is pared down thin, especially at the edges, and the edges of the hole the same. It should be clean and a little rough. The boot and the piece are then warmed and the cement made warm and applied to the leather, and this is well pressed together. It is afterwards finished off with the warm iron and heel-ball, to hide any imperfections. A journal of boot and shoe making is published, called the *Cordwainer*, which may be obtained through any bookseller.—J. M.

Work on Dyeing.—G. C. (*Salford*).—You should advertise your book on the above subject in our "Sale and Exchange" columns. CROQUILLOT would then doubtless see your advertisement.—ED.

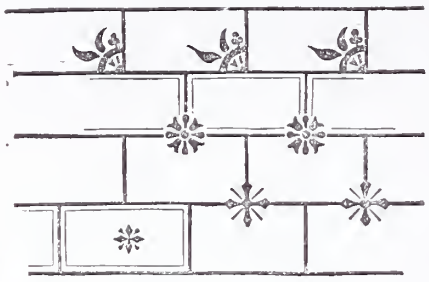
Lantern Slide Transfers.—W. G. (*Cardiff*).—I am sorry I cannot satisfy W. G. as to addresses of a manufacturer of transfers for lanterns. I believe they are chiefly of German make. If W. G., however, will write to Messrs. Lancaster, Colemore Row, Birmingham, who deal in these things, I have no doubt he may get the information needed. —O. B.

Gas Blowpipe.—STEREOTYPER.—The blowpipe that you inquire about was sketched from a home-made one that I made some years ago. I do not know of anyone who sells blowpipes exactly like it; but no doubt you could get one the same in principle, if not in construction, from Mr. Fletcher, Thynne Street, Warrington. It would not be very difficult to make one, and would cost only a trifle, say about 2s. and your time—which, of course one does not reckon when doing such jobs as these. You would simply want a ⅜ equal gas tap, a piece of ⅜ brass tube about 8 in. long, with a thread on one end of it, a piece 3 in. long with a thread on each end, a ⅜ obtuse elbow, and an ordinary brass blowpipe; screw the two pieces of tube into the tap, screw the elbow on to the longest piece, drill a hole in the angle of the nose-piece or elbow large enough to allow the blowpipe to be put through, and solder it round the hole and along the tube, and it is complete, with the exception of the hook, which is easily made and fixed.—R. A.

Sheet Steel.—C. E. S. (*Shipley*).—You will be most likely to obtain the material in small quantities from some local saw manufacturer.—F. C.

Harp.—C. L. (*Glasgow*).—What you require is a three-quarter or half-size harp; but it would be impossible, owing to the limited space at command, to do justice to the subject in "Shop" columns. Even the simplest are very difficult to make, whilst it is well-nigh hopeless for an amateur, unless he is a mechanician of rare ability, to attempt the construction of the action. Single-action harps, such as you want, are frequently to be met with at musical instrument dealers in all large towns, and may be purchased for a few pounds. If you are unable to obtain what you require in Glasgow, write to Messrs. Dawkins & Co., Charterhouse Street, London, who will doubtless be able to supply you.—R. F.

Papering and Painting.—E. H. S. (*Plymouth*).—Probably you have derived some assistance from papers which have appeared since you wrote. Your painstaking and explicit letter shall, however, be fully answered, and I hope the information will be in time for your purpose. I take it the porch you allude to is between the outer and inner door. For this, paint is certainly preferable. Paint it three or four coats, if it is thoroughly dry, according to instructions given in painting billiard room walls. You can make, doubtless, a fair imitation of either grey or pink granites by coating the wall with a ground colour of pink (made with white lead and Venetian red) and then with a piece of honeycomb sponge, marking it when dry with first white and then black paint. Black and white spotted upon a medium grey, or lead colour, ground will give an easy imitation of grey granite. A coat of varnish for finishing is advisable. Granite is scarcely what I would use myself, it is rather heavy and a little inelegant. If the work was painted a plain bath-stone colour, the intersecting



Design for Wall.

lines being run in with dark red, you would get a more tasteful effect. If you can draw a little, and cut a simple stencil, better still. You can then carry out the idea this rough sketch will convey. Use dark red or brown for lines and ornament also. You would only use one design, and could easily manage a simple pattern by the aid of a compass. Keep them smaller in proportion rather on your wall than I show. The lines can be made with a straight-edge and lining fitch (see "Painters' Brushes"). I wouldn't advise an attempt to imitate any marble, it would probably result in a daub. Walls should be coated with glue size before being papered. Paste is best made with a small knob of alum in the boiling water used for mixing. Certainly, if you can afford it, varnish hall and kitchen papers. You will not get a paper fit or worth varnishing for much under 1s. per piece. Don't use good varnish on a common paper; if varnishing at all, have a decent article. Sanitary papers, from 1s. per piece upwards, are good value, and can be sponged but not washed. Paper must be twice coated with patent size previous to varnishing. The size must be applied in liquid form, hence the print of the paper must be made for that purpose, so that it will not rub off.—DECORATOR.

Cleaning Marble Slab.—G. B. (*London*).—The "marks of age" which G. B. wishes to remove are, it may be concluded, mainly smoke stains. The best way to remove these is held to be either to put the marble in water or to bury it in wet sand (the latter by preference), leaving only *just* the surface exposed; and on that surface to sprinkle powdered whiting. The moisture rising through the marble drives the discoloration into the whiting. Completely to get free of old and deeply-seated stains is, however, often no easy matter. Mere surface discoloration is most readily removed with American potash.—M. M.

Brazing Saw Maker's Address.—J. B. (*Sunderland*) asks for the address of Mr. Duncan, whose brazing machine was noticed in WORK, No. 72. If he will look up that number, he will find the address given in the second line of the notice.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—G. B. (*Islington*); NOT AN ELECTRICIAN; PHOTO; E. D. (*London, W.C.*); H. M. F. (*Colchester*); ENGRAVER; H. S. (*Birmingham*); R. J. B. (*Gateshead*); F. C. S.; S. J. S. (*Frome*); J. M. (*Manchester*); J. T. A. (*Rochdale*); JACKO; W. W. (*Cleator*); OLD SUBSCRIBER; J. S. (*Ilbeston*); X. Y. (*Rochdale*); E. M. (*Barnstaple*); MECHANIC; J. K. (*Durham*); G. H. (*Camberwell*); INQUIRER; EXPERIMENT; J. S. (*Ramsbottom*); A. R. (*Scorrier*); X. Y. Z.; L. M. S. (*Hebden Bridge*); J. L. (*Wigan*); T. W. (*Birmingham*); A WOULD-BE ELECTRICIAN; SMOKER; T. A. (*Lancashire*); E. C. M. (*Ipswich*); J. D. (*Glasgow*); A. T. G. (*London, N.*); H. L. (*Reading*); SULPHO-CYANIDE; CARPENTER; R. D. (*London, S.W.*); F. K. (*Woodbridge*); W. H. D. (*Portsmouth*); M. H. (*Withington*); F. M. (*London, N.W.*); CYCLIST; W. H. (*Ponder's End*); J. McM. (*Edinburgh*); A. G. F. (*London, N.E.*); W. L. (*Tilbury*); AMATEUR ELECTRICIAN; J. W. (*Middleton*); C. L. (*Brentwood*); H. M. R. (*Chester*); G. W. (*Brockley*); L. S. (*London, S.E.*); NOVICE; TINNER; A SUBSCRIBER FROM THE BEGINNING; M. V. C. (*Glasgow*); W. W. (*Glasgow*); W. B. (*Newport*); W. B. L. (*London, S.E.*); C. B. (*Clerkenwell*); SAWYER; NED; ONE IN TROUBLE; MILL; J. H. D. (*Luton*); W. A. (*Manchester*); H. D. (*Kentish Town*); J. G. (*Glasgow*); H. R. (*Bacup*); A. H. (*Blackheath*); BIKER; D. J. C. (*London, E.*); E. Y. S. W. (*Weybridge*); J. H. (*Birmingham*); W. B. (*Preston*); W. H. (*Gateshead*); W. W. (*Canonbury*); J. M. (*Newcastle-on-Tyne*); ECONOMIC; H. B. E. (*Leicester*); G. B. (*Clapham*); SADDLER; C. T. (*Maidstone*); E. G. (*Dalston*); J. W. T. (*Birmingham*); SADDLE; A. J. J. C. (*Oldham*); J. H. (*Glasgow*); H. J. L. J. M. (*Ealing*); A. A. S. (*Leeds*); P. D. (*Bootle*), RAPIER; P. P. & Co. (*Manchester*); A. C. C. (*Essex*); AMATEUR; H. M. R. (*Chester*); WAX; W. J. G. (*London, N.*); OSWALDSTREE; X. Y. Z.; J. W. B.; R. T. N. (*Shields*); W. E. J. (*Chippenham*); R. L. (*Ruabon*); W. T. C. (*Tamworth*); J. N. (*London*); W. J. L. (*Bow*); H. M. (*Manchester*); J. J. H. (*London, N.*); T. B. (*Dover*); W. H. G. (*London, N.W.*); G. J. T. (*Fulham*); J. W. (*Barnsbury*); M. H. (*York*); S. C. (*Sheffield*); W. P. (*Tipton*); READER (*Belfast*); A READER OF "WORK"; C. J. T. (*Oldham*).

"WORK" EXHIBITION.

(1890-91).

For Classification, Prize List, etc., see WORK Nos. 70 and 78.

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in pages 290 and 418 of this Magazine:—

For Design for Medal.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

For Design for Certificate.

FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

If any Competitors wish to submit a Model in Clay, Plaster, Wax, etc., as a Design for Medal instead of a Drawing, they are at liberty to do so.

Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

Prize Competition.
Medal (or Certificate, as the case may be.)

A Motto must be affixed to each Drawing, and the name and address of the sender enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted to three competent judges, who will select those that are considered most worthy of prizes.

The Prize Drawings will become the property of Messrs. CASSELL & COMPANY, Limited, who will return all Designs made by unsuccessful competitors to their respective owners carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced in WORK in due course.

For further particulars, all intending competitors should apply to the Secretary, "WORK" Exhibition, CASSELL & COMPANY, Limited, as above, stating which competition they intend to contest.

N.B.—Any Competitor, whether successful or not, is at liberty to exhibit his designs at the forthcoming WORK Exhibition, on filling in the proper application form for space; and success in this Competition will be held to be no bar to his receiving honours if awarded by the Jurors in addition to the above Prizes, but such forms must be filled in and forwarded previous to the 30th of Sept. to the Secretary, WORK Exhibition, as above.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [17 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [15 R

Buyers of Lathes and other Tools send 3d. for list of Second-hand Tools.—BRITANNIA WORKS, Colchester; or inspect largest stock in London, 100, Houndsditch. [16 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [1 S

Stencil Cutter Wanted, who can sketch and cut out artistic designs (for book-marks, &c.).—Apply, enclosing specimen and terms, "Everclean," 100, Wood Street, E.C. [2 S

SEND 3d. IN STAMPS
FOR LIST OF
ECOND-HAND ENGINES
(Gas or Steam),
MATEUR TOOLS, &c.
Cash or Easy Terms.
FULL CATALOGUE, 6d.
BRITANNIA CO., 100, Houndsditch, London.
All letters—BRITANNIA WORKS, COLCHESTER.

AMATEUR PHOTOGRAPHY.—**J. H. SKINNER & CO.,** *W Department, East Dereham, Norfolk.*

J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description.

CHEAP SETS FOR BEGINNERS.
3/6 The Eclipse Camera Set. 3/6
Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6
Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s.6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6
Including Polished Mahogany Camera, with Folding Tail-board, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

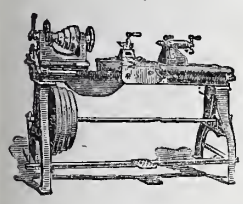
N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at 20 per cent. to 50 per cent. discount to clear. Send post card for Sale List.

HENRY MILNES,
MANUFACTURER OF
HIGH-CLASS LATHES
FOR
SCREW-CUTTING & ORNAMENTAL TURNING
TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.
Ingleby Works, Brown Royd, Bradford.
ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

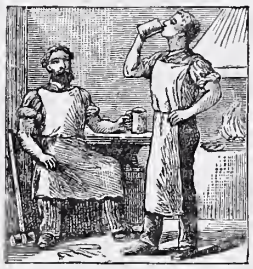
BEAUTIFULLY COOL and SWEET SMOKING.
SMOKE
PLAYER'S NAVY CUT.
Ask at all Tobacco Sellers, Stores, &c., and take no other.
Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,
which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets, containing 12.
The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

JOHN AARON,
Engineers' Tool Merchant,
GAOL LANE, HALIFAX, YORKS.



Lathes, Pillar and Bench Drills.
SAWBENCHES.
SHAPING AND PLANING MACHINES.
All kinds of Tools, Chucks, &c.
SPECIALITIES IN AMATEURS' LATHES.
Catalogues free on application.
All inquiries have prompt attention.

DELICIOUS
TEMPERANCE DRINKS.



Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.
One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.
A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.
AGENTS WANTED.
NEWBALL & MASON, Nottingham.

KING'S COLLEGE, LONDON.
WOOD CARVING.
DEPARTMENT OF TECHNICAL INSTRUCTION.
CLASSES for instruction in Wood Carving will be held during the ensuing Autumn (beginning October 6) at King's College, in the Strand, under the joint direction of the Carpenters' Company and the Council of King's College.
For particulars apply to J. W. CUNNINGHAM, ESQ., King's College, London; or to S. W. PRESTON, ESQ., Carpenters' Hall, London Wall.

DEPARTMENT OF TECHNICAL INSTRUCTION.
KING'S COLLEGE, LONDON.
BUILDING CONSTRUCTION and ARCHITECTURE, DRAWING CLASSES, and CLASSES of DESIGN.
LECTURES and CLASSES for these subjects will be held during the ensuing Autumn (beginning October 6) at King's College, in the Strand, under the joint direction of the Carpenters' Company and the Council of King's College.
For particulars apply to J. W. CUNNINGHAM, ESQ., King's College, London; or to S. W. PRESTON, ESQ., Carpenters' Hall, London Wall.

INVENTIONS *Patented, Worked Out, Manufactured,* and introduced at home and abroad. Special Machines and Appliances designed and constructed. Write or call.—AMERICO-EUROPEAN TRADING CO., LTD., 19A, Coleman Street, London.

POST FREE ON APPLICATION.
CASSELL'S CLASSIFIED CATALOGUE.

ESTABLISHED 1851.
BIRKBECK BANK.
Southampton Buildings, Chancery Lane, London.
THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.
TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.
STOCKS, SHARES, and ANNUITIES Purchased and Sold.
HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.
The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Now Ready, price 5s.
Strange Doings in Strange Places.
Complete Sensational Stories by Popular Writers.
Crown 8vo, 320 pp., cloth.
CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

SPECIAL NOTICE.—The Celebrated Copyright Adventure Story, entitled **Dead Man's Rock,** by Q. (Author of "The Splendid Spur," &c.), will be GIVEN AWAY with Nos. 365 and 366 (price 1d. each) of Cassell's Saturday Journal, forming the First Two Numbers of the New Volume.
Nos. **365** *and* **366** *will each consist of* **48** pages, *and thus the Novel will be Given in addition to the usual Contents of the Journal, which will include the* Commencement of **Two New Serial Stories** *of striking interest, and other exceptionally attractive features.*
CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

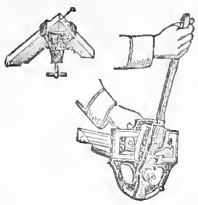
N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.



PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine**, any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,
TOOL MAKERS, DUBLIN.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPUT
SAMPLE BOX 6 OR FOR 7 STAMPS
BIRMINGHAM.

[33

London Warehouse: 124, NEWGATE ST.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

Form for space, is issued with this Number.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 81.] SATURDAY, OCTOBER 4, 1890. [PRICE ONE PENNY.

AN OCTAGONAL MUSIC CABINET.

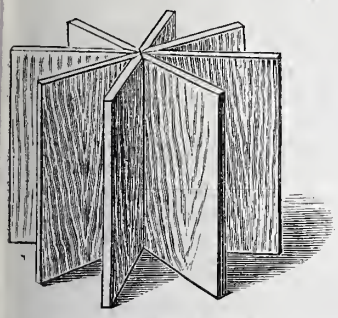


Fig. 6.—Carcase Boards at Top of Music Cabinet.

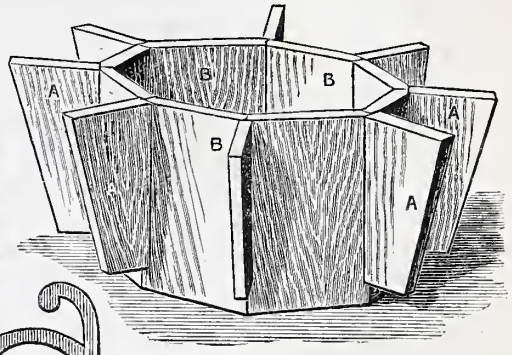


Fig. 7.—Carcase Boards in Central Part of Music Cabinet.

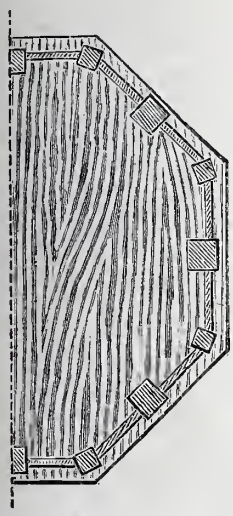


Fig. 5.—Position of Pillars shown in Plan.

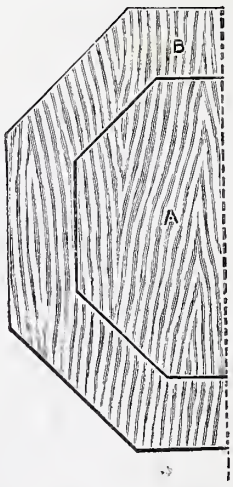


Fig. 4.—Method of cutting Octagonal Table Top, etc.

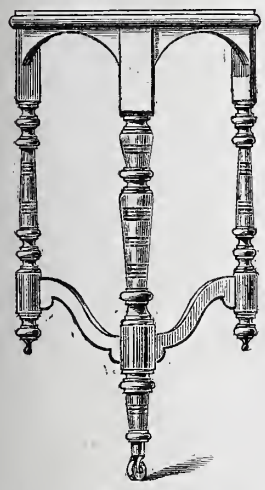


Fig. 3.—Appearance of Sides: Leg shown between Pillars.

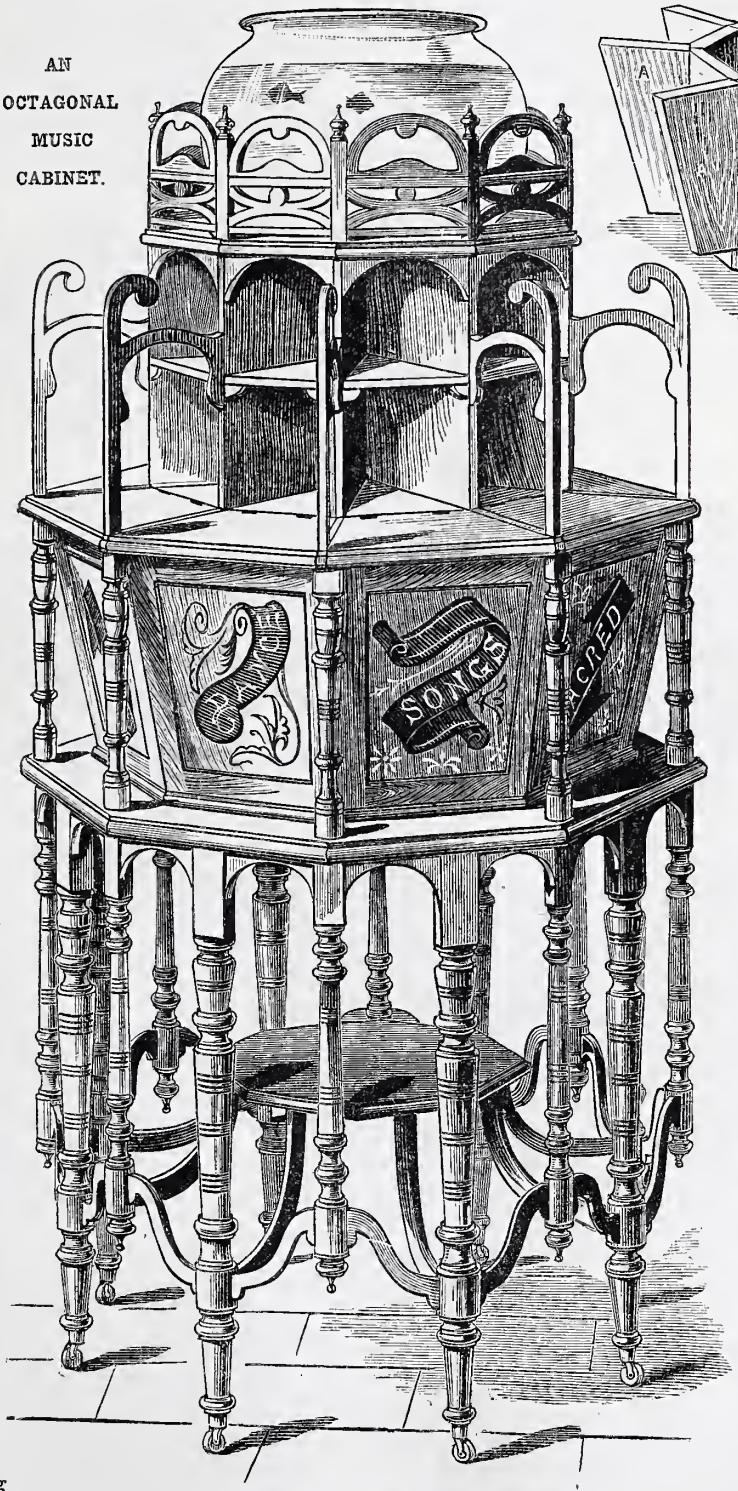


Fig. 1.—Octagonal Music Cabinet complete.

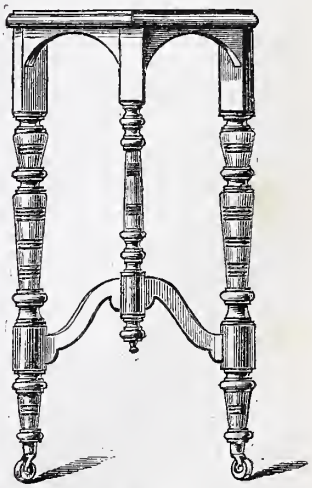


Fig. 2.—Appearance of Sides: Pillar shown between Legs.

AN OCTAGONAL MUSIC CABINET.

BY JAMES SCOTT.

During the past few months I have had several conversations with gentlemen in furnishing circles; and the tendency of the majority of these gentlemen's opinions is that they consider the furniture of the present day is too much of the wall character. By this they mean that more furniture is designed to rest against the wall than to stand in the open space of an apartment. A few moments' consideration of these remarks will show that this is so, and that there is plenty of scope for the designer of the future—or even for him who caters for the public taste at the present time.

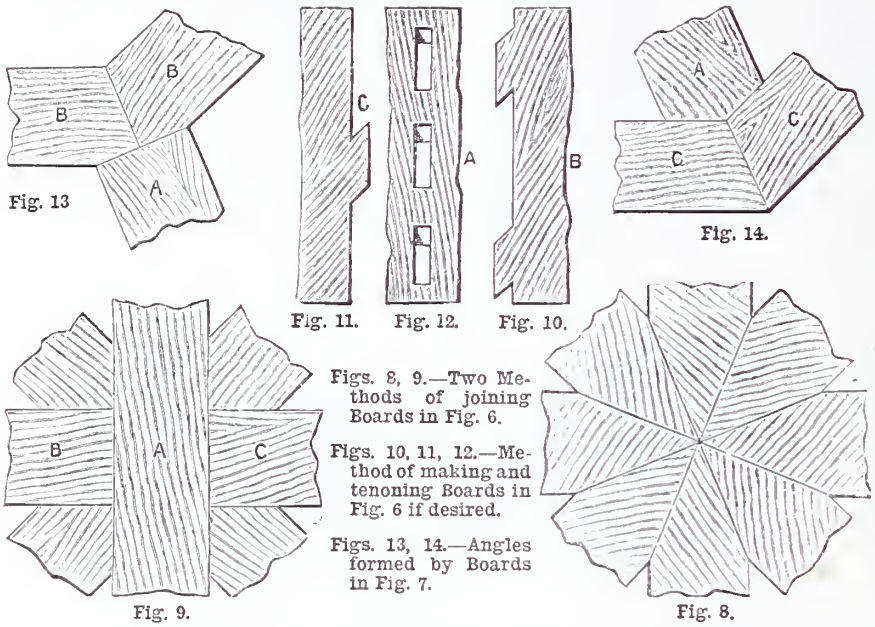
Bookcases, music cabinets, china cabinets, sideboards, chiffonniers, sofas, couches, and settees, and several other articles would lose their beauty—if they have any—by being placed at any noticeable distance from the wall. Almost the only things that will stand anywhere with equal effect in appearance are tables, chairs, ottomans, etc.

The advancing and spreading admiration of art is beginning to induce society to clamour for something away and apart from the old lines on which furniture is indiscriminately built. Instead of pictures being hung (as our grandfathers and grandmothers preferred them) as high to the ceiling as possible, modern taste says that they must be hung so that the spectator can admire and criticise them without having afterwards to complain of pains in his neck. Then again, small fancy brackets, mirrors, china, etc., are becoming more numerous in making a very close acquaintanceship with the wall; which, in its turn, is insisting upon having better adornments in the shape of artistic papers, lincrusta, textile hangings, etc.; and also demands that these adornments shall not be hidden from view by heavy—and sometimes not too pretty—furniture. All this shows that there is a way open for the designer to contract admiration by satisfying the present and future "art" cravings of modern mankind.

Why should not bookcases (those mostly used in drawing-rooms, I mean), cabinets, etc., and even sideboards, be constructed in such a manner that they would stand either against a wall or in the middle of a room? One great advantage to be derived from furniture of this kind would be the alteration which could from time to time be made in the appearance of an apartment, by shifting the furniture to different parts of it; and my own experience proves that people soon tire of the one continual look of their rooms—although they may be very fond of their homes, morally speaking. In this reason is to be found, I think, a solution of the question why are persons so fond—apparently so—of shifting from one neighbourhood to another? The different arrangement of the *same* furniture affords a relief and an agreeable change to the eye.

It is sometimes difficult to say whether demand creates supply, or *vice versâ*. I think, however, that in the present instance, contrary to the usual custom, the demand will create the supply. Of course, properly speaking, *demand* must precede supply; for until hunger is felt, thirst is experienced, and the want of necessary articles noticed, the materials requisite to give satisfaction are not asked for. When, however, supply increases, it not only fully satisfies *present* demand, but creates *future* demand. Let us hope, then, that although the public is asking for improvements in its furniture, our designers will see the reasonableness of it, and will endeavour to satisfy it in the present and create it in the future.

My design for a music cabinet, to stand in any part of a room, is a departure from the old lines; and will doubtless be agreeably accepted as such. The average amateur may eye it with a feeling akin to displeasure, as he may imagine that the amount of skill requisite to build one after this pattern will be above him; but the old proverb, to which the tale of the spider has always been attached, should be fully considered before finally deciding to pass the design by.



Figs. 8, 9.—Two Methods of joining Boards in Fig. 6.

Figs. 10, 11, 12.—Method of making and tenoning Boards in Fig. 6 if desired.

Figs. 13, 14.—Angles formed by Boards in Fig. 7.

So far as the cutting out of the various parts is concerned there is nothing that an amateur should not be able to accomplish; it is in the fitting together of the different parts and pieces that his ability and patience will be tried.

There are several advantages to be gained by the use of one of these cabinets. First comes that already mentioned: placing it with equal effect in any part of a room; then we have a handier access to the music sheets. It is a fact that, although the music sheets may be stowed away in an ordinary cabinet, when they are being used they present an untidy appearance by being cast indiscriminately about piano, tables, chairs, etc.; as the person, in endeavouring to find a particular piece of music, will not take the trouble (not on account of indolence, but of impatience) to put those not wanted back into their accustomed place. It is intended that, in this cabinet, the music sheets shall *stand up*, almost perpendicularly, with the titles uppermost; and, as I have designed it so that they will be on the slant, if they are placed with the titles to the front, any particular piece of music can be easily found without necessarily taking out the whole quantity. And, when each compartment is really full, there will always be plenty of space at the top to enable the books to be pushed back one by one until the required piece is found.

There are more compartments (eight) than are really necessary; but readers of Work, or of any other periodical, will find a convenient place or two in which their favourite journals may comfortably repose. As each compartment will have a lid, the contents within them will be kept comparatively free from dust, etc. The front of each compartment will, of course, be wider than the back, and it would be an impossibility to open the top as a lid if more fretwork than I have shown is used on the sides. The narrow upright I show will not hinder it from working, and the arch will be too high for it to come into contact with it. Of course, all the lids will not be able to be opened at the same time.

Another thing I must speak of before I begin with the sizes is the appearance of the columns. Any beauty the article may possess will be lost if a less number than I represent are used under the table part. I show sixteen, eight of them shorter and thinner than the others.

The difficulty to be overcome, too, of getting the pillars and shaped pieces between properly and nicely fitted, must not be lost sight of. If they are fixed as in Fig. 1, each side of the octagon will have the appearance of Fig. 3, and the shaped pieces at each side of the long pillars will be at an angle with the pieces adjoining them, as in Fig. 5. If, however, the shorter columns are fitted in the centre of each side of the octagon, the pieces can be more easily joined, and the appearance of each side will be as in Fig. 2. Now, then, we will enter upon the construction.

The wood and finish must be entirely a matter of choice. The first to be cut out should be the table top. This will be 36½ in. across each way, and will be about 13½ in. on each of its eight sides. It might be ¾ in. thick, with a moulding round its edge. On to this is screwed the upper carcase, of which the inside of the bottom part is shown in Fig. 7. The eight boards marked B, forming the octagon, will each be 15 in. long and 9½ in. wide, and should be canted at the joints as in Fig. 13. From each corner formed by these boards runs one of the boards A in Fig. 7. These will each be 14⅜ in. long, and 5¾ in. wide on top, gradually sloping to a width of 3½ in. at the bottom end. Next, we want a board the same size as the table top, and similarly moulded. Mark off from the edge of this all round a distance of 5½ in., and cut out the octagon (A in Fig. 4) thus formed. From the ring (B in Fig. 4) will be cut the lids for the music compartments, by cutting out a strip half an inch wide from across each corner. The larger parts will be the lids, and the narrow strips will fit on to the top (after being properly cut at the ends for the

purpose) of boards A in Fig 7, and connect the small turned columns with the boards in Fig 6. The inside octagon (A in Fig. 4) will serve as the bottom board to the eight boards in Fig. 6. Another board, 32 in. across each way, and about 12½ in. on each of its sides, should be similarly cut to this last-mentioned one. The outside ring of this board will form the bottom board for all the compartments, and the back edge of it comes *against the fronts* of boards lettered B in Fig. 7, while the other part of it comes *underneath* the boards lettered A in Fig. 7 and the title boards.

For Fig. 6 we want eight boards, each 14 in. long and 12½ in. wide; they could be united as shown in Fig. 8. If, however, it is preferred that they should be more firmly joined, they might be fitted as in Figs. 9, 11, and 12; one board (A) will then have to be twice the length of the others, and the proper boards will have to be mortised and tenoned as in Figs. 10, 11, and 12. The eight columns round the top carcase might be very slender, as they will not be required for the purpose of strength, and should be screwed to the table top from underneath it. The fixing of the long and short pillars supporting the table, and the various shaped pieces, can be better understood when the article is being built up, as in written instructions a great deal of space must be filled to explain it, and it is unnecessary to go to such lengths.

Small shaped pieces and shelves are fitted between the eight boards in Fig. 6, and some turned ornaments and fretwork are framed up on top. Here will be a nice place for the display of a globe of fish, vase of ferns, or a cage of birds.

Descending again to the lower pillars, as I said before, the appearance of the article will be the better if the eight thickest columns are fitted in the *middle* of each side instead of being in the corners. The length of the longer ones will be 27 in., that of the shorter 18 in. The former might be 1½ in. or 1¾ in. thick, the latter 1 in.

The octagonal bottom board is intended to rest upon eight shaped pieces, and according to the length of these latter so will the height of the former be; and here let me add that if the table top is cut similarly to the other octagon boards, the piece cut from it can form the bottom board.

One or two shelves may be fitted between each pair of boards shown in Fig. 6. The thickness of all the wood used in the cabinet (excepting that of the boards which lay horizontally, which should be ¾ in. thick) is intended to be ½ in.

The title boards will each be 14 in. long, and 13½ in. wide at the top and 12½ in. wide at the bottom. They may be panelled or merely painted.

Before concluding, I must again press on my readers the advice not to have any more fretwork than I show in Fig. 1 within the space traversed by the lids, otherwise the lids will not open.

Now I leave the design with my amateur readers, feeling sure that if they consider an article made according to it worth a place in their homes, they will not be slow in building one. It is also well worth the notice of professional readers, who may, if they will, gain many useful hints for furniture in the designs given in WORK: indeed, this is one of the principal objects for which the Magazine exists, namely, to supply the professional cabinet maker with designs at a nominal price, or, as a man neatly put it the other day, at "next door to nothing."

MODERN FORGING.

BY J. H.

PRINCIPLES OF FORMATION.

THERE is yet another point of view from which the practice of forging must be regarded. Into the alternatives of drawing down, upsetting, and welding the question of strength does not enter, for each operation, when properly performed, produces equally reliable results with the other. The question of strength is—assuming the use of iron of similar quality—one of direction and continuity of grain or fibre. It is very important that, whenever possible, this unbroken continuity of fibre should be preserved intact, and in the generality of work its preservation is not difficult. But it is as well to get certain fundamental and very essential facts impressed upon the mind. The smooth external appearance and accurate dimensions of a forging are by no means sufficient evidence of its suitability for the purpose for which it is required. It may happen that the fibre is wrongly arranged, or that it has not been sufficiently consolidated throughout by hammering, or that it has been overheated and burnt, or that unsuitable material has been selected. It is to the first of these only that the succeeding remarks will have reference.

The most striking characteristic of wrought iron—and also, in a lesser degree, of mild steel that has been rolled—is its *fibrous* condition. This is the quality by which it can be rendered subservient to the will of the craftsman. Anything that tends to reduce or minimise that quality is an evil. It is a remarkable property of these fibrous materials that the very qualification that is of so much value can be changed or modified by the smith. A smith places a bar of iron across the anvil cutter and nicks it around with a chisel. The bar may then be broken short off with little stress, and none but a very practised eye could detect by the appearance of the fracture, which is wholly crystalline, whether the iron were cast or wrought. But if the same bar be bent without nicking, or gradually torn asunder until it breaks, the fracture will be wholly fibrous, the long string-like fibres becoming drawn out as though the bar had been built up of innumerable fine strings of metal. Again, if a crank-shaft or a lever-arm breaks at a sharp re-entrant angle, the fracture will be crystalline. But if it breaks at an angle whose faces are gradually merged into one another with a curve or hollow, the fracture will be partially or wholly fibrous.

It follows from the fibrous character of wrought iron developed during rolling that it must be considerably stronger in the direction in which it is rolled (Fig. 41, A A) than in the direction transverse thereto, B B. The difference is somewhere about in the ratio of 21 to 17—that is, if it would require 21 tons per inch to break the bar through the line B B in a direction at right angles with A A—that is, *across* the fibres—17 tons would suffice to break it along A A—that is, *along* or with the grain. This does not hold good, except to a very slight extent, in the mild steel, where the rolling is only subsidiary to the fusion. In wrought iron this matter of direction and relative strength of fibre has a most marked influence upon design. It shows why the direction in which work is subjected to the greater stress should always coincide with the longitudinal direction of the fibres; why curved work should not be cut from the solid, so severing the contiguity of the grain, if it is possible to bend it round and preserve the fibres continuous. It shows why in many cases it is better to split or divide a bar, and bend or fork it, so preserving continuity of grain, rather than slot out or weld on at random. It explains many points in the practical working of wrought iron as distinguished from the working of the homogeneous mild steels. It shows the advantage of keeping rounding edges, and not sharp edges, on fullering and similar tools, by whose use the grain is not violently *severed*, but rather *moulded*.

Observe the action of the fuller as typical of many others. This reduces the surface of the work without leaving any angular marks upon its surface. It does not *cut* at all, but leaves a wavy surface, with fibre perfectly continuous. And when making a set off in a bar, whether with the object of reducing its dimensions or of bending it, it is always the round-faced fuller—never the keen chisel—that is used. The edge of the set hammer is also usually a little rounding, and does not form a sharp angle. The same is true also of most of the swages and other tools employed in working out moulded forms.

The following drawings are introduced to illustrate in detail these remarks.

Note the two cranks in Fig. 42. A is a crank forged as a solid block, and slotted out at C. B is bent or dipped round. When A is slotted out, the crank webs *a*, *a* are very weak, because the grain or fibre runs in the direction of the shaded lines, and the case is quite analogous to the short grain in wood. In B the fibre follows the contour of the dip of the crank, and the crank is therefore of equal sectional strength throughout. The weakness of the form A is shown very forcibly in locomotive practice. The cranks of inside cylinder engines are made in this manner, and unavoidably so, because there is not room enough to use a bent crank like B; consequently, these cranks invariably fracture through one of the webs (*a*) if they are run over about 200,000 miles. Frequently, in fact, they break before that limit is reached. For this reason the practice of bonding is now often resorted to.

Take, again, the crane lifting-hook (Fig. 43). This is invariably turned round like the dip crank—never slotted out of the solid. If it were slotted, the hook would inevitably break at *a*. Being turned round, the sectional strength is preserved, and the effect of excessive stress is to produce only a partial straightening of the hook.

In forging the eye of a winch handle (Fig. 44), instead of making a solid end and drilling and filing a square hole, the bar is bent round a mandrel, and then welded at *a*.

Instead of drilling a hole in the eye of the crane hook (Fig. 43, *b*), it should be turned round and welded, like Fig. 44, or else punched. In drilling, the metal is absolutely severed; in punching, it is thrust aside and not divided at all. And the punching not only preserves the continuity of the fibres, but also, by bulging out the metal upon each side, preserves an equal section, and little or no jumping up is required. The punched rod (Fig. 45) is an illustration of the same kind occurring in the middle of a bar, and is common in roof truss work.

The eyes of hammers, and the cottar ways in bolts and rods, are also properly punched. There is then no separation, but only a parting or spreading of the fibres.

Fig. 46 shows how the continuity of grain is preserved in large forked ends. Small ends are usually shaped out of the solid, but broad ends, like that shown in the

figure, and also those of moderate width, are formed by dividing the bar and then opening it out. In this group of figures, A is the bar from which the forked end has to be made. A hole is punched through at *a*. The fibre is not thereby severed, but thrust sideways. Then the bar is divided with a hot set from the hole *a* outward to the end. The set is first driven from one face halfway through the bar, and then from the other face to meet in the middle. The punched hole prevents all risk of the chisel or set splitting the fibres too far inwards. Then the bar is opened out, first with a wedge, afterwards with the hammer, as at B, and finally finished as at C. If the fork were cut from the solid, the grain would be short; but being opened out and turned round, it runs continuously.

The direction in which the *layers* of iron occur has frequently to be considered when making forgings. When making a key (Fig. 47) the layers of the iron should not be arranged in the direction of rotation of the shaft as at A, but at right angles therewith, B—that is, they should run towards the centre of the shaft. In the latter arrangement, the pressure will tend to close them; in the former, the pressure would tend to shear the key off in the plane of the layers. The holes for nuts should also be punched at right angles to the direction of the fibre. If punched in the same plane as the layers of iron, they are very liable to become separated. In the forked eccentric rod end (Fig. 48), when forged solid and slotted out, the layers should not run as shown, in the vertical plane of the figure, but in the plane of the paper instead. By the first method, the grain is apt to open at *b*, and the forked end fracture along *a b*.

This liability to crack is much more pronounced in inferior iron than in that of first-class quality. Lowmoor iron and the treble best qualities of Staffordshire iron are comparatively close-grained and tough, but it is not at all unusual to find the worst qualities of iron showing cracks at the end when cut off with the hot set. The appearance of these cracks—not exaggerated in some bad specimens—is shown in Fig. 49. These seams are, of course, due to imperfect union, and are probably often due to the presence of cinder, which has become intermixed with the iron and not expelled during the process of shingling. Sometimes hammering at a welding heat will improve such iron, but if the iron itself is very bad, there is little advantage to be gained by hammering.

Nevertheless, any part that has to be screwed or subjected to great stress or wear should be made as sound and close-grained as possible by consolidation under the hammer or between top and bottom tools at a welding heat. Otherwise the fibres may become partly separated and the metal frayed out, or the open texture of the iron will collect grit and wear rapidly. And after upsetting—an operation that tends to open out the fibres, especially in inferior iron—the metal is hammered at a welding heat, in order to consolidate it.

Every smith who works at the forge is, as a matter of course, well acquainted with the practice, and may think that some of the remarks that are made in these papers are well-nigh needless. Such as may be disposed to view them in this light must remember that I am dealing with theory as well as with practice, and that to beginners in the craft, an elucidation of the why and the wherefore in the various operations of smithing cannot fail to be useful.

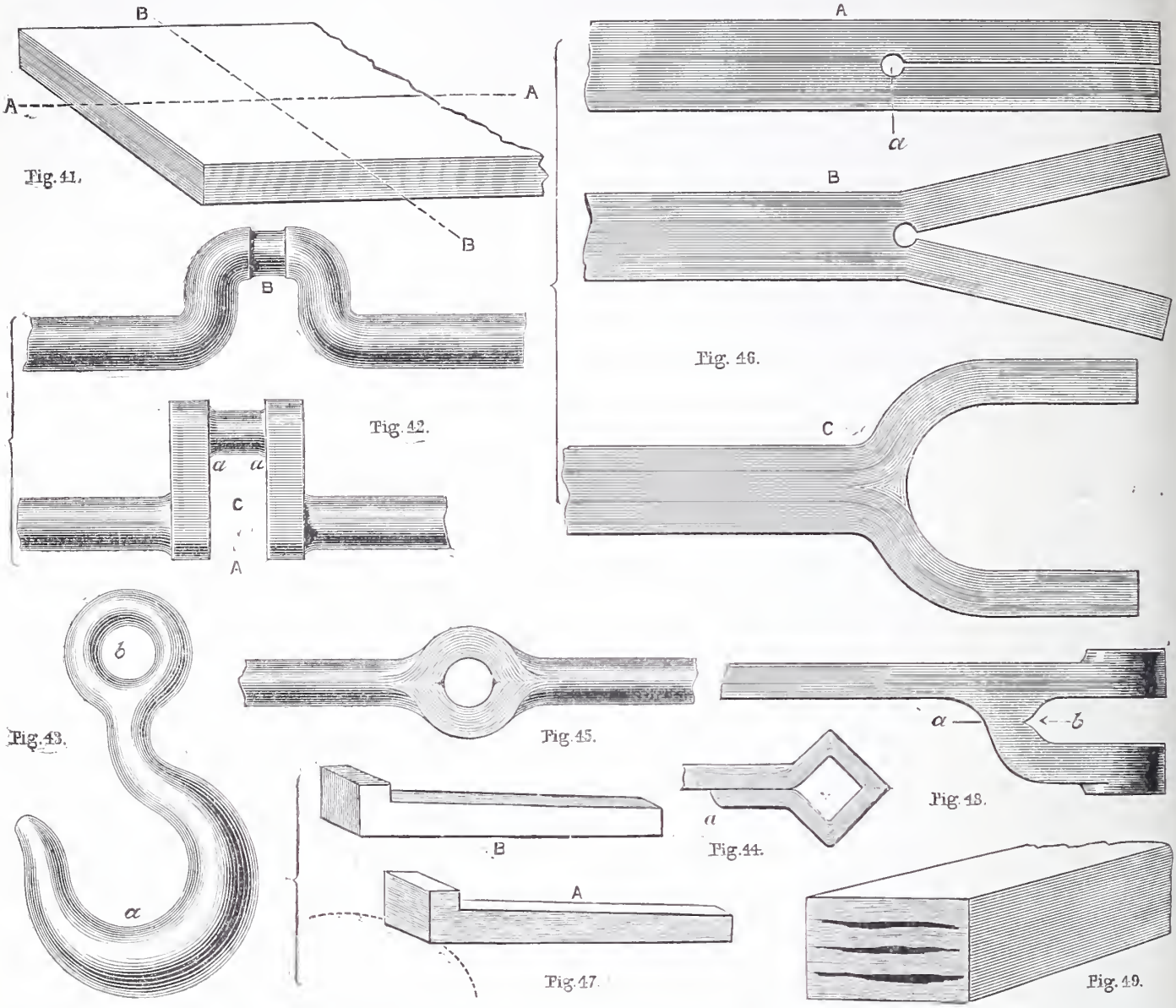


Fig. 41.—Bar of Iron shaded to show Longitudinal and Transverse Direction of Fibre. Fig. 42.—Slotted and Bent Cranks. Fig. 43.—Lifting-hook of Crane. Fig. 44.—Welded Eye. Fig. 45.—Punched Tie Rod. Fig. 46.—Forked End. Fig. 47.—Keys shaded to show Right and Wrong Arrangement of Fibre. Fig. 48.—Forked End shaded to show Wrong Arrangement of Fibre. Fig. 49.—Cracks in Bad Iron.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

THE CYLINDER EXTRACTOR.

VERY many of my readers will, without doubt, wish to attempt a higher flight than the manufacture of the "Little Wonder Extractor" can supply. A Cylinder or Barrel extractor, however, is a piece of work which ought not to be lightly undertaken, and the amateur who turns out a clean and strong job may certainly claim to have passed his novitiate as a tinman.

The same principle governs the action of the Little Wonder and Barrel extractors, the honey leaving the cells of the comb by centrifugal force, but, while in the Little Wonder the entire machine revolves, carrying comb, receptacle for honey, and any honey which has already been extracted, in the Cylinder extractor as few parts as possible are made to revolve: which is a decided advantage. The labour necessary to overcome the inertia of a large mass of material in starting and stopping is saved, and the decreasing weight of the comb, which is perceptible when it and its connections only are revolved, is an indication to the operator that all the honey has been extracted.

Looking at the extractor as a mathematician, many interesting problems present themselves. For a given velocity, the nearer the comb is to the centre of revolution the greater will be the centrifugal force, but the honey in most of the cells will tend to press against their sides as well as leave them. To overcome this tendency the combs should be placed at an infinite distance from the centre of revolution.

It is evident that practice more than theory is what will decide the best position for the combs, and from exhaustive experiments, Mr. Cowan has concluded that the outer surface of the comb should, during extraction, be placed six inches from the centre of the spindle round which it revolves. He has also decided that extractors which hold two combs at the time are preferable to those which hold four or more.

The extractor, then, consists of four distinct features: (1) the frame which holds and carries the comb baskets, (2) the comb baskets, (3) the cylinder, or barrel in which they revolve, and (4) the driving gear, or crank.

I will describe them in this order for a reason which often influences me in my instructions; viz., because the first is most difficult, and at the same time requires least material, so that if a person succeeds in making that, he may hope to bring the whole work to a successful conclusion; while, if he fails, he is not much the worse for the attempt, and the experience gained will probably be worth the bit of tin spoiled.

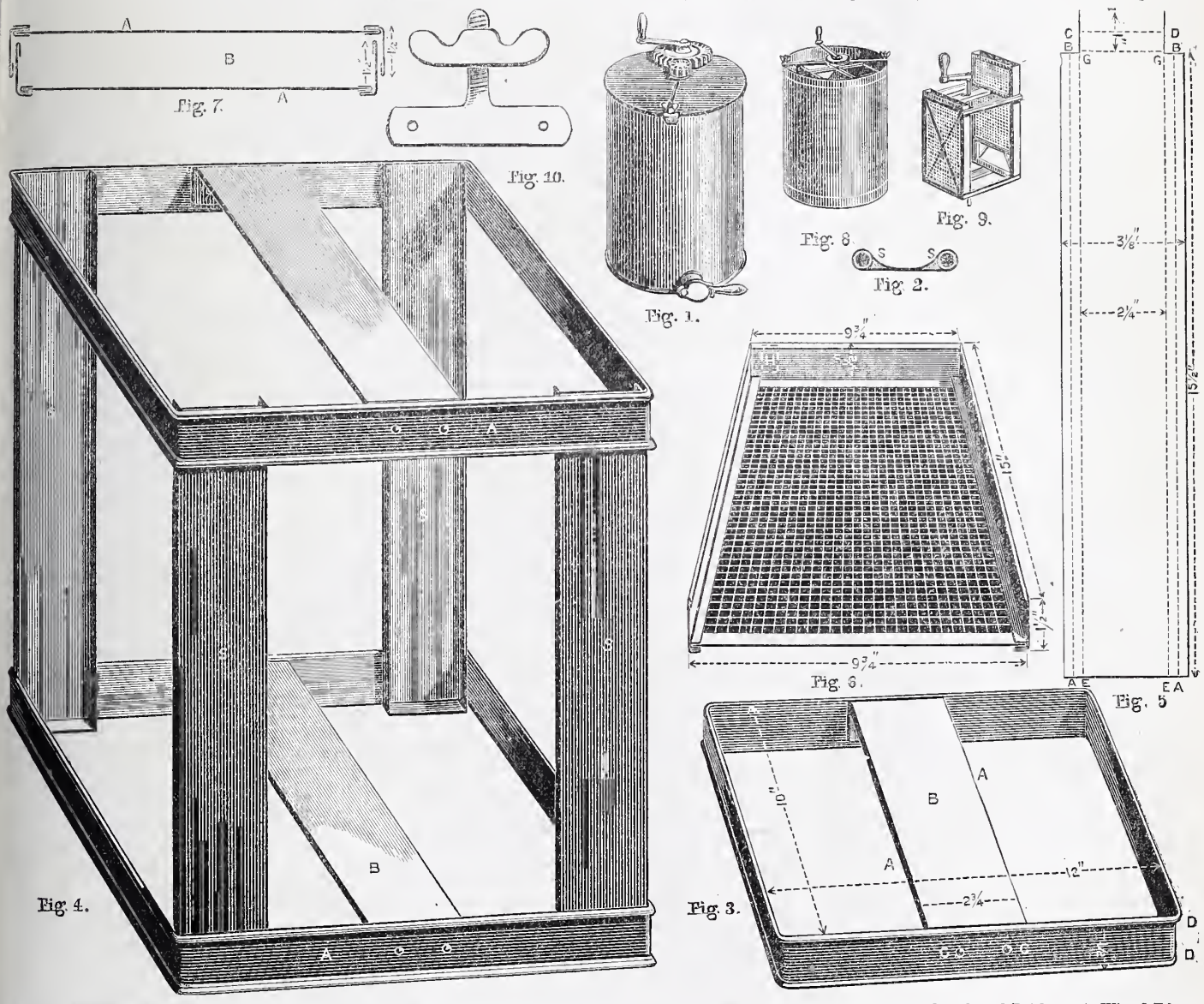


Fig. 1.—General View of Extractor. Fig. 2.—Wired Edge soldered to keep out Dirt—S, Solder. Fig. 3.—Rectangular Band and Bridge—A, Wired Edge; B, Bridge; C, Rivets; D, Edge wired all round. Fig. 4.—Bands (A), Slides (S), and Bridges (B). Fig. 5.—Pattern of Slide. Fig. 6.—Half of Comb Basket—H, Hole for Frame End. Fig. 7.—Section through Comb Basket—A, Wire Netting bound round with Tin; B, Space for Comb. Fig. 8.—Extractor showing Baskets in place. Fig. 9.—Frames, Baskets, and Handle. Fig. 10.—Bolt for Cross-bar.

When making my own extractor, I remember inquiring for very large sheets of tin, but could obtain none larger than the Boat tin I referred to in a former article—17 in. by 12½ in. I cannot but feel that if anyone could get tin very much larger in size, or in rolls, like zinc or lead, that many operations connected with tin-plate work would be much facilitated. If any readers could let us know where such could be found, I am sure they would confer a benefit on many others as well as on myself. For the frame forming the first item in our list, three sheets of tin, the size given above, are required. One of the sheets is to be cut

into strips 2 in. wide, of which it will form six. I may here remark that the edges of tin plates are not always true when they come from the shop; they should therefore be pared until straight. Three strips should be joined together end to end, by turning ¼ in. at the ends over, hooking together, hammering down flat, and touching with solder, as before described. These strips may now be cut to 45 in. in length each, and wired at both edges with wire about ⅛ in. in diameter: No 10 gauge, I think. The wires are to be 44 in. long each. The wiring is effected by turning the edges of the tin over for a distance of nearly ½ in. by means of a mallet and the stake; the wire is then laid along the trough thus formed, and the edge of the tin hammered down so as to entirely envelop it. A good deal of tapping and some practice are required to make a neat bead, but the difficulty is not insurmountable. I may be permitted here to draw the attention of my readers to a plan which I adopted in my own extractor.

I argued that this cage would be a good deal smeared with honey, which would get in between the wire and tin, and there set up fermentation, or be a constant source of dirt. I therefore soldered the tin along outside the wire, so that a nicely formed hollow is made, which can easily be kept clean, and has no corners for dirt (Fig. 2). In this, as in every other part, I used very fine solder, containing a large proportion of tin.

It is best to do all wiring while the tin is yet in the flat, not after it has been bent into shape. This soldering in of the wire to which I referred could be done either before or after the bending into shape, but it is easier to do it before. The inch by which the tin is longer than the wire should not be turned over until a later stage of the work is reached.

These wired strips of tin are now to be bent so as to form two rectangular bands, 12 in. by 10 in.; the inch at the ends which overlap forms a good strong joint when thoroughly soldered. The bending can be done with a wooden vice, such as is usually found in a carpenter's bench, and should be as nearly as possible to a right angle, and the frame or band should not be in winding, but lie flat on the bench; the wired edge would be turned outwards, leaving the inside surfaces flat. If these bands are made to the satisfaction of the amateur, he may proceed with renewed hope to the construction of the rest.

Another sheet of tin must now be taken in hand, and two pieces, 12 in. by 3½ in., cut off across it. These must be wired at both edges, with wires only 10 in. long placed in the middle, leaving an inch at each end free of wire; but the turned over edges of tin may be hammered down flat at the ends. The unwired ends may now be turned up sharp where the wire terminates, thus forming a sort of tin stool 10 in. long, and with legs 1 in. high. These are to be fastened with solder and little rivets to the bands already made. They will, of course, bridge the band the narrow way, which is the only direction in which they will fit, and be equidistant from each short side.

Fig. 3 is a diagram of one of the bands and bridges at its present stage. I need scarcely explain that what I call the bridges are for the purpose of attaching the spindle.

We must now cut four other pieces of tin, 16½ in. by 3⅛ in., and turn over and hammer down ¼ in. slack at each long edge of the entire lot; turn up also ½ in. at one short edge, or end, and hammer down flat; but before any of this turning down is done it would be advisable to take out rectangular pieces at the corners, so as to prevent the tin from being doubled too much. In Fig. 5 I give a pattern of these pieces of tin. The long edges are doubled down along the lines A B, the short one at C D. The long edges are to be then turned up along the line E G, and left standing at right angles to the broad part, and the short end along the line G G, the whole thus forming a kind of trough, open at one end, and having the other end double the height of the sides.

A touch of solder in the corners will bind the edges firmly together, and make the work stronger. The sharp corners of the projecting end should also be nipped off, and rounded nicely with a file.

We are now ready to connect the bands together with these "slides," as I shall call them, as into them the comb baskets slip.

Place one of the bands on the bench with the bridge up, and stand a slide, with the stopped end down, at one of the corners, its back surface being in contact with one of the long sides of the band, and pushed up as tightly as possible towards the corner. A small cramp and a couple of bits of wood can be used to hold the two firmly together, while the square is applied to see that the slide is at right angles to the band. A little solder is then run between the two, and a similar operation performed with the three other slides. The upper band can now be put over the ends of the four vertical slides, and if things have been done carefully, it will be found to fit well, each slide going right into its corner. If, however, things are not true, the square can be applied, and the erring slide or slides found, unsoldered from the lower band, and set right. I put the bridge in, the upper band up also, so that both bridges are turned upwards, and form no troughs to hold the honey, which they might do if turned the other way. Fig. 4 is a diagram of our work at this stage of progress.

Little rivets could be used as well as solder to hold slides and bands together, but they are scarcely necessary; and if used, the heads should not project into the slides, and hinder the baskets from moving freely up and down.

Instead of this framework, a box 10 in. square and 15 in. high could be substituted, having the slides soldered on to two of the sides, while the other two act as backs for the comb baskets. This would be found by many an easier piece of work, and possesses the additional advantage of being easily cleaned, and affording few corners for dirt to lodge in.

I now turn to the comb basket, half of one of which is seen in Fig. 6, drawn from a point near it and between the sides. It will be seen to consist of a bottom of wire netting, two sides of tin 1½ in. high, and one end; the other end is wanting, as it will form the top of the basket when in position. The other half basket is exactly similar to this, but a little narrower, so as to fit inside it, as can be seen in the lower part of Fig. 7.

The width of the outer half of the basket is such as to fit easily between the slides—9¾ in. in mine. The distance between the two nettings can be varied from 1½ in. to more than 2 in., as will be understood from Fig. 7.

To make these baskets, the four pieces of netting should first be procured, cut accurately, two to 15 in. by 9⅝ in., and the remaining two ¼ in. narrower. They should then be bound round with tin which overlaps ⅜ in. at each side. To do this, lay the straight strips of tin, which will be ¾ in. wide, on the bench, and the edges of the netting over them and halfway across. Then solder each wire to the tin, turn the tin over, and solder each wire to the turned-over part also, using plenty of solder and heat, so as to have every wire very firmly held in. By this means the netting is framed in a strong tin frame, which will strengthen it a good deal, and prevent it from sagging. Strips of tin must now be soldered together to form four long pieces 41 in. long by 2¼ in. wide. The edges of these are to be turned over and hammered down to the extent of the usual ¼ in., and one edge turned up at right angles, so that a section of the strips will form an L, one leg of which is 1½ in., and the other ¼ in. Each strip is then to be bent into such a shape as to form the three sides of the half-basket shown in Fig. 6. In two of them the short side is 9¾ in. long, and in the other two ⅛ in. less. To bend the strips it will be necessary to cut the narrow rib with a chisel.

The framed netting can now be laid in position and soldered firmly against the narrow rib, so that there are four thicknesses of tin round the netting.

About ⅝ in. of the sides will project beyond the limits of the netting: this, in the wider pair, should be turned over, and a short bit of wire put in it to afford a hold when drawing out the baskets. In the narrower pair some may be clipped off, and about ¼ in. turned down, so as to have a nice round edge at the top.

To use these baskets, the comb is uncapped at both sides and laid on one half of the basket; the other half is then placed over the first, which it fits, like the lid of a pasteboard box, and the entire basket and comb is slipped down the slides of the extractor, another comb being put into the other basket and slides. The whole is then whirled rapidly until the honey from one side of the comb is extracted; the baskets are then withdrawn, and the other sides of the combs turned outwards and extracted in like manner.

It is unfortunate that a hole must be cut out of the end of each half of the comb basket, so as to let the long top bar of the frames pass through. This could be avoided, however, by making slides and baskets an inch or so longer.

Although it would be better not to make the spindle until we know its exact length—which can only be ascertained when the case is made—yet I can here describe its construction, and leave it afterwards to the ingenuity of my readers. Three classes of spindle may be used; the most workmanlike would probably be ½ in. round iron or steel, tinned all over, or it might be covered with sheet tin soldered on, or it might be a hollow tube of tin: but this I do not recommend. In any case, it passes through the bridges at their middle points, or nearly so, in such a position as to make the cages revolve truly and evenly. The lower end is brought to a long cone, and works in metal bearings soldered to the centre of the bottom of the can. The top of the spindle takes either a cranked handle or a toothed pinion, with which it is driven. The tops of the cages should be a couple of inches lower than the top of the can.

It will be necessary to put tin washers in the bridges to strengthen the hold of the

spindle. They could be $1\frac{1}{2}$ in. diameter, beaten saucer-shaped, with a hole in the middle, through which the spindle passes. After it has been soldered to the bridges these washers could be placed over the point, and attached both to the spindle and bridges. It would be well to have the holes a little small, and to turn out the edges until the spindle can pass through. This will give a firmer hold to the solder than the mere thickness of the tin could afford.

For the cylinder itself we will require a sheet of tin, or rather tinned iron, 55 in. by 26 in.; the top and bottom should be wired with $\frac{1}{4}$ in. wire, and the edges turned over to form a joint. The sheet is then to be bent into a cylinder, and the joint made and soldered.

A piece is next to be cut out for the bottom, and the edge turned up a quarter of an inch all round. The bottom, however, should be slightly, say $\frac{1}{2}$ in., larger than the diameter of the cylinder, as it is to be placed in it in a sloping position, so as to allow all the honey to drain out of the cylinder through a treacle valve, which is placed in the lowest position. The flange of the bottom will be turned down, and firmly soldered to the sides of the barrel. The centre of the bottom being ascertained, a bearing for the lower end of the spindle can be soldered in place either before or after the bottom has been fixed; the under surface of the bearing is to be filed to an angle to suit the bottom, so that its top surface is horizontal. A couple of bands of hoop iron, $\frac{1}{8}$ in. thick and $1\frac{1}{4}$ in. wide, riveted to the edges under the bead, strengthen the cylinder a good deal. To the top one I attach the bolts (Fig. 10), which hold the bar forming the top bearing for the spindle, one of the bolts breaking the joint of the hoop. Fly nuts or hexagonal nuts do nicely to fasten the bar with. This bar is $1\frac{1}{4}$ in. by $\frac{3}{8}$ in.—long enough to reach across—with holes drilled for bolts, and one for spindle to pass through. A plain short crank handle I recommend for driving, as being the simplest and, what is equally important, the cheapest.

Fig. 8 shows the extractor complete with the frame inside, and Fig. 9 shows framework and baskets. The two wires shown crossing each other in this figure should receive attention. They are to prevent the network from bulging, and are $\frac{1}{8}$ in. thick, fastened with solder to the framework at their ends, and to each other in the middle. The outer wire should be bent at the point of juncture, so as to be flat against the network; otherwise, it would be of very little use.

If it is decided to use gearing, wheels like Fig. 1 can be got from Richard Lloyd, Steelhouse Lane, Birmingham. The pinion will fit and be keyed to the spindle, and the wheel will work on a stud riveted to the cross-bar. The cross-bar would, in this case, require to be somewhat stronger—say, $\frac{1}{2}$ in. thick.

The extractor is finished by the addition of a couple of handles riveted to the sides, and covers, of which there are two, one at each side of the cross-bar. It is far easier to have the covers flat, in which case the edges can be turned down, and made to embrace the rim which fits into the barrel. A careful study of an ordinary saucepan cover will show how this can be done. The treacle valve can be got from most dealers in hive furniture, and will cost about 2s.

I will conclude this paper with the warning with which I began: that is, not to embark on such an adventure as making a cylinder extractor without having had previous experience in tin-plate work. It would be far better to be content with the simple Little Wonder than to waste time and material on a fruitless attempt to improve on it.

FITTING AN ELLIPTIC CHUCK.

BY JAMES LUKIN.

INSIDE SCREW FOR MANDREL—SLIDING PLATE—PALLETS—SLOTS.

THE inside screw for the mandrel must be cut before the work is removed from the face plate. A tap is first used centred on the point of the back poppet after a spanner has been fitted to its squared end, and a true entrance given by slightly bevelling the outer edge of the hole. This tap is only required to cut a pitch line of slight depth to give a true start to the chaser which is to follow it. It ought, properly, to be made for this special work, being a tap with sharp threads like the plug-tap, but of smaller size, and slightly taper. An ordinary entrance tap, having no sharp thread at the end, is not fit for the purpose; and if one of an ordinary set has to be used, the intermediate one will be the most suitable. All lathes should, however, be fitted with a proper chuck tap, as it is so frequently needed even for boxwood chucks. Little by little it is to be screwed in, the back centre being constantly advanced to keep it true, and when at the bottom of the hole it must be as gently unscrewed, the back centre being also gradually withdrawn. A hand chaser will readily follow the lead given by the tap, and deepen the thread to the extent required, after which a plug tap, the exact size of the nose of the mandrel, will bring the thread up sharp and clean to its full size. In most lathes there is a smooth cylindrical bit of mandrel beyond the thread, which greatly aids the true fitting of chucks; and, therefore, a few threads have to be cut away, so that the chuck may itself rest on this cylindrical bearing, and bed up true and close against the shoulder of the mandrel. When this part is ready, the face plate must be removed, and, without detaching the chuck, it must be carefully and gently screwed on the mandrel. It ought to fit perfectly, and if it does not go quite home, it must again be unscrewed, and the necessary alterations made. It is open to all to make it a *good* fit, and not a *loose* one. If all proves correct, the chuck can be taken off the face plate and screwed on its mandrel, for the purpose of levelling the face which is to receive the guide bars. This is simply a matter of brass turning with the slide rest, and should present no great difficulty. Light cuts with a round or point tool will soon reduce the surface to an accurate level. A planisher, which is practically a chisel or flat tool for brass, the edge of which is formed as a wide curve, will put a good finish upon this part, and leave it dead level.

For this chuck, however, it would be no detriment if the sliding plate did not take a bearing on the surface of the lower one; the double chamfered bars will, in fact, slightly lift it. But if there is any *convexity* it would be fatal to the work. As it will be as well to complete the turning operations before taking up the file, the top plate will be the next piece to attack, and as we are supposing its boss cast on, we have a capital means of chucking it. But it will be the better plan, first of all, to true up this boss a little, as very often it has lumps and excrescences about its base, which should be removed by a chipping chisel as a preliminary operation. The lower or flat face may also be gone over with chisel and file to reduce any prominent spots upon its surface; after which it is to be clamped on the face plate, and the boss adjusted to run as true as possible, especially if, as often happens, it is not much above what will be its finished size. The exposed side and the boss may now be gone over as before till fairly true, and the boss turned cylindrical. It need not, however, be finished at this stage, the object being to enable it to be held in a self-centring chuck while the rest of this face rests fairly against the outer part, or surface, of the largest jaws of such chuck; or, if no such appliance is at hand, the boss may be held in a large chuck of wood, specially prepared to provide also a good surface for the support of the plate. This will prevent springing during the operation of turning. If there is no back gear to the lathe, it will be necessary to use the slowest speed attainable without it, which will often be sufficiently slow for brass and gun-metal. Thus mounted by the boss, the under side of the sliding plate is to be fixed as accurately as possible, and finished, as the foundation plate was, with a planisher. When this is done, and the whole is remounted on a face plate, it will lie perfectly flat and even, but the boss and the upper surface will probably have become untrue, for which reason they were left in an unfinished condition. They are now to be entirely finished, and the screw traced, but the latter may still be left a trifle too large, that the final touch may be given to it after the chuck is put together. This nose-screw, of course, will present difficulty if the lathe has no traversing mandrel; and unless the amateur is a fairly good hand with a chaser, he should get it cut for him, or get someone with stock and dies to trace the threads sufficiently for the chasing tool to take a decided and accurate lead. I may, however, state here that the American mode of making oval and other chucks, independently of the lathe on which they are to be used, may be followed out in these home manufactures. These chucks fit upon an ordinary flange chuck, which the lathe maker will always supply to fit the mandrel. It is then only necessary to true up the face of this flange, and to fit it nicely to the recess on the back of the bought chuck, and when the screws are put in—which are supplied with the chuck, and tapped on to it—the whole will be found to run true. In making an oval chuck, therefore, the back plate may be arranged to have a recess turned out into which a flange chuck can be fitted, and attached by three or four screws. This will save all the *first* screw cutting described, although it will not bring about escape from having to cut a thread upon the chuck nose, to receive the ordinary cup and other chucks of the lathe.

Having done all this work, we have now to attack those parts which must be finished by tools other than the lathe. These are the guide bars and the grooves on the edges of the sliding plate. Taking the bars first, they are to be filed up true and square. A centre line is then to be made by scribing block or gauge, which line will show better if the bar is chalked; and it will then be as well to go over it with a sharp pointed dotting punch, so as to secure it from

obliteration during the process of filing. This line is to be accurately central, as it will become the sharp edge of the double chamfer. A line must now be also marked on each side of the bar, at a distance from its edge rather less than the thickness — $\frac{7}{8}$ of such thickness will be sufficiently near to produce a double bevel, the section of which will be an equilateral triangle. This is not actually the best angle, but it will facilitate operations to use it, because a three-square file will then exactly make the grooves in the slide. If appliances are at hand in the shape of a planer or a revolving mill, these grooves may be advantageously worked deeper, and, consequently, to a smaller angle, but the dimensions given will answer very well; and if the work is carefully done, the action of the slide will be quite true and steady. Having marked the above lines, add two more about $\frac{1}{32}$ beyond them, merely as a precautionary measure, so that if, in the act of filing up to the lines first scribed, any part should get effaced, the second lines will be a guide to parallelism. All that remains is carefully to file the two flats until the guide lines are just reached, but not obliterated. It is, of course, a matter of skill as well as care, because filing does not come by nature any more than reading and writing. At this stage no attempt at *finish* should be made, accuracy alone being aimed at. The holes for the holding-down screws may now be drilled, and the bars thus far fitted may be laid aside. The grooves in the sliding plate will now call for attention, and a central line must be marked accordingly with a scribing block or gauge. An ordinary plated carpenter's gauge will answer very well, set to mark the exact centre of the bar. This line may now be dotted pretty deeply with the punch, or gone over very carefully with a graver until it is well defined and fairly marked by a decided groove. Having purposely experimented, I have decided that the best tool to use for deepening the groove is a Lancashire three-square file, which is not bellied as a Sheffield saw-file is, but is quite parallel. Use a fairly large one, say, a six-inch, and grind off the end quite square, which will give three sharp cutting angles, and the tool will then be found in every respect suitable for the work in hand. Working partly with the sharpened end, and partly with the sides, the latter being used to finish, very little difficulty will be found in making the equilateral grooves, which will have an angle at the apex identical with that of the guide bars. The finishing touches will be given at a later period.

At this point we are now supposed to have the bars shaped and drilled for their screws, and both the foundation plate and slide levelled and roughly finished. Lay the former plate upon the bench, or upon the lathe bed, which latter will allow the boss to lie in the space between the bearers, and give a true and solid bearing to the plate; or screw the boss (protected by sheet-lead) in the jaws of the vice, and lay the slide upon it, gauging with great care, so as to ensure the centrality of its position. Bring up the bars on each side after this has been done, and press them into their respective grooves. Now take a punch that should fit fairly well the drilled holes of the bars, and placing it in these holes, mark in succession the places for the screws, and proceed at once to drill and tap them. It will facilitate matters, by preventing slipping, if a couple of light screw clamps are used to hold the slide in its central position, while the guide bars are placed and the holes marked, but the main point is to do nothing in a haphazard fashion. Mark gauge lines on the plates; take measurements right and left from a fundamental central line; file up to your lines, but so as not to obliterate them, and consider well and carefully before cutting, filing, or drilling, and there need be little fear of failure. Our work, however, is by no means yet completed. The pallets, by which the slide is actuated, have to be made and fitted, and slots arranged in the back plate to allow them free action. These slots will, in all probability, have been made in the casting; but if not, a row of holes must be drilled, and with file and chisel they must be thrown into one, and the slot squared up to truth.

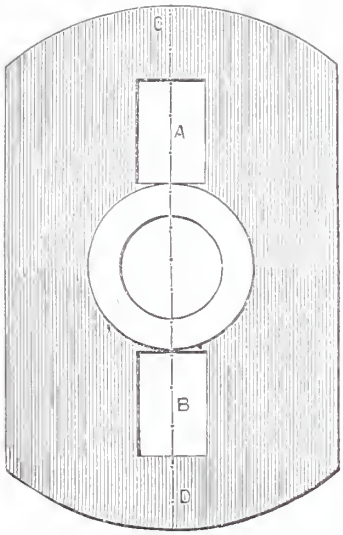


Fig. 5. — Back Plate, showing Slots for Pallets—A, B, Slots; C D, Central Line.

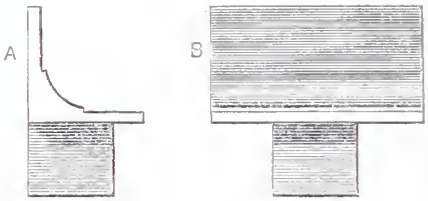


Fig. 6. — Pallets — A, Side View; B, Front View.

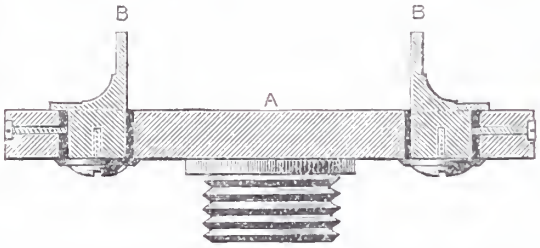


Fig. 7.—Sectional View of Sliding Plate—A, Plate; B, Pallets, showing Tenons and Small Adjusting Screw.

The slots will be about $1\frac{1}{4}$ in. by $\frac{1}{2}$ in. in width. They must be exactly in the middle of the plate, like A, B, Fig. 5, and should be gauged from a central line C D. They also need to be filed out squarely in each direction. The pallets are shown in Fig. 6, A and B. They are of steel, the plate $1\frac{1}{4}$ in. in length and $\frac{1}{8}$ in. thick, the bottom part being extended to form a square tenon. This tenon works freely, but without shake, in the slots of the back plate, and also fits a much shorter, but similar, slot in the slide, to which it is secured by a washer and screw. The reason of the slot in the slide, instead of a square hole to fit the tenon, is the necessity there is for some slight adjustment lengthwise of the plate, in order to make the pallets just grasp the ring that is fixed to the poppet, and thus also ensure the normal centrality of the slide. To aid in this adjustment, there should be a screw tapped into each end of the slide, and long enough to act against the tenon of the pallet, which is thus secured from slipping outwards. It cannot, of course, slip in the other direction, as it is resting against the ring itself.

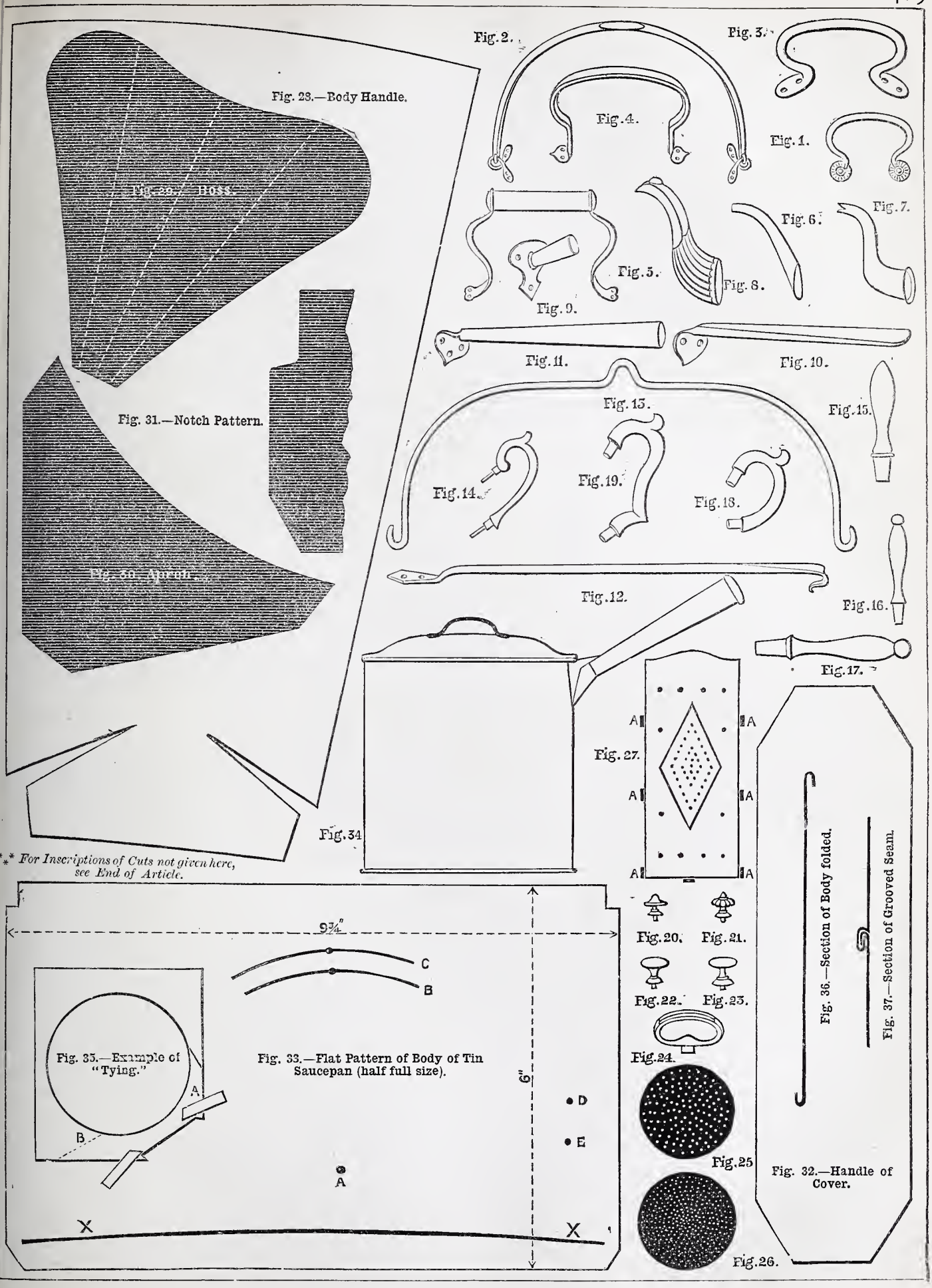
In Fig. 7 is a view, in part sectional, of the sliding plate, where A is the plate, B, B the pallets, showing their tenons and the small adjusting screw by which their position is regulated. In the small space on the opposite side to that of the screw a small packing piece of brass may be inserted when the adjustment of the parts is complete, as it will rarely require alteration, and the motion of the chuck is so slow, comparatively, when in use, that the wear of pallets or of the ring is very trifling. There is nothing in respect of fitting the pallets other than careful filing, so as to make the flat faces accurately square across the face of the slide when in position. A steel set square, frequently used to test the work as it proceeds, will ensure the requisite truth, provided always that the workman can use a file skilfully. This must be premised in the case of an attempt to make a chuck, of which all parts need accurate workmanship.

SHEET METAL WORK.

BY R. ALEXANDER.

TINMEN'S MOUNTINGS OR FURNITURE ILLUSTRATED AND DESCRIBED — REPAIRING HANDLES TO TEA AND COFFEE POTS — STRAINERS TO TIN AND METAL TEAPOTS—THE SAUCEPAN — PATTERN OF SAUCEPAN, AND HOW TO CUT AND MAKE UP.

IN many repairs, as well as in the making-up of new goods, fittings and parts are frequently required that are not in the province of the tinsmith to make himself. These are termed mountings or furniture, and comprise such things as wrought-iron handles for kettles, saucepans, slices, etc., and handles and ears for fish and camp kettles, wooden handles for tea and coffee pots, metal knobs, etc. etc. Subjoined are illustrations of most of the mountings required for ordinary use. They can be obtained of Messrs. Hopkins & Sons, Granville Works, Birmingham; T. P. Lomax, 155, Moor Street, Birmingham; Perry, Son and Co., Temple Street Works, Wolverhampton; and others; and retail of most large ironmongers. It is best to buy from a wholesale house, as the difference in price is very considerable. Prices I have not given, as there are so many sizes and varieties, but the above-named firms will quote prices on application. The fitting of most of these mountings to articles requiring them does not call for special remarks. Coffee pots, when new handles are fitted, should be placed on a tool, and the handle driven into the socket fairly tight with a mallet, taking care not to burst the socket; a hole punched in the socket with a bradawl, and a tack driven in, and the head soldered over to prevent its coming out again. In putting new ears on fish kettles and other things with bail handles, the ear had better be slipped on the hook of the bail before it



*** *For Inscriptions of Cuts not given here, see End of Article.*

is riveted to the article, as, if the hook of the bail turns up much, it will be a job to get it into the ear after it is riveted.

Repairing tin teapots with iron handles: When the handles have come out of their sockets, which is a very frequent occurrence, the tin sockets must first be melted or unsoldered from the teapot, the wrought-iron tangs of the handle filed bright and tinned, the sockets fitted on the handle, and the tangs well soldered to same, then re-solder the sockets to the teapot. It is strange to see the cobble some people make of this simple job, soldering the cast-iron part of the handle, without removing the sockets and putting little straps round, and soldering them to the teapot. Whether it is from not knowing any better, or with the idea of saving time, I cannot say; but the right way, which is the one I have described, is the quickest and best. See that the seam under the sockets is sound before replacing them, as the unsoldering sometimes makes the seam leak, as they are not soldered very strongly when first made.

New Strainer to Teapot.—This is sometimes an awkward little job for a novice, more especially when the teapot is of the common sort, with stamped neck on top of a small lid. The best way to manage it is to cut a piece of tin the required width, long enough to go from top to bottom, punch a diamond-shaped pattern in it (Fig. 27), bend it to a slight curve, place it in position in the teapot, and mark round it with a scriber, scrape the teapot, replace the strainer, and tack in several places; there is no need to solder all over. When putting new bottoms to these teapots, always look to the strainer then, as it is easy to get at; the newer pattern pots, with straight, tapering sides and no necks, are easier to do, as the opening is much larger.

Metal teapots fortunately do not often require new strainers; they need great care, and are sometimes very awkward to get at. I have had some that it was quite impossible to do from the top, owing to their peculiar shape and smallness of opening; but they had to be done, and the only plan was to cut out the bottom and solder in the strainer from that opening, and replace the bottom afterwards—a rather troublesome job, but the only way out of the difficulty.

I am of opinion that, with the instructions given up to the present, most ordinary repairs will be understood. I might multiply examples by the score, without any additional benefit. There are, of course, other repairing jobs that need explanation, but they will be easier understood after some lessons in the method of working up new goods; in the meantime, however, any special job I shall be pleased to advise upon in "Shop."

New Work.—We will now proceed to the subject of new work. I may state here that it is not my intention, nor would it be advisable or even necessary, to describe all the multifarious articles in the trade; but to select what I will call types, by the study of which the workman will be able to understand the making of things of similar shape and use. I propose to commence by describing articles of a cylindrical form, and will take, as a subject to illustrate a class, that most useful of articles, the saucepan.

Saucepan.—Let us take for an example of this kind of work, a two-quart saucepan (Fig. 34). This, when made up, is about 6 in. diameter and the same in depth. Its flat patterns are shown (Figs. 28 to 33). They consist of body, handle, boss, apron, and cover handle; the bottom and cover do not require patterns, as they are struck out with the compasses; the rim of the cover also is marked out by means of a home-made article called a flue rim. Referring to the body pattern, it will be noticed that each corner is notched; the notches at the top (of which the full size is given in Fig. 31) are for the seam and wire, and are cut longer one way than the other, because the fold for the wire requires to be much more than the fold for the seam; the notches at the bottom are so that there shall not be four thicknesses of stuff after the seams are put together.

Marking and Cutting Out.—Let me point out that the body will be in two pieces if cut out of single plates, and in one piece if cut out of 20 in. plates. I shall suppose single plates to be used, for the sake of the example of grooving two pieces together. It will be seen, on laying the pattern on the plate, that two pieces can be got out of each sheet, with a narrow piece left at the top, which will do for the rim—thus one plate will cut the body and rim. The cover, bottom, and small work will be marked out when required. When a quantity is made at a time, it is best to cut out with the stock shears, as two or three sheets can be cut out at one time. When this is done, only the top one of each lot need be marked. To keep the plates from shifting, the tin is cut in convenient places and twisted over and hammered down, forming what are called "ties." Fig. 35 shows an example of this. To cut this circle out you would commence at A, the ties then hold it till you get right round; it will be easily seen that if the cut commenced at B the ties would be cut off before the circle was completed. Great care must be taken to get all straight lines quite true, or, if the folding machine is used to fold the edges, you will soon find it out. Having cut the bodies out, the next thing is to pass them through the rollers, to break the "grain" of the stuff. Take six pieces at a time, and setting the front roller so as not to pinch the stuff, pass them through, setting the back roller down till the pieces roll out a semi-circle; turn them over, place in the rollers again, bend the stuff down so as to allow it to catch under, pass them through once more; turn over again, and place between the front rollers, raise the back roller two or three turns and pass through, and the stuff will come out straight. The reason for doing this is because if it was not done the bodies would, when wired and turned round, present a ribbed appearance, which looks very bad: where there are no rollers it is done on the former, or across the workman's knee; the latter plan is not a wise one, as the "burr" of the tin is apt to cut the apron or trousers. The next operation is folding the bodies for seaming and wiring. Place the body pieces on the left of the folding machine with the top notches *from* you; this is important when the articles are to be what is called lap-wired, which is the most workmanlike way of wiring this kind of article. Set the machine to a small fold—a trifle over ¼ will do very well; too large a fold makes an ugly seam. Raise the front roller of the machine by means of the two screws; this will give a close, flat fold; place a piece in, press it close to the guide-plate, raise the handle of the machine, keep the tin in its place with the left hand, let it come up as far as it will, and then lower it on to the bench again, and the folded piece will slip out easily. The other end must be folded on the opposite side (Fig. 36), or the pieces will not come right when you go to seam them. When all are done, the pieces must be folded for wiring; No. 11 or 10 will be the size wire to use. Set a pair of compasses to twice the size of the wire, mark a line on the tin that distance from the edge, and set the machine till it just allows the line to disappear; lower the front roller to give a rounding fold this time. Raise the handle only half the distance this time, as the fold does not require to be brought over so far for wiring. This completes the folding. Should, as is very likely, any slip out of the machine, either when folding for the seams or for wiring, they must be finished on the hatchet stake; and should there be no folding machine, the whole of the folding must be done on that tool. In that case, in folding the seams the notches must be kept *towards* you.

The number of illustrations leaves no room for the insertion of all the inscriptions on the same page, so those that do not appear are given here:—Fig 1.—Steamer and Colander Handle. Fig. 2.—Chamberpail Bail and Ears. Fig. 3.—Fish Kettle End Handle. Fig. 4.—Tea-kettle Handle. Fig. 5.—Barrel Handle. Fig. 6.—Common Tea-kettle Spout. Fig. 7.—Best Tea-kettle Spout. Fig. 8.—Stamped Teapot Spout. Fig. 9.—Coffee-pot Socket. Fig. 10.—Saucepan Handle, Flat. Fig. 11.—Saucepan Handle, Barrel on Socket. Fig. 12.—Slice or Ladle Handle. Fig. 13.—Fish-kettle Bail. Fig. 14.—Iron Teapot Handle. Fig. 15.—Coffee-pot Handle. Fig. 16.—Gravy Strainer Handle. Fig. 17.—Dustpan Handle. Fig. 18.—Wood Teapot Handle. Fig. 19.—Wood Coffee-pot Handle. Figs. 20, 21, 22, 23.—Various Metal Knobs. Fig. 24.—Dish-cover Handle. Fig. 25.—Gravy Strainer Bottom. Fig. 26.—Coffee Percolator Bottom. Fig. 27.—Teapot Strainer and Tacks. Figs. 28, 29, 30, 31.—Small work of Two-quart Saucepan, as specified, with Figs. full size. Figs. 32, 33.—See Illustrations. Fig. 34.—Tin Saucepan. Figs. 35, 36, 37.—See Illustrations.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

73.—The Timber Merchant and Builder's Vade Mecum.

This is the fifth edition of a valuable work by Mr. George Bousfield, published at 4s. by Messrs. William Rider & Son 14, Bartholomew Close, London, E.C. It deals in a comprehensive manner with every kind of measurement required and practised in the timber trade, and several new tables, problems, and rules, peculiar to the requirements of the trade, have been added, with a brief treatise on the slide rule. Much useful information will be found by the reader on the various kinds of foreign and home-grown timber, mouldings, and terms used in building.

74.—Aluminium: Its Uses and Alloys.

Let me take this opportunity of telling the readers of WORK that any information they may require respecting aluminium can be obtained from the Alliance Aluminium Company, Limited, 7, Great Winchester Street, London, E.C., who issue, and, I presume, supply, to intending purchasers an exhaustive pamphlet on aluminium, its qualities, and the method of working it, named as above. The Company produce and supply four qualities of metal, distinguished

A A, A, B, and C. The first quality has a guaranteed purity of 98½ to 99½ per cent., the impurities making up the hundred parts consisting of iron and silicon only. This is sold at 1s. per lb., or 1s. 3d. per oz., and is particularly recommended when almost absolute purity and that softness are required. The least pure quality c contains only from 90 to 95 per cent. of iron and silicon, and is sold at 11s. per lb. For orders of 2 cwts. and over these prices are considerably reduced. THE EDITOR.

SHOP:

CORNER FOR THOSE WHO WANT TO TALK IT.

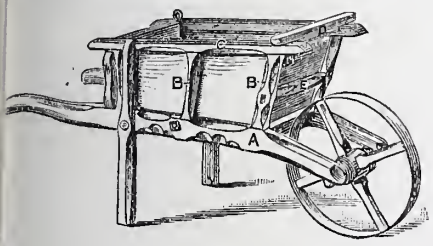
NOTICE TO CORRESPONDENTS.

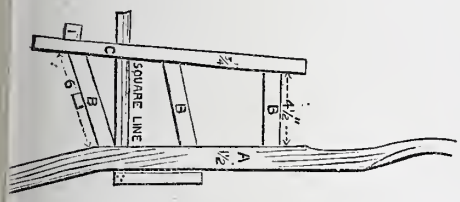
In consequence of the great pressure upon the "Shop" columns of WORK, *contributors are requested to be brief and concise in all future questions and replies.*

answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Child's Barrow.—H. J. A. (*West Hougham*) writes:—"I enclose a rough sketch of a child's barrow; if it is not plain enough, I will try to help you further if I can. It will look very well if you spend a little time and trouble in making it, and paint it a showy colour. The size of the stuff required is appended below:

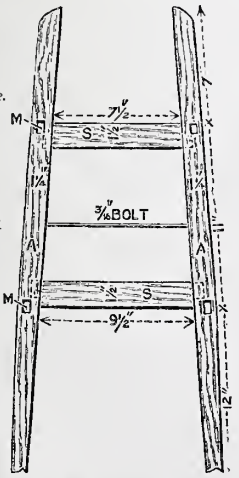




It will do for a child from the age of 4 years till it is 7 years.

SIZE OF STUFF FOR BARROW.

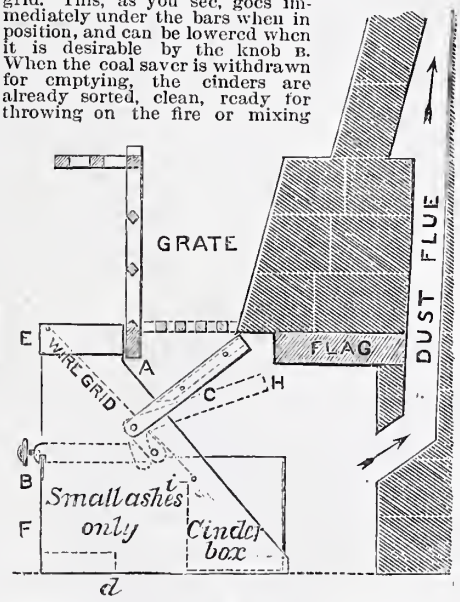
	in. deep.	in. wide.
Shafts (A)	1½	1¼
Cross Pieces (S)	1½	1½
Standards (B) ..	¾	1
Top Rails (C) ..	1	¾
Front Rail (D) ..	1½	1
Bar for front (E)	1	½
Legs	1¼	1¼
Boards for sides	¼	thick
Boards for bottom	⅜	,,
Bolts	⅜	,,
Wheel	10	high



Child's Barrow and Parts.

Circular Saw Teeth.—A. R. (*Scorrier*) writes:—"I would like to call the attention of the readers of WORK to Figs. 1 and 2, on page 403, No. 77, where it reads, 'the length, space, and rake of teeth. Figs. 1 and 2 I have proved to answer well.' It should have been stated how much the teeth had been reduced to those in sketch sent with letter. The length of teeth, Fig. 1, should be 1½ in., and space from point 2⅞ in.; and in Fig. 2, length of teeth 1 in., and space from point to point 2 in."

A Coal Saver.—J. W. B. (*Southport*) writes:—"Enclosed is a sketch of a coal saver of my own construction, and has been in actual use now for nearly two years. It has saved *tons of coal* and *clouds of dust*. I should have patented it only for one reason. Kitchen grates are not all of the same construction as to size of opening underneath, and the 'saver' could not be made for stock. It is a most useful article for a kitchen. Amongst its many advantages are: it keeps the hearth always tidy, as the rakings from the front always fall into it. The grid (wire) is fixed at an angle that ensures everything rolling either down or through, and so altogether out of sight. There is an inclined portion underneath the bottom of the grate which directs any cinders, etc., on to the grid. This, as you see, goes immediately under the bars when in position, and can be lowered when it is desirable by the knob B. When the coal saver is withdrawn for emptying, the cinders are already sorted, clean, ready for throwing on the fire or mixing



Sectional view of Coal Saver in position under Grate.

B, By pulling out knob B, the incline C is lowered so as to pass under A when being emptied. H, Position of incline when being taken out from under the grate. At the point *d* the inside front of the cinder box is made so as to go just under the lower edge of the wire grating.

with small coals. The cinder box can be lifted out. There is nothing amongst the ashes which can possibly be burnt, and it is simply a matter of carrying it to the dust-heap. When the cinder box has been removed there is no obstruction. It is merely a matter of tilting it up. Every cinder is collected, and that without trouble. The remainder is removed without the usual dust from sorting on the hearth. It is much better than a grid, because that has to be emptied at times. The top portion E is brass, plain. There are three brass knobs in front; the one on drawing being the centre one. A brass moulding might be put on the bottom round the front to point D. It would smarten it a little. It does not in the least interfere with the draught. Just about the point F I had some perforations, but they are not necessary."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Cement to resist Action of Carbon Bisulphide.—F. D. (*Dartmouth*).—The following cement has been kindly recommended by a friend who has had some experience in such matters. Soak some pieces of best glue in water until they are soft and swollen, then drain off all the water and make the glue into a cement by adding enough glacial acetic acid to thoroughly dissolve the glue. Then add a slight trace of strong solution of bichromate of potash, and stir all well together. This will resist the action of carbon bisulphide.—G. E. B.

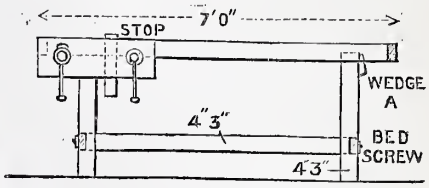
Softening Plaster Cement.—F. A. (*Peckham*).—Try soaking the silver mounts in a mixture of equal parts muriatic acid and water made warm in a porcelain or stoneware vessel. This should soften the plaster, and will not injure the silver or the glass. Be sure not to try this on zinc, tin, or brass mounts coated with silver, or on nickel-plated mounts. On plated mounts try a strong warm solution of potassium cyanide. I have known this to loosen mounts when I have not wanted them loosened.—G. E. B.

Engine.—SIDE LEVER.—Perhaps one of the makers will supply you with a set of drawings for a guinea or two, provided you are not a rival in trade. If they will not, make friends with an intelligent engineer, and get rough sketches from him, or permission to make sketches yourself.—J.

Pump Castings.—AMATEUR.—Any of the model makers supply these. Stiffin, 324, Essex Road, N; Lee, High Holborn; Bateman, High Holborn; Lucas & Dane, Hatton Garden.—J.

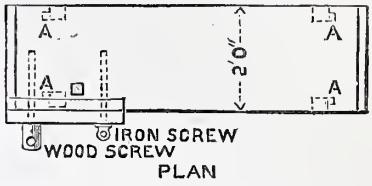
Battlesden Cart.—G. H. (*Camberwell*).—An article on the above appeared in WORK, No. 19.

Carpenter's Bench.—J. B. F. (*Brixton*).—The accompanying sketches show the elevation, plan, and end view of a bench which you will find give much more satisfaction than an ordinary joiner's bench, especially for home use. I have worked for years on one, and would not use the other



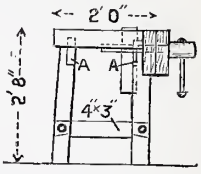
ELEVATION

pattern under any consideration if I could help it. The top is made of 4 in. beech, clamped at each end with a piece 1½ in. by 4 in. simply nailed on. The screw cheeks are of beech and the rest yellow deal. The legs are simply mortised into



PLAN

the top and fastened with hard wood wedges driven tightly in, as at A. The long rails are stubbed into the legs about ½ in., and the short rails halved on, and four 6 in. bed screws hold the whole together. This method makes it very portable. I have two screws to mine, as shown, and most people will tell you that this makes it a cabinet-maker's bench; but, if you once get used to two screws, I feel sure you will never want to work with one, unless you have one of the patent iron screws and cheek. There are several very nice patterns of benches that can be bought from £1 upwards; the one I have described can be bought for about 30s., made entirely of beech.—E. D.



END VIEW

Banjo Vellum.—J. K. (*Manchester*).—Brass wire is used for the edge of the vellum. To put on a vellum, get a vellum 2 in. larger than diameter of hoop; if your hoop is 12 in., you must use a 14 in. vellum. With a bradawl make a series of holes round the edge of vellum, keeping them about ¼ in. from the extreme edge and say about 1½ in. apart. Take a piece of string a banjo 2nd or 3rd string is the best, and long enough to go right round the edge of vellum—and thread it through the holes, taking care that both ends of the string come out on the under side of the vellum. Put the vellum in water to make it pliable, but do not let it stop in too long, say about one minute (some vellums are liable to tear if made too wet), let the water drain off, lay the vellum on hoop, put on the brass wire ring, pull the ends of string, turning up edge of vellum all round, pull the string tight so that the edge of vellum lays well over, tie the string, and then put on the band that pulls the vellum tight; put on six or eight brackets at equal distances apart, then pull down band evenly all round. Banjo makers use longer screws and nuts made specially for this purpose. Let the band stand up above the level of the edge of hoop, say about ¼ in., until the vellum is thoroughly dry before pulling down further, put on all the brackets, cut off projecting edge of vellum with a sharp knife, and then leave until thoroughly dry. When dry, it must be pulled down evenly and gradually, a little at a time, until the band is level with the edge of hoop. A good vellum, when properly put on and pulled down, ought to be as tight and with as little spring in it as a piece of board.—J. G. W.

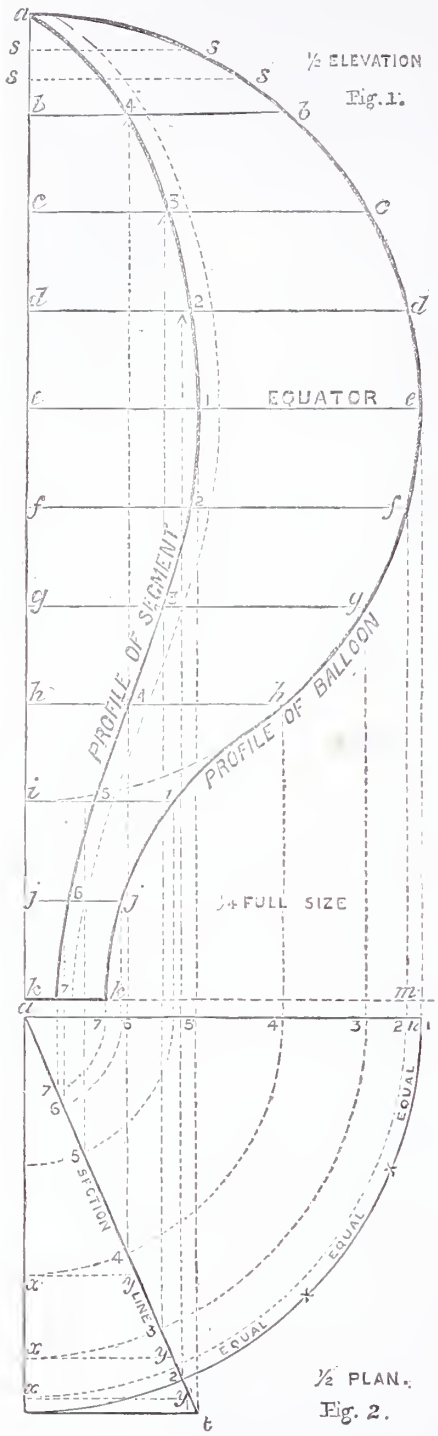
Bassinette.—A. M. (*New Brighton*).—In your letter you say you are a toy dealer, and that you wish for detailed particulars sufficient to enable you to make a bassinette. Now at first I thought it seemed that you considered there was an opening in your business which could be beneficially filled by the sale of toy bassinettes; but upon thinking twice I concluded that you would not make such as these yourself, you would purchase them cheaper, and what you really required was a bassinette for your own, or, I should say, more correctly speaking, for your child's or children's use. I think you will agree with me that it is extremely unlikely that many readers would wish to make a bassinette; for we must not presume that all of them are married men, although I do not suppose by saying this that married bliss detracts from a man's character—the reverse is, I believe, the fact; but please remember I am a bachelor. Furniture, on the

other hand, and many other things, can be used by both single and married persons. I, and others, frequently give designs for furniture, etc., to applicants in our "Shop," with but scanty details. The reason for this is that we do not wish to disappoint an inquirer, and so give as much as space will allow, knowing that many other readers are fully acquainted with wood-work details, and may find the designs acceptable. I could give a design of a bassinette here, but it would serve no useful purpose either to you or others, for a few pages of WORK would be required to adequately describe the construction; and I am afraid that but few readers would be so well acquainted with such particulars as with wood joints, etc. But, probably, in due course, you may find this subject taken up and treated upon fully.—J. S.

Cast Iron Softening.—F. J. (*North Finchley*).—Put the castings in an iron box enclosed in coke screenings, cover with a layer of fine sand well damped, heat in a furnace to a low red heat, and allow to cool gradually. Or steep for twenty-four hours in a mixture comprising one part of nitric acid to four parts of water. This will barely penetrate below the outside skin.—J.

Manufactories of Pins, Mohair Laces, and Elastic.—E. B. (*Bristol*) asks where manufactories of these articles are to be found in the United Kingdom. As pin manufacturers I may mention William Avery & Son, Headless Cross, Redditch; and as makers of mohair laces and elastic, Riddle Brothers, Great Victoria Street, Belfast.—S. W.

Enlarging Diagram, Paper Balloon Making.—W. T. P. (*London*) asks how to enlarge "fairly correctly" the diagram given in reply to J. T. J. (*Manchester*) at page 245 in "Shop," WORK, No. 67. I would, were I in W. T. P.'s place, prefer to construct, full size, entirely afresh, a segment of the balloon I intended to make, rather than enlarge the diagram alluded to, which is professedly only "something like" the shape. I therefore give him a method of ascertaining the form of the required segment, which is of other practical utility, and is capable of very varied application by draughtsmen of every description, and in handrailing for staircases. First draw a half elevation of your balloon full size, see Fig. 1, commencing with a perpendicular line *a k*, and a horizontal line *e e*, which I have marked "equator," as it represents a "great circle" of a globe; with *a e* in your compasses draw a semi-circle almost to *i* on the line *a k* (the portion I have dotted shows the part not necessary to be drawn except to determine the point *i* where it cuts the perpendicular). The radius *a e* should be half the intended height of the "globe" part of your balloon, exclusive of the neck, the length of which latter now decide and mark off at *k k*, and half the width of which is the length of the line *k k*; prolong this line horizontally to *m*, so that *k k m* is equal to *e e*, and then on *m*, as centre, with *m k* as radius, through *j i* describe an arc which will meet and die into the semi-circle at a point between *h* and *i*. This line *a e h i j k* is the profile or *contour* of the half of your balloon. Now divide *a e* into any number of equal parts—the more divisions the more exact will be your drawing; but I have selected only four so as not to encumber the diagram with too many lines, and so confuse it. With the same division in your compasses divide *e i* into the same number of parts, and *i k*, which should be half of *e i*, into half that number of equal parts, and draw horizontal lines from these points as at *b, c, d, e, f, g*, etc., to the periphery or profile line. To keep clear in your mind, regard these horizontal lines as representing the position of the smaller circles on a globe *i e*, as the edges of circular planes parallel to the equator. This completes the half elevation. Now proceed to make a half plan thus (see Fig. 2):—Drop the perpendicular of Fig. 1, viz. *a k*, still further, and upon any point thereon, say at *a*, Fig. 2, with *a t* as radius (which should be the same radius as *a e* in Fig. 1), describe a quarter circle or quadrant as shown, and draw from the centre *a* the horizontal line *a n*. Next decide how many segments you intend to make your balloon consist of; the more segments the rounder it will be, and the more troublesome will be the pasting. I have selected eight, because I am referring to OPIFEX's reply as above, but for large-sized balloons I should prefer ten or twelve. Anyhow, the construction is practically the same; whatever the number of segments decided upon may be divide your quarter circle into half that number, as you see I have chosen eight and divided my quadrant into four equal parts. Now join your first division at 2 with the centre *a* by a straight line and prolong it a little to *t*, and draw a horizontal line *t t* to meet it, which is a tangent to the quadrant *n t*. Keep clear in your mind what this line represents; it is the length of the curve *t* 2, straightened out, as though it were no longer *bent* but *flat*. It is not exactly the length being only an approximation to it, but it is sufficiently accurate for the purpose. This completes the drawing of the half plan. Now to find the points through which the outline of your half segments will pass, drop perpendiculars from Fig. 1 at *e, f, g, h, i, j, k*, on to the line *a n* in Fig. 2 as shown, viz., the dotted lines *e n, f* 2, *g* 3, *h* 4, *i* 5, *j* 6, and *k* 7. Then with your compasses turn the arcs, dotted, until they cut the line *a t*, which represents the edge of a section plane, right through the balloon, perpendicularly passing through its axis and north pole *a*, and remember, for clearness' sake, that where this section line *a t* cuts the quadrant *n t*, which represents in plan the equator *e e* (in Fig. 1), it gives the point on *e e*, at which such a section, if actually made, would cut the equator, viz., at the point 1, or nearly that point. I say nearly, because I have drawn the point 1 not as it would be if the segment were curved, but as if it were projected out to the flat, as W. T. P. wants to cut out his segments of *flat* paper. Therefore to find the point 1, draw the perpendicular upwards from the point *t* at the end of the prolonged portion of *a t* beyond the quadrant, till it cuts the equator in Fig. 1. Now proceed with the arcs 2 2, 3 3, 4 4, etc., in like manner, drawing the dotted lines *x y, x y, x y*, horizontally till they cut the section line A T; and erect perpendiculars



Enlarging Diagram, Paper Balloon Making.

from these points of intersection cutting *b b*, *c c*, *d d*, *f f*, *g g*, *h h*, *i i*, *j j*, and *k k* (in Fig. 1) at the points 2 2, 3 3, 4 4, 5, 6, and 7 on those lines. In my diagram, as all this construction in dotted lines would be confusing, I have omitted to take the points from the intersection of tangents with the section line as bases for the perpendiculars, preferring to take instead the intersections of the arcs with section line as their bases, which is, I admit, inaccurate, but is near enough if allowance be made afterwards in sketching in the curve of the profile of half segment, as I have done above. This sketching will be rendered the easier, the greater are the number of horizontal division lines which have been drawn, and the greater will be the accuracy, especially at the crown on north pole of balloon, where I have dotted in the lines *s s, s s*, giving three extra divisions, thus regulating the curve *a* 4, if the same process of construction as that for the other points be gone through as before. When you have sketched in with a firm curved line joining these points 1, 2, 3, 4, *a* above, and 1, 2, 3, 4, 5, 6, 7 below the equator, dot in a parallel curve as shown for the lapping over of the pasting, or as the ladies would say, the "turnings in." Having thus obtained a half segment, trace it and turn it over on the perpendicular *a k*, Fig. 1, and laying eight sheets of paper the right size one upon another, with your pattern on the top, and with a flat iron or two, or other weight, to hold them down, cut right through them with a pair of shears, and all your segments will be exactly alike. Do not forget to cut by the dotted line or they will not fit when pasted, overlapping each other. You may vary the effect by using alternate segments of blue and white, pink and white, or other colours. If you desire a circular crown, as recommended by OPIFEX, cut a circle out and snip the edges every ½ in. to enable it readily to take the curve, or it will either keep flat or pucker. For the pasting follow instructions given by OPIFEX, except that gum is always very difficult to manage. I prefer stiff paste, such as printers use, which should be very sparingly used; it dries almost as quickly as it is put on, does not wet the paper so as to pucker it, and does not crack afterwards.—J. W. H.

Adhesive Gum.—J. T. J. (*Manchester*) wants "some kind of adhesive material which shall be in a portable form quite dry and solid, but which would dissolve in spittle or water and be quite tasteless." I do not know precisely where to recommend J. T. J. to procure what he requires, but he might ask at Grundy's, Exchange Street, or Lomax's in Cross Street, Manchester, for *mouth-glue*, if they are still in existence. I used to buy it there thirty years ago or more. If it is no longer sold, for there cannot be much demand nowadays for it, I believe it is made in the following manner:—Steep in cold water for several hours gelatine glue or best "Scotch," pour off, say, next morning, all superfluous water not soaked up, place the jelly in a clean glue-pot, boiling it at a regular heat for several hours, renewing the water in the outer pot as it simmers away, and taking care not to let the outer pot get dry, or it will burn and render quite useless the glue in the inner pot. When it runs clear and limpid in a fine stream from the stirring stick add a very small quantity of powdered sugar candy. Make a small box of wood, the inside of which should be the size of the stick required, say, 3 in. long by 1¼ in. by ⅝ in. deep; and when the sugar has been thoroughly melted and stirred well into the glue, pour out enough into the box or mould to fill it. First oil the mould with thick oil or lard to prevent it sticking to the glue. When cold this glue can be readily moistened by spittle, and will only taste slightly sweet of the candy; but no injury will be done to it, if, whilst hot, one or two drops of essential oil of cloves, cinnamon, or essence of lemon be added to give a flavour preferable to that of mere sweetness. Vanilla, raspberry, orange, peppermint, musk, or whatever flavour J. T. J. prefers can be as easily put in. I have mounted moist sheets of Whatman's drawing paper on drawing boards with mouth-glue, both purchased as above, and with glue thus made for water-colour drawings, as also sheets of parchment for patent drawings, when such were required by the then Patent Law.—J. W. H.

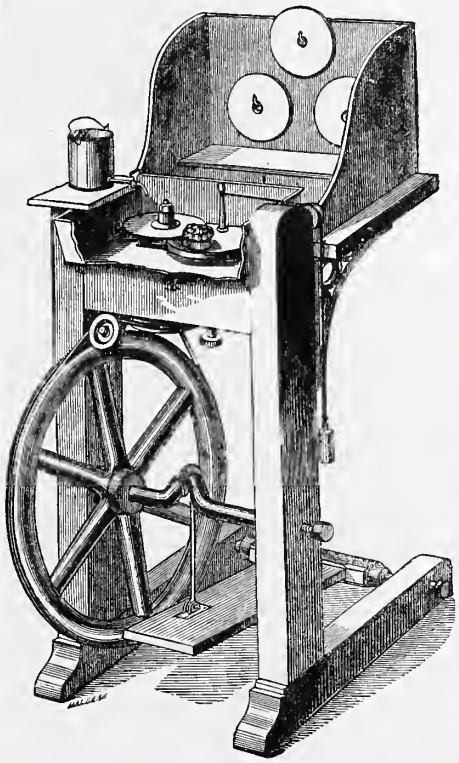
Pattern Maker's Tools.—A SUBSCRIBER.—No; your carver's tools will be of little value in pattern work. A few of the gouges will have a limited use in some core box work, and that is all. A carpenter's kit would, in the main, be required; but there are special tools, such as paring chisels and gouges, that are wanted in addition. I gave a list of pattern-maker's tools some time since to a correspondent in WORK, which you can turn up and refer to. You will not be able to work at pattern making without a lengthy previous training. A mere knowledge of wood working is not sufficient, but you must understand the moulding of patterns as well.—J.

Perforating Designs.—E. E. (*St. Pancras*).—Notwithstanding the very admirable way in which you describe all the details, an example which I wish every correspondent would follow, you leave me to guess one very important point—namely, the purpose of the perforation. I will therefore suppose that it is for the purpose of "pouncing." I have never done myself more than one or two of these, as I much prefer to use "gelatine tracings," or fish-glue tracings, and now suggest to E. E. to try this plan from the following description, after which, in case he prefers "old grooves," I will give him a "wrinkle" in that direction also. Take a sheet of gelatine or fish-glue (procurable at any first-class artists' colourman) and fix down over your design (just as is done by chromo-lithographic artists), and with a "dry-point" carefully trace every line you wish to reproduce, cutting in the lines sharply like an etching. In designs where a part is repeated, trace only one repeat and such "register" marks as are necessary to ensure moving your tracing to the exact spot you require. (Fret-workers please note this useful "Means, Mode, and Method.") Of course it will be necessary to trace right-hand and left-hand portions of the design. Having prepared your tracing nicely, and sharply cut with the "dry-point," which, perhaps, I had better describe as a needle

xed in a holder or handle, with a triangular point, ot a round one, fill in with dry, finely-powdered olour, white, black, red, blue, etc., according to our subject and its after processes (of which you nust recollect I am left somewhat in the dark), very part of the in-cut line. Now turn your sheet, after dusting off carefully all superfluous colour rom its surface, leaving only the lines full, downwards on to the surface you are about to use, and with a piece of indiarubber go all over the design, when you will press out, in continuous lines, the colour (which is upside down in the fine grooves of the tracing) on to your surface. I am obliged to assume, for the purpose of clearness of explanation, that E. E. and other readers are not conversant with this method; if he or they have seen or practised it, I crave their indulgence for the sake of others who may not have heard of it and yet may see some new adaptation of it. I would suggest to plumbers, for instance, that where they want to cut out a dozen or more pieces of sheet-lead all exactly alike, this plan would suit them "down to the ground." Once the tracing is made, it never deteriorates, and can be used over and over again simply by refilling the lines with fresh colour. I believe that with the Birmingham japanners these tracings have long ago superseded "pouncing," and for porcelain painting on flat surfaces, where plates, etc., are required all alike, it would be invaluable. A tracing thus made in full continuous line would take less time than perforating in equidistant dots; besides, the perforation is very imperfect, as the holes are merely punctured, not cut clean out, and the paper inside the hole-area, so to speak, still hangs about, as it is not got rid of. Again, in folding a design into quarters, as E. E. describes, some of the holes, when the perforated paper is again spread out flat, are upwards, and others downwards. However, to get over the perforating quicker, let me recommend E. E. to get a piece of vulcanised indiarubber about 1½ in. by 1 in., and ⅛ in. thick, and force through it lengthwise eight or ten needles at regular intervals, until their points are in line. This can be done by warming the needles, not so far as to injure their temper, but enough to soften the rubber, which, when cold, will adhere to and maintain them in position. E. E. will now be able to prick eight or ten holes instead of one at a time, and by bending between thumb and finger the elastic rubber, he can fit any curve of the design, forcing the needles through by pressing with a flat piece of wood or bone with the left hand, using the right to keep the needles exactly on the lines of the design. Perhaps he might find, with some little practice, that even twenty needles would be manageable; or, again, he might have different tools, some five, some ten, some twenty points each, whilst for straight lines he might cement a thin piece of brass (such as printers' brass rule) to one side of the rubber to prevent its bending. Being most anxious to help, if E. E. or any other correspondent tries either plan and should encounter any difficulty, pray write again detailing minutely what the obstacle is. Let me add, that when requisite to repeat left-handed a portion of a right-handed design accurately, a very simple expedient only is necessary, viz., to fix to a sheet of glass the design with its face down, and then trace on the gelatine through it by means of light, or reflected light behind it, tracing the other part with the face of the design next the gelatine, which will give the right and left properly reversed. Tell us how it acts.—J. W. H.

Painting Cart.—APPRENTICE (*Westfield*).—Your chief difficulty will be in getting the groundwork right preparatory to painting your cart. To paint it from the bare wood to the finishing process of varnishing proceed as follows:—In the first place, give the cart a coat of lead colour all over, composed of boiled oil, white keg lead, and a little lampblack. In a few days after give another coat of lead colour thinned down with turps. When dry, stop all screw or nail holes and cracks up with putty made of whiting, keg lead, and japan. Stop all over, including the wheels, and do not miss a single place. In a couple of days after give another coat of lead colour. Now mix a can of filling. Get 3 lbs. of patent filling and 1½ lbs. of keg white lead, and mix into a stiff paste. Put this into a can, and thin down with half a pint of gold-size and varnish mixed; thin it down also with turps until workable. Use a moderately large tool, and give the top and the outside of the body only a coat of this filling until it has had six coats, giving it one coat daily. Now mix a coat of staining colour. Get some red Indian or Tuscan, and mix in pot with turps, and also a little gold-size just to bind it, and give the filling a coat of this all over. When dry, commence to rub or scour down. This rubbing down is very dirty work, but upon it depends the after beauty of coach painting. Get a piece of pumice-stone, sawn across the grain, and a bucket of clean water, with a sponge and leather; also a piece of bath brick and a flag. Rub the pumice-stone upon the flag to get it smooth, using plenty of water. Get your sponge full of water, and rub the panel; then scour the panel with the pumice-stone, and keep scouring and rubbing and washing the panel off until you get all the red off, then it is quite smooth. The Bath brick is to keep the pumice-stone clean. When the body is rubbed down, leave for a couple of days for the water to evaporate out of the filling; then dust well down, and give it a coat of finely-ground lead colour. When dry, sand-paper it all over with very fine sand-paper, and give another coat of lead colour. If the cart is to be painted black, give it a coat of dead black, and afterwards a coat of black japan. If of another colour, first give it a coat of dead colour, and, when dry, add varnish to the colour left, and give it another coat of varnish colour. If the wheels and springs are to be painted lemon or vermilion, you must paint the wheels, springs, and shafts white, with a little of the colour added to it. This will make a good ground to work upon. Next flat the cart down, and the wheels, etc., with a cloth pad and water, using a very little of powdered pumice-stone. Next pick out and fine line the cart, wheels, etc. Also paint the inside of the cart, all round the sides, under the seat, buff or cream, made of white lead mixed with oil and a very little of black japan. Next wash off the cart well; then dust it from lint, etc., and give it a good flowing coat of carriage varnish in a warm room, keeping the heat up until dry.—W. P.

Cutting Agates, Jaspers, and Opals.—E.L.B. (*London, S.E.*).—The cutting of opals with the fewest number of tools was described in "Shop," WORK, No. 59, and this is in fulfilment of my promise to make inquiries about some simple means of cutting and polishing the harder stone—agate. In that quest I have not had perfect success, but, as it may meet your requirements, I proceed to describe it. First and foremost, it seems to me that you must have a lathe of some sort or other, for the amount of friction to be obtained by using one's hand only makes the job an everlasting one, if even it is not quite impossible. Given the lathe, then you must fit on to it three



Lapidary's Lathe.

discs of wood as large in diameter as you conveniently can—suppose we say nothing under five inches? The first of these—the wood mill or lap—should be made of sycamore wood, at least ¾ inch thick. The powder used with this mill is fine emery, and is applied to the front with water. With this you will have to do all your shaping and cutting, and all hollows and irregularities of shape must be removed by this mill. Another disc of wood you will have, use in making a list lap. That is made out of the selvedge of cloth, yards of it coiled round and round in one compact mass, and finally glued firmly to the wooden disc that is already fitted, or that can be fitted, to your lathe. Any wood will do for this one and the next, providing that it will not split. The material used with this list mill is powdered pumice and water. When you have got a good surface on your stone with this, you will require another lap for finishing with, to be used with putty powder and water. Now, if you make two list mills, one can be used for putty powder, but a disc of wood faced with buff leather is the correct article. The stones are fixed for cutting in the same way as opals, and of course you can polish opals on these laps better than in the rough method spoken of before. The sycamore wood, I am told, can be obtained of Tyler, Mortimer Market, Tottenham Court Road. Jewellers sometimes use arrangements like those described above, but it is only for an odd job. Such tools restrict the worker to narrow limits, for no means are here used to slit pieces off, they must be ground away. Then the vertical rotation of the mills is not considered the best, it is the horizontal portion which is used by the lapidaries for cutting everything from pastes to diamonds. Evidently other scientific amateurs have been in the same straits, for one of them has devised a lapidary's lathe for cutting microscopic specimens, which, of course, can be used for the simpler work now in question. It is made exclusively by Messrs. Cotton & Johnson, 14, Gerrard Street, Soho, W.C., and its price, with the same fittings as the one I shall next describe, is twelve guineas. The diagram herewith is the general aspect of the machine, and it possesses a great advantage to amateurs, viz., it is driven by the foot, consequently both hands are at liberty to attend to the work. One firm publish a small pamphlet, which you could, no doubt, obtain by writing for it or calling. The other one they make is a "portable lapidary machine," length thirty-one inches, breadth sixteen inches, height over all twenty inches, which can be reduced to seven and a half inches when the separate parts are taken to pieces and packed inside. With this and the other is supplied a very clever arrangement for holding and adjusting the position of the stone with regard to the mill; it is called a facetting machine, and they claim for it that it is possible for any amateur to cuts facets on stones correctly. There are three laps, viz., lead, wood, and the slitting disc, and three cement cups, and the price is £6 15s. This is a horizontal mill, and has to be driven by the left hand while the right attends to the work. The polishing powder (mine are what they consider the complete set), the cement, and cement sticks can all be bought there, as well as the diamond, already powdered, for this slitting mill. For a great amount of detailed information on this subject, you cannot do better than get Vol. III. of Holtzapffel's "Turning and Mechanical Manipulation," where under Section II. is found a descriptive catalogue of the apparatus, material, and processes for grinding and polishing commonly employed in the useful arts. This part goes pretty fully into the matter, but further on, in the same volume, is a chapter on lapidary's work; it is undoubtedly the best and most complete that has been published. By-the-bye, the facetting machine replaces the "gim" peg spoken of and illustrated in that book. If you study this, there is not much fear but you will succeed; but if, after all, there are any details you cannot master, then I am still at your service with the greatest of pleasure.—H. S. G.

Lantern Lens.—J. McMo (*Edinburgh*).—In all probability your lens was originally made for photographic work, and if not of too long a focus—that is to say, supposing that it will give a picture on the ground glass when held in front of the lens opening in a camera and properly focussed so as to obtain a sharp picture—you will be able to use it as such without alteration. If, however, the picture is formed further away from the ground glass than the length of the camera will allow, you must use it on a camera of longer focus. By uncovering the front combination of the lens you will see that it is formed of a double convex and a plane convex lens, with the concave side of the glass ground in such a manner that the convex side of the other fits into it, the two being cemented together with Canada balsam. If you can remove the back combination from the mount and secure this front lens into its place you will thus have a view lens suitable for ordinary landscape work; but you will in all probability require a long focus camera, as it is the two combinations together which form the short focus usually required in a lantern lens. Even supposing that the lens was not intended for photographic work, you will be enabled to use it in the manner above directed; but it will doubtless be slow in working, and will most likely be capable of giving pictures 8½ in. by 6½ in. (whole plate size).—C. A. P.

Bright Stove Work.—STOVE MAKER.—I do not quite understand your question. You say you want something that will keep your polished parts of stoves bright for an unlimited period. Do you want the polish to show, or does it not matter as long as it does not rust? If the former, I should say, give the parts a coat of clear varnish, the polish will then last as long as the varnish does; but as you make them for sale, I should think the better plan would be to melt some mutton suet in a clean vessel, and rub the bright parts with it whilst hot; of course the polish will not show, but it can be easily rubbed off to show a customer.—R. A.

Chucks.—J. S. (*Dorchester*).—In Vol. IV. of Holtzapffel's "Mechanical Manipulation," pp. 567, 569, you have a full description of chucks for turning tobacco pipes. It is the best book on plain turning; published by Holtzapffel & Co., 64, Charing Cross, price 20s. or 25s. I have not myself done that work, but could sketch the chucks for you if you don't care to get the book.—F. A. M.

Fountain.—RALPHO.—I am unable to comply with your modest request for "an everlasting perpetual fountain," but an article on quasi "Self-acting Fountains" appeared in No. 69. This will probably interest you.—C. M. W.

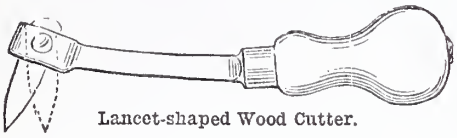
Lathes.—C. C. (*Darlington*).—I hope to write again upon "Lathes and Turning Appliances," and the subjects you name should come amongst the first to be treated.—F. A. M.

Answers in "Shop."—C. (*North Shields*).—Arrangements are being made by the publishers of WORK to deal more promptly with the great strain upon the "Shop" columns of WORK.—F. J. C.

Millboard Rings.—F. T. (*London, N.*).—The best tool I could recommend for the work is a mount cutter's knife, which needs some practice

to use with economy; or if you cut a large number one size it would be the best way to have an iron stamp made and a letter press would cut them; but I should think you could get them ready cut at a very small cost. I should advise you to send a pattern and quotations to the City Frame Co., 29, Basinghall Street, London, E.C., who would give you a price for the work ready cut.—G. R.

Printers' Wood Letter.—G. P. (*Sussex*).—Wood type has for many years been cut entirely by machinery, first on end grain and latterly on side grain wood, by means of a sort of governing pantograph with a revolving cutter at the other end, and a tracing point wherewith to follow the copy at the actuating end. By this means the letter can be cut to any proportionate size of the original by merely altering the foci or centres of the pantograph. But if G.P.



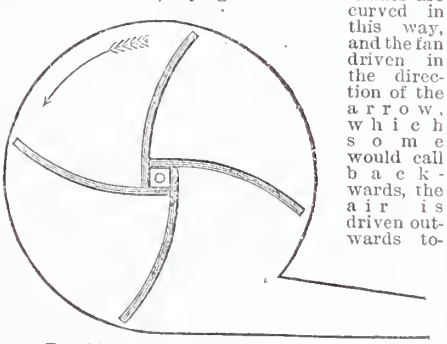
Lancet-shaped Wood Cutter.

wants letters, say, anything above 24 line (*i.e.*, more than 4 in. high—6 lines to pica equals 1 in.), he can cut them in pine (best) with a tool similar to our illustration for outlining, and take out the white portions with small gouges cheaper than he could purchase them. If pine be well soaked in raw linseed oil and allowed to dry, it will last as long as any hard wood such as sycamore, and is only half the weight, which enables the formes to be carried about at half the cost.—J. W. H.

Metal Tubing for Nickel-plating.—W. L. C. (*Aberdeen*).—Metal tubing of all sorts can be obtained from Messrs. Cotton & Johnson, 14, Gerrard Street, London, W. They supply some of the large nickel-plated pencil manufacturers, so you will get exactly what you require there. The particular make used is called "triblet drawn tubing," that means that the tube is drawn over a triblet or mandrel, the result being that it is smooth and regular, both inside and outside. This sort is kept in stock from ¼ in. to 1½ in. diameter. Its cost is from 1s. 10d. per pound downward. It is kept in lengths of about 4 ft., but the firm supply any lengths as required. The small tubing down to ⅛ in. diameter is not triblet drawn. You will find that the firm will pay immediate attention to any communication you make.—H. S. G.

Overmantel.—E. H. (*Stockport*).—There is no reason why you should not make use of picture-frame moulding for such an overmantel as you describe, but I am afraid the result will not be happy. Of course a great deal depends on the pattern of the moulding you select, and the simpler it is the better. If you are content to have only one frame, oak moulding will look very well, but I do not like the three frames. You cannot prevent the end ones looking too much like additions. They will not look like part of the original design, but will give the impression of being the result of an afterthought. If you want to frame the oleographs, do so, but do not join their frames to that of the mirror or centre part. Leave a small interval, and then there need be nothing unsuitable in the arrangement. Sizes must depend a good deal on your own taste and on circumstances of which I know nothing, such as size and height of room, limit of expense to which you wish to go, etc. Get the spindles done by any turner.—D. D.

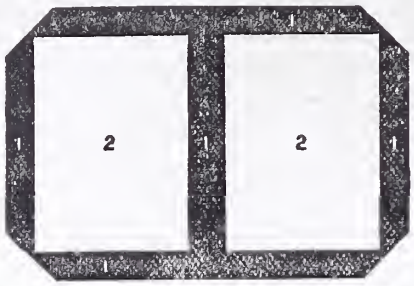
Fan Blowers.—W. J. (*Cheltenham*).—All that is meant by curve refers to the blades of the fan, which are curved to radius of 12 in. or less, as shown in the sketch accompanying. When the blades are curved in this way, and the fan driven in the direction of the arrow, which some would call backwards, the air is driven outwards to-



Fan Blowers, showing Curved Blades.

wards the circumference of the case. If it were driven forwards—*i.e.*, opposite to the direction of the arrow—the air would be gathered in towards the centre; of course it would blow after a fashion, but not nearly so effectively as by the former way.—A. S. P.

WORK for Reference.—'PRENTICE BLACKSMITH.—There have already appeared in WORK designs and suggestions for covers and fretwork case for our esteemed and useful periodical. 'PRENTICE BLACKSMITH, however, does not seem to have been suited. Therefore we will try another plan. If he can make or procure a portfolio of the required size—that is, a pair of covers joined to a flexible back—he can easily stretch a number of elastic cords from end to end of the central portion, and



Folio for WORK. 1, 1.—Leather or Cloth Cover. 2, 2.—Millboard. The Margin of the Cover is to turn inside the Boards; a Paper Fly-leaf will cover the inside and make all neat.

slip each number under one of the elastic cords. P. B. had better read Mr. Clarkson's capital articles, and he will learn how to make a portfolio very quickly; but if he takes a pair of millboards the required size, and covers them with leather—I have used skiver and roan, the latter being upholsterers' remnants—using glue and patient care, I have no doubt he will succeed; but the best plan after all is to have the numbers bound, or, taking advantage of Mr. Clarkson's instructions, bind them yourself. The folio, however, may be a useful hint, and instead of leather, American cloth or leather cloth is a cheap and durable substitute.—B. A. B.

"WORK" Exhibition.—The secretary writes, in answer to a crowd of correspondents, that he takes the words "subscriber to WORK" in their widest sense—*i.e.*, any reader who "subscribes to" or "endorses" our efforts to make it a useful magazine by making it known amongst his, or her, friends, and takes an interest in the articles and in "Shop." No proof is required; it must be, and is, left to the conscience of everyone who applies for space, and to his, or her, witness's conscience as to whether they are now, or will be in future, WORK readers and co-workers. He also wishes it to be distinctly understood that it is out of his power to make any individual exceptions from the conditions and regulations governing the exhibitors, and in this connection wishes to point out that no exhibit, even if it bear the official label, will be received in an *unpacked* state. He finds many people imagine that they require separate application forms for each exhibit. This is not the case unless they come under different groups, when a separate form is necessary only for such group, be the exhibits one or more, in such group. Official labels are in no case issued until the application forms are not only received, properly filled up, but are also granted; and these labels cannot be afterwards exchanged or supplemented. It is as well, therefore, to send a requisition with the application for space, stating whether one or more packages will be necessary, noting that in all cases a separate label will be issued, even to the same exhibitor, for each *group* under which he enters, which, in case he chooses to enclose both in one package, should *both* be affixed outside. Exhibitors in London preferring to deliver their exhibits personally cannot have them back on demand; they will in all cases be returned by carrier, and the carriage will have to be paid on delivery. *No exhibitor* will, on any pretence whatever, be allowed inside the exhibition either before its public opening or after its final closing. In conclusion, the secretary earnestly wishes intending exhibitors to forward their applications for space to him at the earliest possible moment, and not to procrastinate by waiting till the 30th October (the last limit allowed), as at the present rapid rate all available space will be allotted long before that date. Finally, he begs correspondents to write their names and addresses legibly, as several letters have been returned from the post-office owing to uncertainty arising from such illegibility.—J. W. H.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. K. (*Plymouth*); E. E. K. (*Plymouth*); FRETWORK; AMATEUR; E. H. (*London, N.W.*); FAIR PLAY; J. H. G. (*Sheffield*); S. E. (*Camberwell*); J. F. (*Birmingham*); J. S. B. (*Devonport*); W. P. B. (*Southport*); SAWYER; R. W. M. (*Kildare*); OLD BOY; J. M. (*Glasgow*); W. H. P. (*Chelmsford*); W. C. B. (*Poplar*); R. J. W. (*Fulham*); E. T. (*Dudley*); J. M. K. (*Westmoreland*); D. L. (*Blairgowrie*); J. H. F. (*Sheffield*); R. H. P. (*Cornwall*); G. B. (*Islington*); W. C. (*Hulme*); J. B. (*Devon*); A. M. (*Willenhall*); YOKEL; SAUL; MIEUX QUE CA; D. C. (*Kilmarnock*); BARTLETT; LIMITED; ELECTRIC; F. B. (*Cardiff*); E. G. W. (*London, S.W.*); CONSTANT READER OF "WORK;" C. C. (*London, N.W.*); E. W. (*Peckham*); G. J. C. (*Lewisham*); S. J. S. (*Acton*); W. C. (*Birmingham*); H. J. G. (*Northampton*); J. T. W. (*Sunderland*); C. W. (*Barnsbury*); BOOT-LASTS; F. J. C. (*Maidstone*); ONE OF OUR READERS; E. O. N. (*London, E.*); A. B. L. (*Barnsley*); E. A. D. (*London, W.*), BAMBOOZLED; R. W. (*London, W.C.*); ARNOLD; AMATEUR; J. J. (*Glasgow*); W. T. (*Exeter*) AMBITIOUS HEIGHT; A. S. (*London, W.*); J. W. R. (*Hants*); F. C. J. (*Rotherham*); J. G. (*Sheffield*); W. M. (*London, N.W.*); R. H. W. (*Hackney*); H. M. (*Liverpool*); J. MCA. (*Barrow-in-Furness*); H. H. M. (*Glasgow*); KALULU; A. R. (*Glasgow*); W. MCC (*Hull*); W. G. (*Devonport*); R. J. A. (*Newcombe*); F. T. (*London, N.*); TAILOR; T. D. (*London, W.*); R. J. G. (*Northampton*); GHOST; W. H. S. (*Hammersmith*); F. W. C. (*Stratford*); S. C. (*Sheffield*); E. L. T. (*Oporto*); F. W. (*Kennington*); CONSTANT READER OF "WORK"; N. MCK. (*Oswestry*); R. W. G. (*Chester*); H. M. F. (*Colchester*); A. S. T. (*London, E.C.*); J. B. (*London, W.*); A. H. (*Winsford*).

Trade Notes and Memoranda.

IN America the use of raw hide for gearing has come largely into use. It is often necessary to employ gear wheels running at a high rate of speed, and the wear which takes place, together with the accompanying noise, makes their use objectionable. Many attempts have been made to overcome these defects, and patented solid raw hide gears, made by the New Process Raw Hide Company, of Syracuse, N.Y., have met with remarkable success. In the manufacture of the raw hide great pressure is applied, and all superfluous matter eliminated, leaving the same extremely light, and making it the strongest material for its weight known. The blanks are first cut, then a number laid together, and the teeth afterwards shaped out. The wheels so made have come into extensive use on electric cars, where their silent and even operation has added much to the comfort afforded by these cars. These gears may be run together or against metal gears, and require no lubrication. They are not only remarkably durable in themselves, but it is claimed that the life of large iron gears is longer, used in connection with them, than when running with metal pinions.

A SYNDICATE has been formed and the money found for the utilisation of the Niagara as a motive power. The names of Mr. Pierpont Morgan, Mr. W. R. Vanderbilt, Mr. D. O. Mills, and Mr. Jessop, guarantee the interest taken in the scheme by American capitalists. The president is Mr. Edward D. Adams, with vice-presidents, treasurer, and engineers complete. It is found that 4 per cent. of the total flow of water over the falls would develop 120,000 horse-power; and the scheme is to divert this small part of the terrific current around the town of Niagara, and bring it out, by means of a tail-race, underground. The new company, with property above the upper rapids, will take the water from the river by short canals to the wheels located in vertical pits, and from them discharge through a tunnel used as a tail-race into the river below the falls. This rock tunnel, of 490 square feet area, will have sufficient inclination to carry off the whole of the water which has passed through the turbine motors. Although it is proposed to develop a very large amount of power, the water abstracted from the river will be a very small proportion of the whole, and its loss will not be noticeable. Four per cent. of the flow of the river would provide 120,000 horse-power, assuming that only 140 ft. of the actual fall of 200 ft. were utilised. As the town of Buffalo is eighteen miles distant from the falls, the power will have to be transmitted to it by some means yet to be determined. The choice lies between rope transmission, as at Schaffhausen; transmission by compressed air, as at Paris and Birmingham; by pressure of water, as in London; and by electricity. The Cataract Company have resolved to invite from certain selected engineers and engineering firms plans for the utilisation at Niagara of 120,000 horse-power, and to submit the plans for an authoritative opinion to the judgment of a scientific international commission.

☞ IMPORTANT NOTICE.

A Prospectus of the forthcoming "WORK" EXHIBITION, 1890-91, is included in every copy of this Number of WORK. Purchasers receiving copies *without* the Prospectus are requested to notify the same to

The SECRETARY, "WORK" EXHIBITION.
MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
LONDON, E.C.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	.. .. ..	1s. 8d.
6 months, "	.. .. ..	3s. 3d.
12 months, "	.. .. ..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [2 R

Buyers of Lathes and other Tools send 3d. for list of Second-hand Tools.—BRITANNIA WORKS, Colchester; or inspect largest stock in London, 100, Houndsditch. [3 R

Glass Silverer and Beveller, Lead Glazing, &c.—EDWIN HAMMOND, Junction Road, Romford, Essex. Please state requirements. [5 R

Tools! Tools!! New list, 1d. stamp. All kinds, low prices.—STIFFIN & Co., 324, Essex Road, London, N. [1 S

Model Engine Castings.—Illustrated Catalogue, 4d.; Screws and Bolts; list, stamp.—STIFFIN & Co., 324, Essex Road, London, N. [2 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

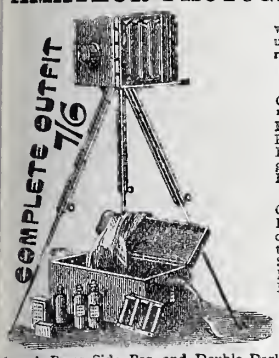
"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

AMATEUR PHOTOGRAPHY.—**J. H. SKINNER & CO.,** *W Department, East Dereham, Norfolk.*



J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description.

CHEAP SETS FOR BEGINNERS.

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6

Including Polished Mahogany Camera, with Folding Tail-board, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at 20 per cent. to 50 per cent. discount to clear. Send post card for Sale List.

SEND 3d. IN STAMPS

FOR LIST OF

SECOND-HAND ENGINES

(Gas or Steam),

AMATEUR TOOLS, &c.

Cash or Easy Terms.

FULL CATALOGUE, 6d.

BRITANNIA CO., 100, Houndsditch, London.

All letters—BRITANNIA WORKS, COLCHESTER.

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

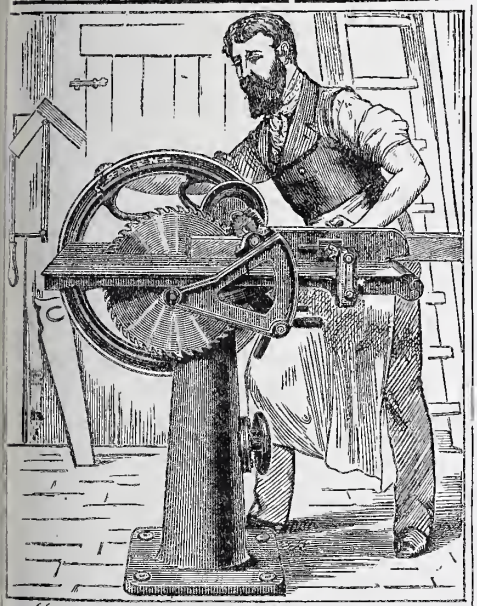
Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.

SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

PRICE, TALBOT & CO., LIMITED,

LATE DALE & Co.,

26, LUDGATE HILL, LONDON, E.C.



"THE LEYTON"

New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

CASSELL'S CLASSIFIED CATALOGUE, containing particulars of upwards of ONE THOUSAND VOLUMES published by Messrs. CASSELL & COMPANY, ranging in price from

THREEPENCE TO FIFTY GUINEAS,

will be sent on request *post free to any address.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

MONTHLY, 4d.

CASSELL'S TIME TABLES.

TOOLS TOOLS

MOSELEY & SON

323. HIGH. HOLBORN.

200 PAGE-CATALOGUE

BY POST 6D

ORDERS OF 10/- CARRIAGE PAID

KING'S COLLEGE, LONDON.

WOOD CARVING.

DEPARTMENT OF TECHNICAL INSTRUCTION.

CLASSES for instruction in Wood Carving will be held during the ensuing Autumn (beginning October 6) at King's College, in the Strand, under the joint direction of the Carpenters' Company and the Council of King's College.

For particulars apply to J. W. CUNNINGHAM, ESQ., King's College, London; or to S. W. PRESTON, ESQ., Carpenters' Hall, London Wall.

DEPARTMENT OF TECHNICAL INSTRUCTION.

KING'S COLLEGE, LONDON.

BUILDING CONSTRUCTION and ARCHITECTURE, DRAWING CLASSES, and CLASSES of DESIGN.

LECTURES and CLASSES for these subjects will be held during the ensuing Autumn (beginning October 6) at King's College, in the Strand, under the joint direction of the Carpenters' Company and the Council of King's College.

For particulars apply to J. W. CUNNINGHAM, ESQ., King's College, London; or to S. W. PRESTON, ESQ., Carpenters' Hall, London Wall.

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

MELLIN'S FOOD

FOR INFANTS & INVALIDS.

DOUGLAS HERBERT FISH. *Age 6 months.*

"39, *Nightingale Road, Clapton,*
"*23rd February*, 1889.

F. M. FISH writes :—"He has been fed on MELLIN'S FOOD entirely, and proves by his strength and size how excellent the Food is."

F. M. Fish

MELLIN'S FOOD BISCUITS.

Palatable, Digestive, Nourishing, Sustaining. Price, 2s. and 3s. 6d. per Tin.

SHAKESPEARIAN WISDOM ON THE FEEDING AND REARING OF INFANTS.

A pamphlet of quotations from Shakespeare and portraits of beautiful children, together with testimonials, which are of the highest interest to all mothers. To be had, with samples, free by post, on application to

G. MELLIN, Marlboro' Works, Peckham, London, S.E.

Bovril

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.

The enormous sale and general satisfaction which our Goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS
At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, ***EAST DEREHAM, NORFOLK.***

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 82.] SATURDAY, OCTOBER 11, 1890. [PRICE ONE PENNY.

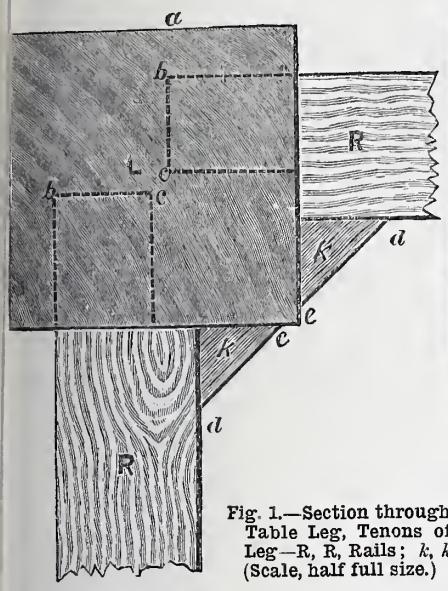


Fig. 1.—Section through Mortices of Table Leg, Tenons of Rails, and Leg—R, R, Rails; *k*, *k*, Blockings. (Scale, half full size.)

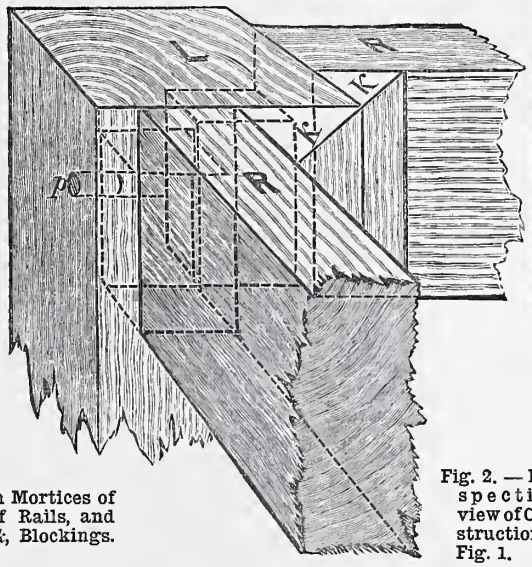


Fig. 2. — Perspective view of Construction in Fig. 1.

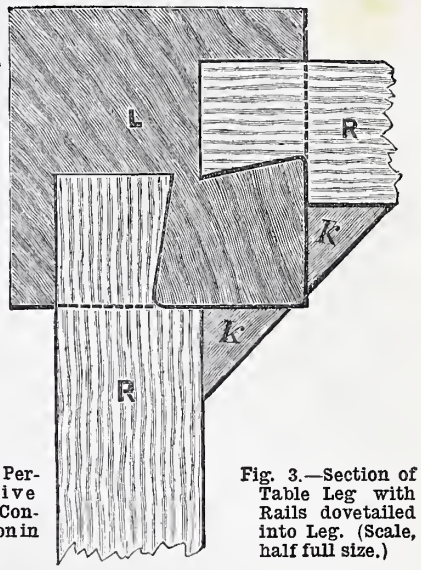


Fig. 3.—Section of Table Leg with Rails dovetailed into Leg. (Scale, half full size.)

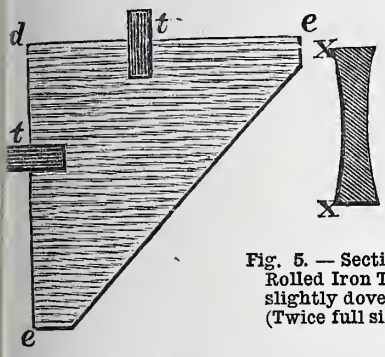


Fig. 5. — Section of Rolled Iron Tongue slightly dovetailed. (Twice full size.)

ig. 4.—Section of Blocking (*k*, Figs. 1, 2), showing Tongues of Wood or Iron at *t*, *t*, for extra hold. (Full size.)

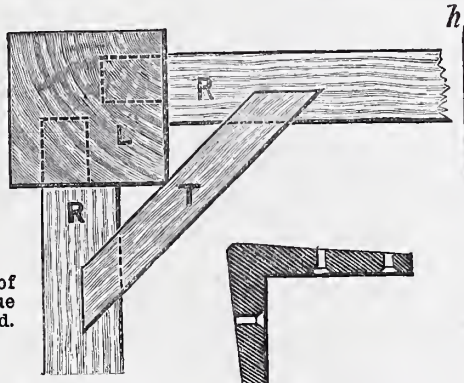


Fig. 6.—Plan of Head of Table Leg and Rails, showing Tie, T. (Quarter size.)

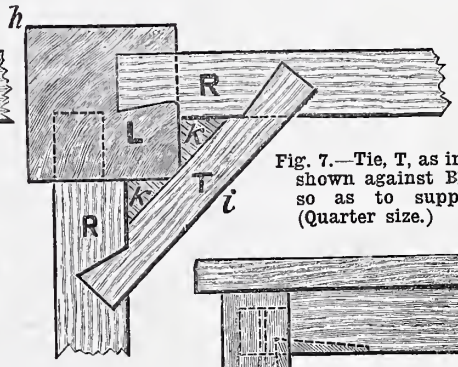


Fig. 7.—Tie, T, as in Fig. 6, shown against Blocking so as to support it. (Quarter size.)

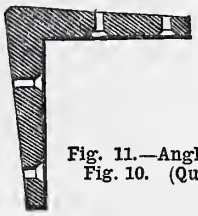


Fig. 11.—Angle Bracket as in Fig. 10. (Quarter full size.)

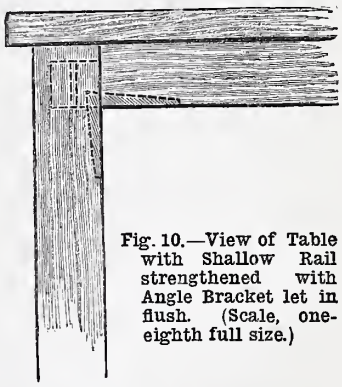


Fig. 10.—View of Table with Shallow Rail strengthened with Angle Bracket let in flush. (Scale, one-eighth full size.)

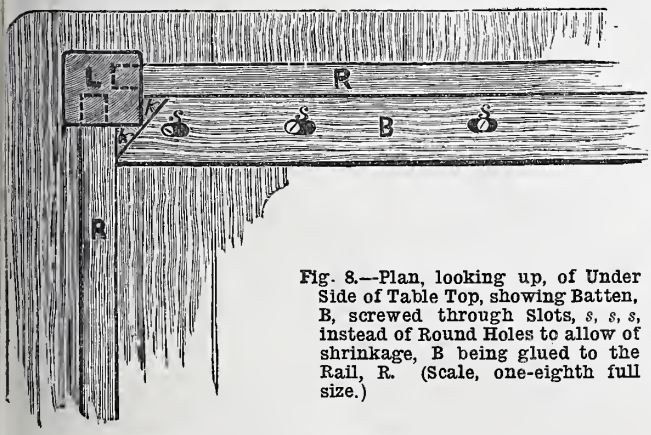


Fig. 8.—Plan, looking up, of Under Side of Table Top, showing Batten, B, screwed through Slots, *s*, *s*, *s*, instead of Round Holes to allow of shrinkage, B being glued to the Rail, R. (Scale, one-eighth full size.)

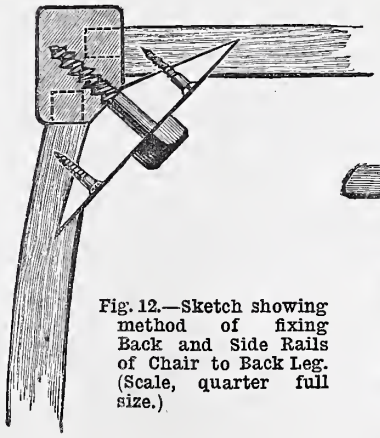


Fig. 12.—Sketch showing method of fixing Back and Side Rails of Chair to Back Leg. (Scale, quarter full size.)

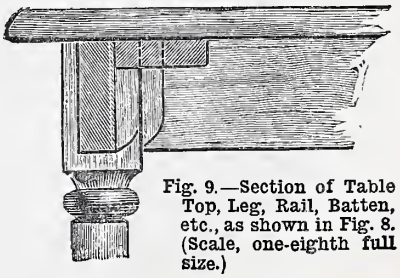


Fig. 9.—Section of Table Top, Leg, Rail, Batten, etc., as shown in Fig. 8. (Scale, one-eighth full size.)

CONSTRUCTIVE STRENGTH IN WOODWORK.

CONSTRUCTIVE STRENGTH IN WOODWORK.

BY JOHN WHITFIELD HARLAND.

In my two previous articles it has been my endeavour to show that whilst the tendency of workmen is naturally to work on in the old grooves and follow on in the way they were taught to do during their apprenticeship on the same old lines, that it is just worth while to think out, each for himself, the reason which dictates the method used, and to judge whether it really effects the purpose or not, and if not, or if only partially effective, how it can be improved upon in practice, either by economy of time or material, or both, or by obtaining, even at the sacrifice of one or both, extra strength of construction, thus enhancing the value and durability. I have met often during my travels abroad and experience at home with thorough workmen—those who have taken pride in the thought that when they were dead and gone the work of their hands would long survive them. I do not say that there are many who feel this—would that there were more—but these exceptions might have been more numerous if workmen took more thought about means, modes, and methods, and did not go in so much for piece-work and systematic overtime. I would fain see resuscitated that noble spirit of pride which animated the old guilds, both in England and Germany, when the high ambition to produce a masterpiece worthy of each craft, lightened the drudgery of apprenticeship, and sustained the fainting courage, and buoyed up the hope of the "journeyman" on his travels in search of new experiences amid hardship and toil, still learning and working for the end in view—the qualifying to become a master, not so much of others, as of his craft and of himself. This was the age of chivalry, so to speak—the chivalry of labour, when men *loved* their work for its own sake rather than for the coin it brought them. It has been said, most truly, that the boundary line between Work and Art is love. Work that is done under the influence of love of work is already Art.

I now come to the consideration of constructive strength in structures involving the third dimension, which, for clearness' sake, I will call *cubic* framing, the simplest form of which is a box, which, though not, strictly speaking, framed together, usually is an instance of the third dimension of constructive strength. It is easy to see that a casket—*i.e.*, a box with panelled ends, sides, and lid, all of which must be framed together separately—can be afterwards framed together in one or more ways so as to be strong. Again, a cupboard, a sideboard, or a chiffonnier, with the front made into a door, or pair of doors, is an example of cubic framing. Then we come to the familiar table and the ordinary carpenter's bench, in both of which we have to decide how to obtain strength and rigidity, with the least labour and the least waste of material. Here, again, the characteristics of wood must be borne in mind—viz., its grain, and consequent liability to split, or to shrink in one direction. Instead of making a simple frame in any of the ways shown in my second article (see Work No. 76, p. 383), in constructing a table, we no longer frame sides and ends together, but into a third member (*i.e.*, the legs), destined to bear not only weight acting downward, but very complicated side thrusts in every lateral direction. As the bottoms of the legs rest upon the floor, and the strains occur at their upper extremity, a very great leverage acts in favour of breaking the joints of the legs to the framing.

Fig. 1 shows section of leg L of table morticed with rails (end and side) R, R, tenoned into it, which is the usual way. Note that in order to avoid weakening the leg L the rails are reduced on their inner sides so as to leave shoulders for them inside, and keep the mortices separate instead of running one into the other, thus eating away the core of the leg, which would be bad construction. Thus the points *c*, *c*, which are the closest points of the two mortices, have sufficient of the wood of the leg L left between them to permit of coherence. Care should therefore be taken in morticing not to cut the mortices any deeper than just to clear the tenon ends, which ought to be made to touch the bottom of mortice, smoothed carefully to one exact depth all over. I have shown tenons of the rounded form at shoulder spoken of in previous article. Note that the proportions shown are $a\,b = c\,c$, $b\,c =$ twice $a\,b$, $d\,e = b\,c$, and therefore $a\,b + b\,c = d\,e$ plus the depth of shoulder. Fig. 2 is a perspective sketch of Fig. 1, dotted lines showing tenons, etc., and lettered to correspond with above description, and with Fig. 1.

Instead of tenoning the rails into mortices in the leg L, they may be dovetailed as shown in Fig. 3, a method which, on the whole, I prefer, for the following reasons:—

A dovetail is not so likely to *draw* as a tenon, even when pinned as at *p* (see Fig. 2). The dovetail can be made the full depth of the rail, whilst the tenon must be at least three-quarters of an inch lower down the leg than the top of the rail to leave any wood at all above the mortice; and thirdly, the dovetail gives better facilities for good fitting, requires no cramping up when gluing, and is more easily kept square. For amateurs, greater ease of construction will be found in the dovetail than the mortice, which, of course, is not through, and is therefore not so easy to mortice perfectly square. In order to further strengthen the junction between rails and leg, what is termed "blocking" is resorted to. A reference to Figs. 1 and 3 will show that at *k*, *k*, a three-cornered piece of wood is glued into the angle formed by the inner parts of the leg and the rail, to stiffen the framing and assist the leg to resist strains and side-thrusts. Here let me interpolate a very simple and, I believe, entirely new blocking, useful for staircases and for every other purpose for which blocking is available. My idea is that if the glue should perish some other form of attachment ought to be provided, and the very simplest form seems to be to cut a "saw-gate"—*i.e.*, a groove with the saw in both surfaces; and care being taken that they are opposite, drive into both, when gluing, a tongue, either of wood or iron (hoop-iron preferably), as shown in section Fig. 4, at *t*, *t*. This would not only hold up the block *k* to its work, but would exclude the air entirely from those surfaces inside the tongues—viz., *d t*, *d t*, even if the glue perished on the surfaces *t e*, *t e*. In large contacts the tongues might be made of hoop-iron, rolled to the section shown in Fig. 5, which would amount to a double dovetail, the saw-gates being made wider inside by inclining the saw both ways a little, to allow the extra thickness of metal at *x x* to be driven in. In making a single article, nails or screws should be used in blocking, as glue, in our variable temperature, is unreliable if used alone.

Perhaps the form of tie (T) shown in Fig. 6, used as it may be either alone or in conjunction with blocking, ought to be more employed in good construction than it is. If used as an adjunct to blocking, it might be fitted so accurately (see Fig. 7) as to maintain the blocking in place, at any rate at the top, and should be glued to it.

In billiard tables, where perfect rigidity is a *sine quâ non*, not only are the rails tenoned into mortices in the legs, but bed-screws are also inserted to pull up the tenons into their places, between the double tenons. I hope shortly to give full instructions for constructing billiard tables in Work, many workmen and amateurs expressing a desire for this information, especially as I regard the training to eye and hand afforded by this pastime, in the matter of angles of incidence and projection, as most valuable when this subject of uniting firmly rails to legs will be further treated of.

Many years ago a Manchester chair-maker, a Mr. Reilly, patented a tie, similar to T, Fig. 7, but with a screw-bolt put through from *h* to *i*, to hold the back leg firmly to the seat rails; and as I happen to know that the carrier's monthly account from Liverpool to Manchester for timber, mahogany chiefly, was from £30 to £40, his patent must have been fairly patronised. It *sometimes* pays to try to improve upon ordinary methods in constructive strength. It must not be lost sight of, that when the rails of a table are framed to the legs in either of the ways shown above, that the fastening of the top down to them may be made a very important factor in maintaining them square and rigid, by screwing or nailing the top down to them but there is also another consideration to be taken to account, and that is the probable shrinkage in *width* of the top, which, especially if jointed together, tends to break and open such joints; besides the minor consideration of appearance being sacrificed to some extent, by showing nail or screw-head in the top. This is by far the most difficult problem in this connection. We require the support the top affords in strengthening the framing below, and yet, if it shrinks, it will either split or a joint will open, even if made of the driest and best-seasoned timber. If as is frequently done, the top is "buttoned down, as it is called, it shrinks without splitting, but it affords little or no support to the frame. Perhaps the best job is to join up the top first, lay it in its place, and mark from below where it lies upon the end rails. Then get out and plane up square and true two battens. Take off the top, taking care that the battens are exactly the length of the rails and fix them with screws to the under side of the top, *not* through round holes, but through oval ones or slots, enabling the wood to shrink naturally. If properly fitted, these battens which cannot shrink endways, may be skew nailed, glued, or screwed against the inside of the end rails, and will maintain the rigidity and squareness of the top frame against all strains. This is shown in Figs. 8 and 9, the one, a view looking under table top, the other, a section through both top and rail showing good fixing for batten against both. Again, where there is either no room for, or the design does not permit of, a rail deep enough to stand the various strains on the leg, and no bottom rail can be used, iron angle brackets let in and screwed to both leg and rail may be very advantageously resorted to. (See Fig. 10 of the form shown larger in Fig. 11, where the knee, known to be the weakest point, is made doubly thick and let further in, the inside being square and the outside bevelled off.)

The above remarks, specially applicable to tables, which furnish the most evident examples of side strains, are also to a lesser extent to be borne in mind in reference to cabinets, caskets, mantels, and indeed every other form of cubic framing, in which, however, greater strength and support are usually obtainable by using cross-rails, or plinths, or other means of connecting the bottom of the legs as well as the top. I recommend iron or even steel angle brackets, as Fig. 11, also for repairing chairs that have been rocked back on their hind legs, and got consequently very shaky in the back tenons and mortices. It is astonishing to find so many otherwise sensible and even well-educated people delight in thus ruining chairs by rocking to and fro on the back legs, whilst the front legs are raised from the floor, and who never seem to reflect what a fearful compound strain they are exerting on a poor tenon, perhaps only 1 in. × $\frac{3}{8}$ in., going into the mortice $\frac{3}{4}$ in. at most! The rail 16 in. long, and the leg from seat to floor another 16 or 17 in., form a bent lever equal to a straight one of 32 or 33 in., at the end of which the whole weight of a man is acting to break it, in or near the middle! Is there any wonder that chairs give way under such treatment? But as people will go on, and do go on, doing such stupid things, the workman should, with this knowledge of the sort of strain his chairs will be probably subjected to, endeavour to gain all the strength possible at this point. I recommend, after the chair is framed together, angle blocking of the form shown in Fig. 12, secured with good glue and screws to back and side rails, and by means of a $\frac{1}{4}$ in. thick coach-screw held firmly to the back leg, which should have a short chamfer, as shown, accurately fitted to the inside face of the blocking, as a bearing to pull it up to with the coach-screw. By this means great extra strength is given, and in the event of the leg ever working loose, a part of a turn of the coach-screw would effectually tighten it up again.

Within the scope of these articles it would be quite impossible to allude to all the various forms of cubic framing, but I think that the types above chosen will be sufficient guide for all other cases, which they govern to a large extent; and if the application should prove difficult in any particular case, I will give such further explanation as may be requisite in "Shop." I may also point out that in tables the end rails may be dovetailed as in Fig. 3, whilst the side rails are morticed and tenoned as in Fig. 1, which is sometimes done in very long narrow tables when the tenons go right through the leg and are wedged up.

PARAFFIN LAMPS.

BY THOMASO.

DEFECTS IN PARAFFIN LAMPS—BURNERS—RESERVOIRS—MY FIRST LAMP—USEFUL READING LAMP—WHERE TO BUY BURNERS—MATERIALS.

OIL has many advantages over gas as an illuminant, and this, I think, people are beginning to find out, if the number of lamps seen on every side affords any criterion. One thing particularly noticeable is the number of shop-keepers who use them instead of gas, almost making one think that the time-honoured joke on the "fibbing" propensities of gas meters is at last being taken seriously, and that people have realised the fact that they can never be certain they have had their money's worth of gas.

I notice, too, that oil is replacing the gas for street lighting in one or two places in London. Verily, history repeats itself. I quite expect in the near future that we shall have the lamplighter impartially distributing the oil over the passers-by in the good old style.

There is a class of people who would be glad to use oil instead of gas, but the fear of fire or explosion deters them. They read the report of the latest fatal lamp accident, and putting the paper down with a shudder, determine to stick to the gas. "For," they argue, "if I use oil, why should not such an accident happen to me?"

This is all very well, but it assumes that there is only one kind of lamp in existence, and that dangerous; an assumption that a moment's thought would show the absurdity of. There is a large number of different styles of "safety" lamps in the market, some of them good, some otherwise. I do not purpose picking out one style of lamp and holding it up for universal admiration and imitation, but rather to point out the defects which nine out of every ten lamps possess—even the best.

First as to the burner. The different styles may be roughly divided into those having flat wicks, and those with wicks which take a circular form. It is the flat wick burners that are so erratic, and cause the majority of the accidents.

On taking one of them in hand, you will notice that there is a sort of dome over the top, with a slit (or slits) in it, through which the flame rises. If you look through that slit you see the wick tube projecting through a piece of perforated zinc. Now if you suppose the lamp to be lighted, it will be easy to comprehend the reason why explosions take place.

The flame, of course, makes the dome very hot; the heat extends to the rest of the burner; and as a result the air drawn in through the perforated zinc to feed the flame, instead of being cold, as it is theoretically supposed to be in order to keep the wick tube cool, is really hot. This hot air, together with the heated dome and the flame, all combine to form a sort of hot chamber surrounding the wick tube. It is not, therefore, surprising that the oily wick in the tube gives off inflammable vapours.

Now, suppose the wick is rather thin and works very easily up and down, an exceedingly common occurrence, for people do not like a hard-winding lamp; or suppose the oil shopman is out of wick the exact width required—another very common occurrence—the chances are that he puts in a size smaller, and says nothing about it. The lamp is lighted as usual, and all goes well for the present. But now suppose the lamp is carried about—say upstairs, and, maybe, past an open door or window—a puff of wind reverses the air current momentarily, the flame is blown downwards, and the wick not fitting, allows it to ignite the vapour, which is, of course, present in force all round the wick. This, after flickering a few times, ignites the oil, and it ends in the coroner's jury recommending people to use safety lamps.

This matter of the good fitting of wicks is more important than is generally supposed. I nearly had an explosion myself through having the wick too narrow, in one of the oil cooking-stove lamps. The amount of error was only a little over $\frac{1}{16}$ in., and yet, when I happened to look a few minutes after lighting it, I found the flame flickering down the edge of the wick into the reservoir. I subsequently got over the difficulty by care in trimming: rubbing the charred portion of the wick from the centre, and thus spreading it out—a rather precarious method at the best.

The blowing downward of the flame is almost peculiar to flat wick burners. A large chimney has to be used, and as a consequence the draught is very weak, and the flame unsteady. The duplex burners are, of course, better, as the increased heat causes a stronger draught, but, as a consequence of this, they take some time to put out.

We now come to another danger, common, I believe, to all classes of burners—*i.e.*, the liability to turn the lighted wick down into the oil. The danger is greater with the flat wicks, because the length of the wick tube is less. That this danger is recognised, is proved by the number of contrivances which have been introduced for extinguishing the lamp instantaneously, and without turning down the wick, a contrivance which you will notice has not been applied to round wick burners.

If the extinguisher is adapted, and the wicks fit well, there is nothing to be said against the flat wick burner, except that it does not give a steady flame, and the chimney is apt to get smoky if the lamp is carelessly trimmed.

Now let us turn to the round wick style of burner (the Argand), of which Fig. 2 gives a full size view. Burners of this kind are very much used now, and I think deservedly. Observe the length of the wick tube—nearly double that of a flat wick burner. There is evidently not much danger of turning down the wick into the oil. Notice, too, that the air is drawn in at the bottom of the burner, a considerable distance from the flame, giving one the impression that the burner is kept cool during use. This is, in fact, the case, for after it has been alight for some hours, the burner is cool to the hand, and the draught is so good that the chimney may be taken off by the unprotected fingers, if it is taken hold of close down by the burner. The flame can be turned up to three or four inches if the lamp is well trimmed, and excepting a slight movement at the top, is free from anything approaching flickering. The draught being very strong, the flame cannot be blown downwards. In fact, the Argand burner is altogether as safe as it is possible to make a burner, and does not need any of those strange and wonderful "safety" contrivances.

So much for the burners. We now come to another important point, and that is the reservoir.

A very large percentage of the annual deaths from lamp accidents is due to the china or glass reservoir. The lamp is dropped or knocked over, or perhaps explodes. In either case the blazing oil flies all over the place. I am aware that there are many arrangements whereby it is rendered practically impossible for the oil to ignite if the lamp capsizes, but granted they do all that is expected of them, and that in addition the burner is quite safe, still, glass reservoirs ought to be avoided, for all the safety burners in the world will not save your lamp from smashing, and your carpet from spoiling, if the lamp is knocked over.

I do not wish to convey the impression that all cheap lamps are necessarily dangerous, and that it is necessary to have an expensive one in order to be free from risk, but I would urge on everyone who uses, or contemplates using, lamps, to see that they

have metal reservoirs, for it is very unlikely that the force of an explosion would burst metal, and if it neither bursts nor breaks, there is evidently not much danger.

There is just one more point I want to call attention to before starting on the practical part of this article. It chiefly concerns people whose fear of injury prevents them adopting lamps in preference to gas.

On looking over the accounts of lamp accidents, one finds it an almost invariable rule that the sufferers are people low down in the social scale—poor people, to put it plainly. Whoever heard of one of the "Upper Ten" suffering from a lamp accident? I never did; and if any reader can call to mind an instance, it would only be an exception, and exceptions, as you know, prove the rule. The fact of the matter is, that the poor are the only purchasers of those cheap, showy lamps, usually sold for 1s. 0½d., complete—glass reservoir, vile burner, bronzed-iron stand, and fairly top-heavy. What more can they expect for their money? Not much, certainly. True, they can get a better, and infinitely safer, lamp, in the shape of the 6½d. tin hanging lamp, but it is so inconvenient and ugly, that it is not surprising that its more showy and dangerous rival is preferred for ordinary domestic use.

The lamps I am about to describe are safe enough if care is used in choosing a burner. When I made my first reading lamp (Fig. 1), with a burner of the kind illustrated, I put benzoline spirit into it in mistake for paraffin. After some hours the vapour of the spirit ignited in the chimney, but the flame was prevented from extending to the reservoir by the strong draught. If a lamp will not explode with benzoline, it is quite certain it will not with paraffin.

The first lamp I purpose describing is the reading lamp, Fig. 1. The cost of materials totals up to what may perhaps seem a good deal, but a safe lamp, giving a good light, and having a good appearance (qualities which do not always go together), cannot be obtained at as little cost as a "family exploder." Good articles (and materials) are rarely cheap, and the converse is equally true.

Now just a few words as to what I consider to be essentials of a good reading lamp. The first and most important is, that the reservoir should not be so large that the table is in deep shadow for some distance round the lamp. This is generally the case with lamps which do not slide up and down, such as those with the metal base and cut-glass reservoir. They certainly look very imposing with the ornamental paper shades about two feet in diameter, but they are of no use except to show off the shade. Another point is, that the burner and shade should be adjustable at any height independently of each other. In the majority of reading lamps, the shade is fixed to the reservoir or burner, with the result, that if it is required to show a light round the room, the hot shade has to be taken off altogether.

It goes almost without saying that the lamp should be firm on its base. This is assured in the lamp illustrated, as the peculiar form of the base gives great stability without much weight, the stability depending not so much on the weight as on the shape. Indeed, I see no objection to making it of hard wood instead of cast iron, provided some means can be devised for securing the upright rod firmly, and without liability to twist. So much for the theory. Now for the practical part.

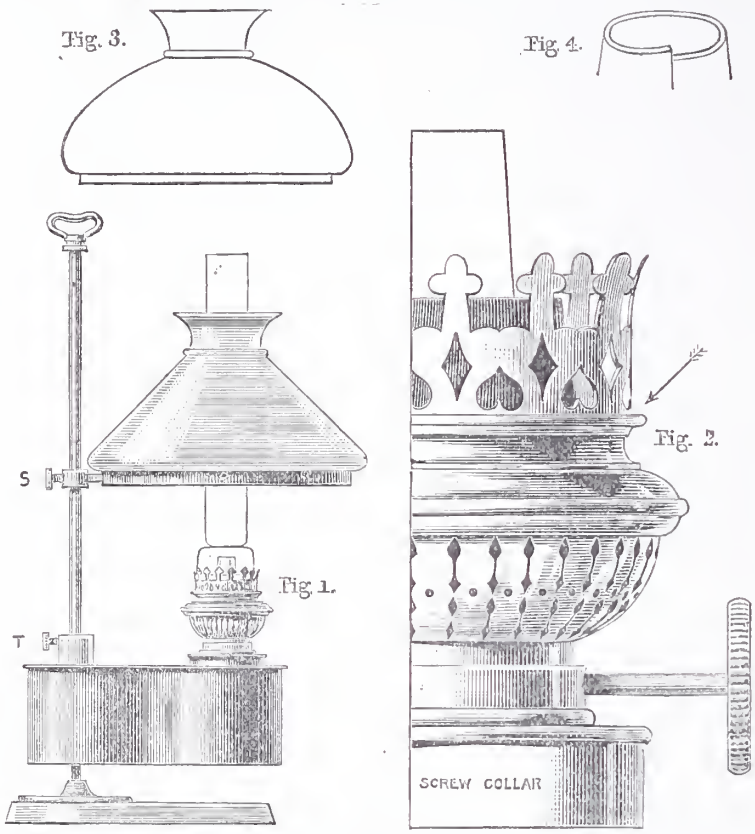
The burner can be obtained of Messrs. Benetfink, 107 and 108, Cheapside, London, E.C., and probably of other lamp makers and dealers. Ask for it by the name of the "Kosmos" burner, large size (the word "Kosmos"—trade mark probably—is embossed on the milled head of the wick-winder), and be sure and get the collar for it to screw into; price, complete, about 3s. net. There is another burner of the same make, but only about half the size; that is not the one intended. Of course, there are other burners, perhaps equally good, and, maybe, one or two that are better. Intending makers of the lamp can please themselves. I only mention this particular burner because I am most familiar with it, and have tested it fully. If you use the style of burner I recommend, I can only say, beware of cheap imitations. The burner intended is most beautifully finished, and the outside is burnished; the imitations are merely stamped into form. If another kind is used, see that the chimney is small enough to go through the hole in the shade without touching. The shade can be obtained in either of the shapes I have shown (Figs. 1 and 3), green glass outside and white in; price about 1s. 6d. net. The general size of these shades, and the size required, is 7¼ in. across the rim. The shape shown in Fig. 1 can be got in opal for about 6d., but the green shade looks more refined. As to the best shape, I think that in Fig. 1 throws down the light better. I generally use a paper shade when using the lamp to do rough work by, in case accidents might cause a run on the eighteenpences. The chimneys cost about 4d., and being made of German glass, with care in cleaning last for years. Lengths of special wick are sold in boxes of one dozen, but the ordinary flat wick obtainable at the oil-shops, and sold by the yard (about 1s.), answers all purposes. A quarter of a yard is a convenient length for the wick of this lamp.

It is astonishing how few people know how to trim a lamp properly. Smoke and smell seem to be accepted as one of the evils of this life for which no remedy exists. The few hints which I give on the subject of trimming, although especially intended for the particular lamp I am describing, are applicable, to a certain extent, to lamps in general.

Dry the new wick thoroughly before putting it in, and cut it as level as possible before any oil gets on it. Scissors are of no use in cutting a round wick after the first time. After it has been alight once, the very best way to get it level is to put a corner of the duster over the finger and rub the charred part off. Some of the pieces may fall into the burner; to get them out, unscrew the part that holds the chimney from the rest of the burner (Fig. 2 divides just above the winder). Never fill the reservoir right up to the top, as it increases the amount of oil which oozes over in all lamps, particularly if they are moved about much. If the common oil is used the impurities settle at the bottom, and after a time give a muddy appearance to the oil, causing the lamp to burn badly; it is therefore necessary, once in awhile, to clean out the cistern.

It may happen that after the lamp has been in use some time, one end of the wick gets higher than the other, like Fig. 4. This is easily remedied by pulling up the lowest end with the fingers. When putting in a new wick, however, it is of no use trying to get the ends even without cutting them.

Some sheet brass and wire will be wanted from the metal warehouse. About 2 ft. of 9 in. No. 9 roll brass will be enough. This brass is kept in rolls of various widths and thicknesses, and is very useful for a variety of purposes. Get also 30 in. of flat brass wire, ½ in. by $\frac{1}{16}$ in. This flat wire is also useful for a number of purposes, such as key labels, nuts, etc. Eighteen inches of $\frac{5}{16}$ in. square brass wire will also be wanted. Two or three patterns will be wanted, but they are very simple, being made exactly like the casting required. The parts of an old stand might, perhaps, be utilised to save making one or two patterns, but I do not advocate the employment of old lumber in work of this kind, which is always in sight. Another reason is, that no amount of good and



Paraffin Lamps. Fig. 1.—Reading Lamp complete. Fig. 2.—Burner (full size). Fig. 3.—Alternative Shape of Shade. Fig. 4.—Faulty Position of Wick.

careful workmanship put into an article composed of odds and ends of lumber, will make it look other than one of the noble army of makeshifts.

AN ARMCHAIR: HOW TO MAKE THE FRAME AND UPHOLSTER IT.

BY DAVID ADAMSON.

SEAT FRAME—TENONS IN SIDE RAILS—EAST END FURNITURE.

OF equal importance with the back is the construction of the seat frame; and here possibly a few little matters may perplex the novice who is attempting to make a chair for the first time. The back and front rails are simple enough, as they are merely squared ends, but the sides, being shaped, will require some consideration. Before going further, let it be said that the rails are either tenoned or dowelled into the legs. Some authorities contend that the former is the only legitimate construction for chairs, while some equally competent practical men invariably use dowels. I do not intend here to discuss the question which is the better method of the two—if, indeed, when equally well done, there is any superiority in one of them over the other. I refer merely to durability and stability, for it may almost be considered as beyond dispute that a dowelled joint is more quickly made by inexperienced workers, if not more easily, than by those whom practice has made equally adept in forming either.

Now it will be evident to the most casual observer that the tenons on the side rails may be either in a straight line with them, so that the mortice is cut in a sloping direction from the face of the leg, or that they may be so formed as to enter a mortice cut square into the leg. Both methods are shown in Figs. 7 and 8, which it will be understood are given merely as diagrams to explain the different constructions, and are not intended as working drawings from which measurements are to be taken. In Fig. 7 we have the tenon cut with its sides parallel with those of the rail, the mortice in the leg, on account of the slope of the side, being made at a corresponding angle. In Fig. 8 we have the alternative when the mortice is cut at right angles into the leg in the usual manner, the tenon for it projecting to the same degree from the bevelled end of the rail.

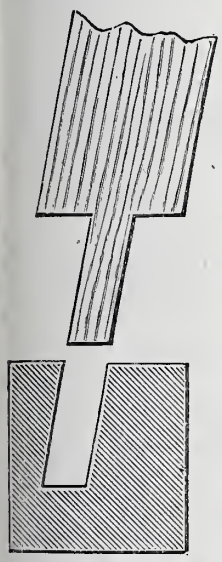


Fig. 7.—Tenon in Side Rails: Mortice in Legs correctly cut.

Which, then, of the two methods shall the chair-maker adopt? To set his mind at rest, let it be said that the construction shown by Fig. 7 is the better of the two, and that few, if any, practical chair-makers would prefer the latter, even were they not to say it should never be practised, which most good men would. The objection to the formation shown on Fig. 8 is based on common-sense reasons, and though I am far from saying that there are no occasions on which it might be used with advantage, they are quite exceptional ones, and the beginner should certainly prefer the other. But to give him some reason for this. The rails, it is safe to assume, will be of some straight-grained wood, with the grain running in the direction of their length; and having said this, the reason for preferring the tenon cut, as in Fig. 7, will be evident almost without explanation. The tenon is naturally the weakest part of the rail, but if it is straight-grained, there can be no doubt it is stronger than if cross-grained. The weakest form of tenon, of course, would be one with the grain running straight across, but even diagonally the wood cannot be so strong as when cut properly. In Fig. 8 it will be seen that the tenon is to a degree a cross-grained piece, while in Fig. 7 it is not so. It will be hardly necessary to say more on this point; but perhaps I might explain that though the word "tenon" has been used, the remarks apply—though not to the same extent—to dowels. These it will generally be found better to be as in Fig. 7 than as in Fig. 8. The dowel, however, being a straight-grained piece, may have greater liberties taken with it than would be safe with a tenon. Either with dowels or tenons, be very careful that they fit tightly, and rely more on this than on glue to fill up loose joints, which, after all, is nothing more than is necessary in any good joinery. A difficulty may arise about getting the dowel holes opposite each other and in their proper positions, both in the legs and in the rails. Careful measurements will, of course, prevent mistakes, but it will be much simpler after the ends have been properly squared—or, rather, mitred off, in the case of the side rails—to cut a piece of veneer, thin wood, or card to fit the face of the end. By puncturing holes in this card, an accurate template is formed for the dowel centres, both in the legs and in the rails. It will be as well to see that the dowels in the side rails do not interfere with those of the front and back rails. Let them clear each other in the legs, instead of cutting through or into one another. By marking out the dowel templates properly there will be no risk of this; and I think the matter is so clear that nothing more need be said about it. If, however, any considerable number of readers should experience a difficulty about it, I shall be pleased to be more explicit when treating of the construction of some other chair on a future occasion. I may say the same generally about any other point which may not be quite clear to novices, for it is obviously impossible to foresee all the little difficulties which may occur to them, though I fancy if they will consider a little most of them will disappear. Every fresh piece of work a man undertakes will present some new feature of difficulty, and no instructions can do away with the necessity for thought on the part of the worker. I am often met, when amateurs ask me how to do certain definite things, with some supposititious questions after this sort: "Well, but how would you do in such and such a case?" the contingency of the form of construction or the material being so remote as not to be worth a moment's consideration till it actually occurs. On the fertility of resource to surmount the difficulties which are constantly occurring even to the most experienced, the value of the worker depends. The more experience a man has to draw on, the better, of course; but though practice will enable most to become proficients in merely manual dexterity in a limited class of work, it does not obviate the necessity for thought when anything outside the usual run is attempted. The best and most valuable workman is he who uses his brains as well as his hands. This may seem altogether beside the matter of our chair; but what I want to urge, if I may, is that our craftsmen should not be content to degenerate into mere skilled labourers in one branch of work, but that they should, when necessity arises, be able to turn their hands to the construction of anything in which the same materials and class of tools are used. In the East End of London, for example, it is no uncommon thing—not going beyond chair-frames—to find men who are incapable of making anything out of their usual rut. They are good, say, at dining-room small chairs, but are quite incapable of making easies, couches, or the numerous class of fancy frames. This should not be; for without saying that a man should not—indeed, almost must, if he wishes to succeed in any of our large centres—become a specialist in the construction of any given class of articles, it seems ridiculous that he should be content to limit his constructive capacity. That there are men who are good all round is not to be denied, but on the contrary, how often do we find a man who is quite content to set a self-made boundary to what he can do? By all means let a man be a specialist, but because he is particularly skilled in making one thing, or in one branch of his craft, that is no reason why he should not have acquired some proficiency in others. Complaints are numerous that Germans and foreigners generally are making things harder all round for the English artisan, but surely in cabinet-making—or, rather, let me say, in joinery work in all its branches—this is rather a slur on native talent. It is rather owing to the self-imposed restrictions of the English worker, and his too ready acquiescence in the fallacious notion that because he is clever at one thing, therefore he need not know anything more. In saying this, I am not forgetting the vast amount of slop stuff made by the foreigners in furniture workshops; but is all English work of the best? and might not much of it, especially of the common-made London kind, be considered equally poor? I don't think it is sufficiently well known that this rubbish is sent to all parts of the country; and without saying that nothing of an inferior quality is made in the provinces, or that all London furniture is bad, it is an undoubted fact that more of the lowest class of furniture is put together in London than in all the rest of Great Britain. The share the general public have in encouraging the production of such need not be enlarged on, but it is a somewhat singular thing that most of the lowest-priced and worst furniture is made by men who limit their work to the production

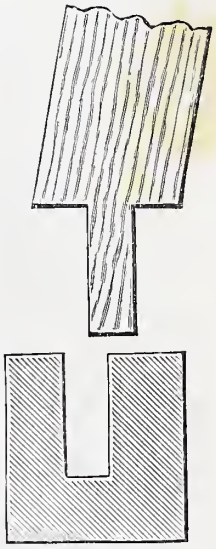


Fig. 8.—Tenon in Side Rails: Mortice in Legs incorrectly cut.

of a very limited range of articles. I would, therefore, earnestly urge the young artisan not to be content with learning only one branch of his trade, but to become as conversant as his abilities and opportunities will permit with others. He won't be a whit the less able in the one to which he devotes his special attention from knowing others, and there is no reason whatever why, whenever occasion may arise, the cabinet-maker should not be able to make in its entirety the chair-frame under consideration. I hope amateurs will pardon this digression, which may possibly seem a needless one to them, although they may find the remarks suggestive.

Reverting to practical consideration of the chair, it will be seen from Fig. 4 (p. 411) that the outer edges of the rails are set a trifle within the legs. It is not absolutely necessary that they should be so, but it will be better that they should, in order that the thickness of the coverings of the upholstery may not project beyond the squares or uprights. There is, I believe, no recognised rule for this, but about ⅛ in. is sufficient. If the frame is made for a very thick cover, a little more might be allowed, but as a general thing it will do very well. It merely remains to be said, that the rails will be quite stout enough if made from 1½ in. stuff, though of course they may be more, and in any case they should hardly be less than about 2 in. deep. Perhaps some may want to know how many dowels should be used for each rail. If so, it may be said that a couple at the end of each would do, but as there is plenty of room for them, three will be better, for the side rails especially. Braces, as the small corner blocks often used in chairs are called, are not necessary in the present one, but if the seat should seem rickety, or if there is any fear of it becoming so, they may be added. As, however, they should not be required, no special remarks about making and fitting them need be given.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

HEATING EFFECTS OF ELECTRIC CURRENT IN LAMPS—CANDLE-POWER OF LAMPS—RADIANT POWER OF INCANDESCENT LAMPS—ELECTRIC LIGHTING BY MEANS OF PRIMARY BATTERIES.

Heating Effects of Electric Current in Lamps.—When an electric current passes through a wire, the current encounters resistance to its passage, and part of its energy is expended in overcoming the resistance of the wire. This expenditure of energy causes a rise of temperature in the wire, and its resistance increases as its temperature is increased by the current. But, when the current passes through a carbon filament, its effect thereon is entirely opposite to that on a metal wire—that is to say, the resistance of a carbon filament is greater when cold than when it is hot. Mr. Sprague estimates that a filament of carbon in an incandescent electric lamp offers twice the resistance when cold that it does when at full light-giving temperature. It is most important to note and remember this whilst dealing with incandescent electric lamps. In planning an installation, we have to take into account the resistances likely to be encountered in the circuit, and must make allowance for the difference which exists between the cold and the hot resistances of the lamps. The heat given out by an incandescent electric light may be put down as one-tenth of that of a gas light of equal candle-power.

Candle-power of Lamps.—Much misapprehension still exists in the mind of the public respecting the light-giving power of incandescent electric lamps, and a just comparison of the light from one of these with that of a gas-burner or a paraffin lamp. In all exhibitions of the electric light, some grand effects have been produced in lighting, by grouping several incandescent lamps together. This has enhanced the value of the lamps in the eyes of the visitor, who has, consequently, gone away with a wrong impression respecting the real light-value of a ten candle-power incandescent electric lamp. The term "candle-power" is derived from the candles used in the English standard system of photometry or light measurement. The candle used in this system is a spermaceti candle, weighing six to the pound, and burning at the rate of 120 grains per hour. Lights are tested by this system with an instrument named a Bunsen photometer. This is a metal bar, at the two ends of which are the lights to be compared. The bar is graduated with a scale representing standard candles, and on the scale is made to slide a screen of white paper with a spot of grease on the middle. This screen is moved along on the bar until the spot of grease is equally visible or indistinguishable on either side, when it is known that the two lights have equal power upon it, and the respective strength of their lights is then known by reference to the scale. Some idea of the comparative value of incandescent lamps with gas lights, may be gathered by knowing that a Sugg's Argand gas-burner, giving a flame exactly three inches in height, always represents a light of sixteen candle-power, whatever quality of gas it may burn.

The light-giving power of an incandescent electric lamp is governed to a certain extent by the area of carbon surface brought by the electric current to an incandescent condition. But there are various shades of incandescence, so to speak, obtainable from a carbon filament, and, consequently, the candle-power of a lamp depends upon the degree of intense whiteness to which the filament has been brought. The highest illuminating power is obtained from these lamps when the filament not only glows white, but also gives forth a sparkling white light; but it should be observed that few filaments can stand the intense vibration necessary to produce this light. In all cases, to run lamps at such high temperatures, means a shortening of the filament's existence, and only the very best survive for long such treatment. It has been shown before that the light from one of these lamps depends largely upon the volume of current which may be pushed through the filament of carbon, and I have shown that the resistance of the carbon decreases as it becomes hot. Therefore, to bring the filament to a sparkling white condition, we must push through it a larger volume of current than it carried when only white hot. This is achieved by increasing the electromotive force of the current together with its volume, and, consequently, the filament is subject to a higher strain. In the following table, from the Edison and Swan Company's price list of incandescent lamps, the limit of the electro-motive force is noted, beyond which it is deemed not safe to go. The variation of the candle-power of each lamp and the current required is also noted. In this table (and for all future purposes in this article) the abbreviations "E.M.F." and "c.p." stand for electro-motive force and candle-power respectively.

TABLE OF EDISON-SWAN LAMPS.

C.P. of Lamp.	Voltage.	Ampères of Current.	Limit of E.M.F.
1	3 to 8 volts	·8 to ·3 ampères	8 volts
2½	5 „ 8 „	1·4 „ ·45 „	8 „
2½	9 „ 25 „		25 „
5	10 „ 35 „	3· „ ·35 „	65 „
8	15 „ 25 „	2·8 „ ·3 „	120 „
8	26 „ 55 „		120 „
16	30 „ 105 „	3·7 „ ·4 „	120 „
25	45 „ 105 „	2·2 „ ·7 „	120 „
32	55 „ 105 „	2·3 „ ·9 „	120 „
50	80 „ 105 „	3·5 „ 1·4 „	120 „
100	80 „ 105 „	7· „ 2·9 „	120 „

It will be seen from this table that the c.p. of light can be obtained by pushing a large current through a short and thick filament, or by pushing a smaller current through a long and thin filament offering a higher resistance. For instance, a lamp taking a current of 3 ampères sent through a short and thick filament at a pressure of 10 volts, will give a 5 c.p. light, and the same value of light is obtainable from a lamp with a long and thin filament taking only ·35 ampères of current, but requiring an E.M.F. of 35 volts to push this current through the extra resistance. The result in watts of current required to bring the carbon filament to a proper incandescent condition, will be found to be higher in the low resistance lamps than in those of high resistance. It may be explained here that the unit of measurement denominated a watt, is obtained by multiplying the total volume of current in ampères by its pressure in volts. Let us take, as an example, the current required for a 5 c.p. lamp as stated above. In the case of a lamp requiring 3 ampères of current with an E.M.F. of 10 volts, we have

$$\frac{\text{amps.}\ \text{volts.}}{5\ \text{c.p.}} = \frac{3 \times 10}{5\ \text{c.p.}} = 6 \text{ watts per c.p.}$$

If we choose a lamp with a higher resistance requiring a voltage of 35, we have

$$\frac{\text{amps.}\ \text{volts.}}{5\ \text{c.p.}} = \frac{\cdot 35 \times 35}{5\ \text{c.p.}} = 2\cdot 45 \text{ watts per c.p.}$$

Dividing these by 2 we get an average of 4·22 watts per c.p. This is rather above the general average of those lamps, which is about 3½ watts per c.p. for lamps taking less than ·9 ampères of current.

Radiant Power of Incandescent Lamps.—The radiant power of incandescent electric lights, or their ability to illuminate space around them, is shown by the following table, which will be found useful to readers wishing to know how many lamps of a certain c.p. should be employed to light up a room. This table is slightly altered from one given elsewhere, in which the figures expressed decimal parts of a system. I have avoided the decimals and have given the round figures nearest these, expressed in feet and inches for the sake of simplicity. Nevertheless, although for the convenience of the reader, and to enable him the better to fix in his memory, I have constructed the table in this manner, it will be found sufficiently close for all practical purposes. It is desirable, I am well aware, to be exact whenever one can, but in this case I am inclined to think that the exactness—which, as I have said, would involve decimal parts—would be more perplexing than helpful.

TABLE SHOWING LIGHTING POWER OF INCANDESCENT LAMPS.

Dimensions of Room.			Number of Lamps.			Height of Lamps above Floor.
Length.	Width.	Height.	10 c.p.	16 c.p.	20 c.p.	
Feet.	*Feet.*	*Feet.*				*Ft. In.*
15	15	12	3	2	1	8 0
18	18	16	5	4	3	8 6
24	24	17	9	7	6	9 6
33	33	23	16	12	10	10 0
37	37	32	25	19	16	12 6
52	52	40	40	30	26	14 0
63	63	46	60	45	40	17 0
72	72	52	100	75	68	21 0

Electric Lighting by Means of Primary Batteries.—Suppose, now, we wish to light up a room with the electric light in a manner equal to the light obtainable from two of Sugg's Argand gas-burners representing 16 c.p. each burner. We may get this light by using one large lamp of 32 c.p., or two smaller ones of 16 c.p. each, or four lamps of 8 c.p. each, or, perhaps, eight lamps giving a light of 5 c.p. each lamp. If we employ one large lamp of high resistance—say, a 60 volt 32 c.p. Edison-Swan lamp—we must also employ a high E.M.F. to overcome that resistance; but since, as a rule, the amount of current required to produce a given light diminishes with the increase of resistance (though not in the same ratio), it follows that to obtain a given candle-power, it is optional with us to use, either lamps of low resistance taking many ampères of current at a low pressure (*i.e.*, low E.M.F.), or a lamp taking a fraction of an ampère at a high pressure. What really decides the matter is the convenience which we have for obtaining either the E.M.F. or the large current.

Now, to obtain a high E.M.F. from batteries, means the employment of *many* cells, since we have no cell which gives an E.M.F. of more than 2 volts. On the other hand, if we wish to use a large current, we must employ large cells, since small cells offer a high internal resistance, and this pulls the volume of current down. In the case of a dynamo, the E.M.F. can be increased in two ways: either by putting more wire on the armature, or by driving faster, so as to cut more lines of force in a given time. In putting on more and finer wire on the armature, we do not use the finer wire because in itself it gives a higher E.M.F., but because we can get more coils of a finer wire in the same space, and thus cause more yards of active wire to cut the lines of force in a certain time.

In the former case, the E.M.F. of the dynamo increases with the length of the wire, so also does the resistance. In the latter case, when the speed is increased, the wire of the armature becomes heated through being obliged to carry the larger current.

If we employ more than one lamp of high resistance, and place these in circuit with the machine so as to form branches of the circuit, or conduits for the current between the main wires of the circuit, we shall lower the total resistance, and a current of lower E.M.F. will suffice. But in this case we shall require a larger volume of current, and thus a similar expenditure of energy to furnish the increased current at a lower E.M.F. Suppose, for instance, we use 1 lamp requiring 1 ampère of current at 60 volts pressure. We know by the rule already given, that 60 watts of current energy will have to be expended in lighting the one lamp, since 1 ampère multiplied by 60 volts equals 60 watts. Now we couple two such lamps in parallel—that is, place them side by side to form two bridges across the space between the two line wires. We have now two channels open through which the current can pass, and the resistance falls to one half of what it was when only one lamp was used, since $\frac{60}{2}=30$, so we shall only require an E.M.F. of 30 volts to push the current through the lamps. But, as we have now two lamps, each requiring one ampère of current, we shall require a current of two ampères, and 2 ampères multiplied by 30 volts equals 60 watts as before. If we carry the sub-division to six lamps, we shall find it governed by the same rule: $\frac{60}{6}\ \frac{\text{volts}}{\text{lamps}}=10$ volts, and 10 volts multiplied by 6 ampères equals 60 watts.

Suppose, now, we decide to light up our lamp by means of current obtained from a primary battery. Let us first select our battery, and then, before purchasing it, sit down and count the cost. As the Bunsen battery is a powerful one, having a high E.M.F. with a low resistance per cell, we first see what can be done with that battery. The E.M.F. required to light the lamp is 60 volts: the E.M.F. of a Bunsen cell is about 1·86 volts. If we divide 60 by 1·86 we get 32 cells in series as the number we shall require to make up the battery. Let us see what current we shall get from this battery. Estimating the resistance of a quart Bunsen cell at 0·08 ohm, the hot resistance of the lamp at 30 ohms, and the resistance of the line wires at ·5 ohm, we get by Ohm's formula—

$$\frac{1{\cdot}86\times32=59{\cdot}52}{0{\cdot}08\times32+{\cdot}5+30=33{\cdot}06}=1{\cdot}7 \text{ ampères,}$$

and this is about the quantity of current needed to light up an Edison-Swan 60 volt 32 c.p. lamp.

Using the current from this battery at the rate of 1·7 ampères per hour, it will only work some six or seven hours at the most at a time without recharging. Let us see, therefore, what it will cost to get a 32 c.p. light for this time by the means under consideration.

The cost of the installation will probably be as follows:—

	£	s.	d.
32 qt. Bunsen cells, complete, at 4s. 6d. per cell	7	4	0
6 lbs. sulphuric acid at 2½d. per lb.	0	1	3
12 lbs. nitric acid at 6d. per lb....	0	6	0
1 32 c.p. incandescent lamp	0	5	0
1 lamp-holder	0	1	0
Connecting and line wires, about	0	1	0
	£7	18	3

To provide 1·7 ampères of current, the battery will consume in each cell 31·46 grains of zinc per hour at the least; but probably this will be exceeded owing to local action in the cells, consequently nearly 1 lb. of zinc will be consumed in addition to acid used during the run of six hours. The working cost will, therefore, be not less than ½d. per c.p. per hour for material alone. To this must be added the value of labour in setting up the cells and cleaning them after the run is ended (which will be a serious item), together with a fair allowance for depreciation of plant. It should also be understood that a Bunsen battery working under these conditions cannot be tolerated in the room to be lighted, but must be kept out of doors in a shed, or in some place where a strong draught can be arranged to carry the noxious nitrous fumes away up the shaft of a chimney.

Instead of employing this number of Bunsen cells proper, we may modify the charge of the inner cell, using a solution of chromic acid instead of nitric acid, and thus get what may be called a chromic acid battery, each cell of which will give an E.M.F. of 2 volts, whilst only offering an internal resistance of 0·06 of an ohm. By this arrangement we shall be able to reduce the number of cells down to 27, with a consequent saving in first cost of £1 2s. 6d., and, as the chromic acid solution will only cost 1s. per quart, a saving of 1s. 6d. on each charge. But, although we have secured enough E.M.F. and current to work the lamp with a smaller number of cells, and have also avoided the noisome stench of the nitrous fumes, our new arrangement will not be nearly so constant in action as the old one. The chromic acid cell soon polarises whilst yielding a current of 1·7 ampères (unless its solution is kept constantly in motion by mechanical means), and, consequently, ceases action at the end of three hours.

If we employ lamps of lower c.p. and of lower resistance—for instance, two 16 c.p. lamps having a cold resistance of 15 ohms each—on referring to the table of Edison-Swan lamps, we shall see that such low resistance lamps take a large quantity of current to light them, viz., 3·7 ampères each. This rapid outrush of current means more than an equivalent consumption of zinc, because the rapid consumption of this metal in the cells causes an evolution of internal heat, and this soon destroys the amalgamation and wastes the zinc through local action.

Again, if we employ several small lamps coupled up in parallel to form bridges between the main conducting wires from the battery—say, for instance, four 8 c.p. lamps instead of two 16 c.p.—the evil of heating the battery, through demand for a large volume of current, is increased and intensified, and to counteract these we must employ larger cells, or arrange our cells in parallel as well as the lamps. Even when thus arranged, the run down is very rapid, and the consumption of zinc and acid correspondingly large. From this it will be seen that batteries are the most inconvenient and bulky of all generators for providing current to electric lamps, and are only admissible where no other means can be employed, or in special cases where only small lamps are required.

Having thus shown the expense and inconvenience attending any attempt to light up a large room by means of primary batteries, I will next show what can be done in electric lighting by means of batteries, and what to expect from the current supplied by them.

A CORNER CUPBOARD WITH CARVED PANELS, OR FOR GESSO ORNAMENTATION.

BY E. BONNEY STEYNE.

None of the articles of furniture that modern taste has rescued from banishment are better worthy than the old corner cupboard. The word corner is always full of pleasant associations; the snug corner of a will, a corner of one's heart, a corner of the hearth, and so on, readily come to mind in proof of this.

There are very few rooms that could not spare a space for a cupboard such as this, and for a carver to display his skill, few surfaces repay him so well; for the result is hung like a picture, and well in evidence, in a way that hardly happens to carving bestowed on furniture. For here are no shelves to hide its beauties, no clock face

to draw superior attention, but the whole, in spite of its use, might exist solely to display its ornamented panel, so far as those who see it are concerned.

The design chosen is that of the tree of knowledge—the Igdrasil tree—a well-known decorative symbol, yet always with a charm of its own, despite its frequent use. The M. and N. are, of course, merely the baptismal synonyms for the actual initials of its maker. Should he possess a family coat-of-arms, it might, of course, replace the date on the shield. The olive branches that surround them may be poor heraldry, but are sufficiently good sentiment.

The old corner cupboard is so well known that I have abstained from working drawings, but should any one with skill to carve yet be ignorant, I fancy, wherever he may dwell, that he would not have far to look for an existing specimen, the study of which is better than any description.

The carving should be in low relief. If the owner's taste is in sympathy with its use, some shaded gold upon the fruit of the tree, and on the initials and date, would not be out of keeping.

If gesso replaces the carving, the final colouring may be either roughly naturalistic or purely conventional, with the background left in the natural wood or painted, as the owner chose.

The cupboard is rather broader in proportion than usual, but by lengthening the stem of the tree the design could be adapted to a narrower one without other alterations of any importance.

It will be noticed that the old corner cupboard, now so seldom seen in any but very old houses, has been reproduced in all its simplicity and severity of outline. The ornamentation and rehabilitation of the cupboard consist entirely in the treatment of the panels of the door. To those who wish for more embellishment I may suggest the overlaying of the door frame and sides with fretwork, with the addition of brackets below, and a gallery of spindles and rails at the top.

Corner Cupboard with Panels Carved or in Gesso Work.

A DARK-ROOM AND BACKGROUNDS IN COMBINATION.

NOVEL, PORTABLE, AND HANDY FOR AMATEUR PHOTOGRAPHERS.

BY A. S. P.

The want of a suitable dark-room is generally a great drawback to the amateur photographer. A closet without windows, and necessitating the use of the ruby lamp, is usually the only place procurable; but such closets seldom make good dark-rooms, and in many cases the plates developed therein are failures. This new idea, that of a dark-room and backgrounds combined, must prove of great utility where space is a consideration; a dark-room that can be put together in two or three minutes, then, when operations are over, taken to pieces and stowed away, or the parts used as backgrounds. The construction is simple, and any amateur who can do a little joinery may easily make it. Fig. 1 is a view in perspective of the framework without the covering, and consists of a series of frames put together by mortice and tenon. The cheapest wood is white or Baltic pine battens, cut up into 2½ in. by 1 in., and of suitable lengths. The front and back frames are each 6 ft. broad and 6 ft. high, the two end frames are 4 ft. broad and 6 ft. high; the front frame has the opening for the door 2 feet wide; and the right-hand end frame, the opening for window, 19 in. by 13 in. The roof frame is made 6 ft. by 4 ft. 2 in., from which it will be seen the front and back frames overlap the end ones at the edges. This roof frame has a ledge of ½ in. wood 2 in. broad, nailed all round, and projecting downwards like the lid of a trunk. This shuts down over the edges of the top of the four frames, and keeps the structure rigid and perfectly light-tight. The frames are put together by mortice and tenon (see Fig. 3, A, B). The mortices being cut through, and the frames put together with glue, the tenons are wedged on the outside.

The front and back, also one end, have each a rail midway of the height, also morticed in the same way. The window end has two cross rails and two uprights to form window opening (see perspective, Fig. 1, and also Fig. 4). The rail A, Fig. 4, is 30 in. from the floor. To this rail is hinged the table inside, and the short post C has a hinged bracket made to fold aside and allow the table to fold downwards. The door frame, Fig. 2, is made to fit the opening in the front exactly, and may be hinged to the door post A, Fig. 1, or to the corner post B. The door opens outwards, and in order that the door, when shut, may be perfectly light-tight, a check is screwed on all round inside the opening, projecting into the opening half an inch or so. This check is put on after the cloth covering has been tacked to the frames. The hinges for the door should be sunk into the edge of the door frame to secure a close-fitting joint. The frames, having been put together with glue and wedged firmly, are to be cleaned off, squared, and fitted together temporarily with screw-nails as a skeleton framework, as represented in perspective, Fig. 1. The roof frame is now fitted on with the ledge before mentioned, giving allowance for the cloth covering, about a sixteenth of an inch all round being sufficient. The screws are now taken out, and the various frames and door covered first of all with stout brown paper. This covering is put on both inside and outside. The paper is cut to the sizes to fit the various parts of the frames, then damped

o within an inch of the margin, and pasted n place. When dry, it will be stretched as ight as a drum. The paper must be pasted o the sides of the frames, not the edges. Now proceed to cover the outside only with strong calico, and as this material will be too narrow in the web for the frames, two breadths must be sewed together. The method of sewing the calico together is explained in Fig. 8. The two pieces being laid together, a seam with the sewing machine is run up some $\frac{3}{8}$ in. or $\frac{1}{2}$ in. from the edge. The two selvages thus turned in will go towards the frame, giving the opposite surfaces to paint on for backgrounds. The cloth is now stretched on the frames, and nailed with tacks in the edges only, not the faces of the frames. The several frames with cloth on the one side and paper on the other, give a choice of surfaces for painting on, and one or both sides may be utilised as backgrounds.

The end frame, with window opening, makes a very realistic background by painting the plain surface of the calico to represent an old ruined wall, with real or imitation ivy clinging to it and around the window. The effect of this background may be heightened by making the sitter look through the window opening. Indeed, the complete dark-room may be made to represent a small rustic cot or cabin by painting an imitation window on the front with the doorway. The amateur must, of course, be something of an artist to carry out these ideas. An important consideration

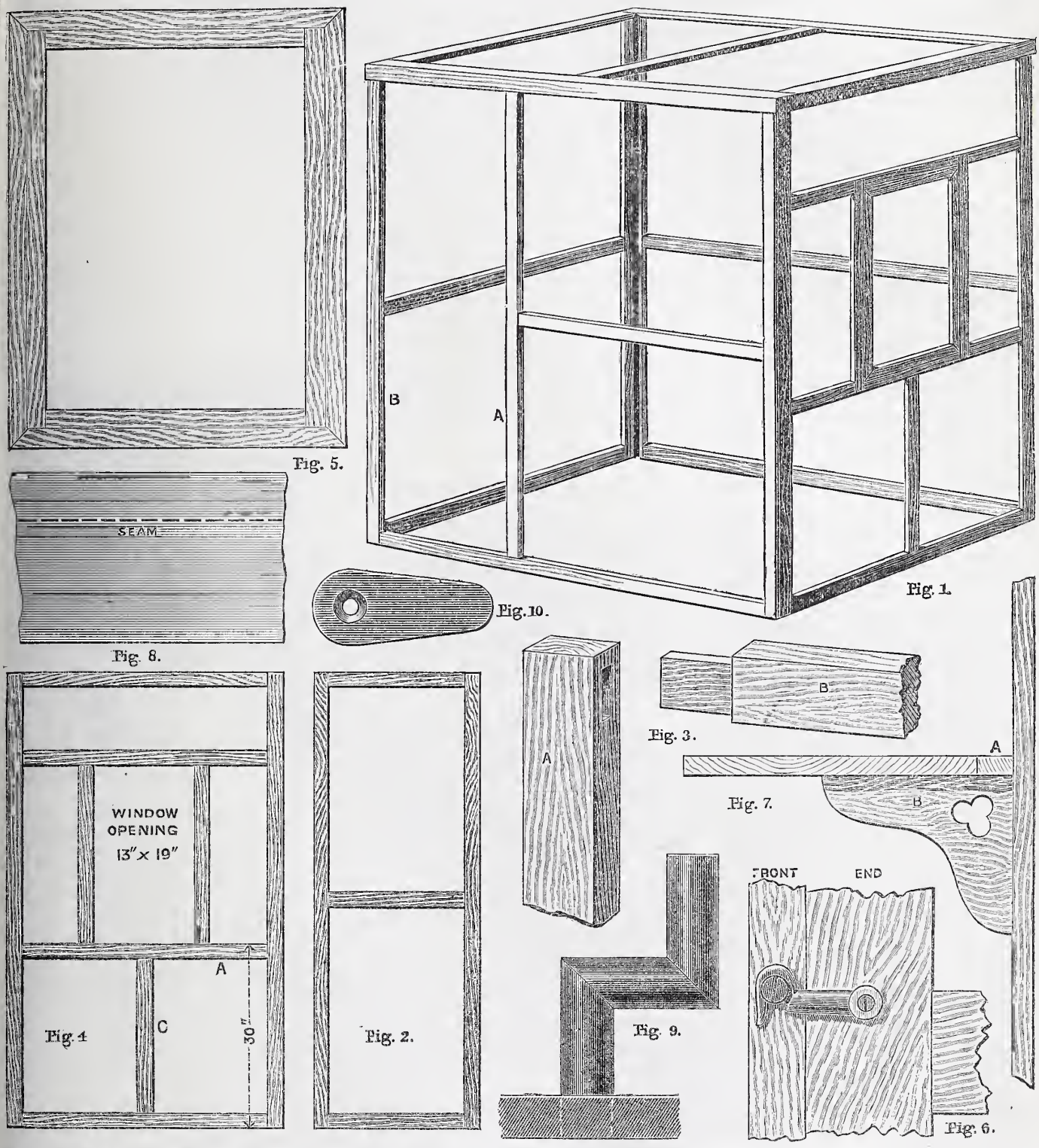


Fig. 1.—View of Framework without Covering in Isometrical Perspective. Fig. 2.—Door. Fig. 3.—Mortice and Tenon Joint. Fig. 4.—Window End. Fig. 5.—Frame for Window. Fig. 6.—Mode of hooking Frames together. Fig. 7.—Developing Table. Fig. 8.—Joining the Calico. Fig. 9.—Ventilating Tube. Fig. 10.—Turn-button for Window.

in the construction of a dark-room is the ventilation. Fig. 9 is a tube of tin or zinc 2 in. diameter with two elbows. This tube is fixed in the centre of the rail in the roof frame.

This form of tube will effectually ventilate the room and keep out the light. Air must be also let in somewhere near the bottom of the room. In the window end cut a row of 1 in. holes, immediately above the ground rail on the outside, and through the outer covering only. For the inside, cut a row of 1 in. holes just below the rail under the opening for window. The air will thus be admitted, and all white light kept out, while the foul air will escape through the zinc tube above described. Now we have to make a frame for the window, as well as a check to receive it and hold it in place. This check is made of wood 1 in. broad and $\frac{3}{4}$ in. thick, and is mitred at the four corners, as shown in Fig. 5. When it is screwed on, about half an inch of the inner frame shows around the inside. This is to form a stop for the window frame. This frame is made to fit exactly into the check just described. It may be made of stuff $1\frac{1}{2}$ in. broad and $\frac{3}{4}$ in. thick, and should have a rebate, or check, cut to receive a pane of common window glass. It is held in its place by four small turn-buttons, shown full size in Fig. 10. This window and its surrounding check is shown somewhat enlarged in Fig. 5. A similar frame is made to fit inside the same opening as the glass frame fits into. This frame is covered with one or two thicknesses of the yellow or ruby fabric sold by most photographic apparatus dealers at about one shilling per square yard. This frame is held in place by the same turn-buttons. By this means the room may be used with either red or white light according to the operations going on. A ruby lamp is usually a necessity in a dark-room when working by night. In this case it is unnecessary. All you have to do, if using this dark-room indoors, is to place a small bracket or shelf just below the window on the outside, and on this shelf place a candle or ordinary lamp. The light will show through the cloth frame, and serve all the purposes of a ruby lamp. Now as to the fitting up of a developing table. This is simply a folding-down board, and may be the whole length of the inside measurement of the room at the window end, or only part of that length. First of all, a fillet is firmly screwed to the rail that supports the window frames. This fillet is 1 in. thick and 2 in. broad. To this fillet is hinged the board or table of the same thickness, namely, 1 in. The developing table should be at least 12 in. broad. An end view of the table and fillet will be seen in Fig. 7. The hingeing is at A. The hinges may be either sunk into the edges of the fillet and table, or put on flat below. To support the table, a wooden bracket B is made and hinged to the upright post C, Fig. 4. This bracket is 1 in. thick, and folds under the fillet to which the table is hinged, allowing the latter to fold down when the room is out of use, or the outside being used as the background before described.

The only remaining operation required to complete the structure is the hooking together of the frames. For this purpose sixteen 2 in. window-shutter hooks and eyes must be procured. These hooks are fixed on to the vertical standards of the ends, four on each standard, and the eyes screwed into the edges of the front and back frames. Fig. 6 shows this. In the drawing, instead of an eye, a round-headed screw is shown, which is a very good plan. To ensure good light tight joints, strips of thick flannel, or other soft material, should be glued all round the edges of the ends, and also on the top and bottom edges of the front and back frames. It is a good plan to put two or three thicknesses of this material all round the bottom edges of the frames where they sit on the floor, so that the weight of the structure will keep the joint close. Inside the window frame and on the check for the door strips of flannel should also be glued. The dark-room is now complete, and should be put together to see if all is working right. If the amateur can without difficulty lead a water supply into the dark-room, the best plan is to fit a porcelain or zinc trough into the developing table, and lead in the water by a rubber tube through the roof, while the waste may be led out by another tube from the trough. This method is always handier than using a basin and jug. The putting together of the dark-room only occupies about two minutes, and very little space is taken up by the frames when put aside. The cost from beginning to end is very little, and the dark-room is far superior to any of the dark tents and other articles sold by photographic dealers, giving more freedom, air, and pleasure in the various operations connected with photography.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

75.—A New Form of Violin.

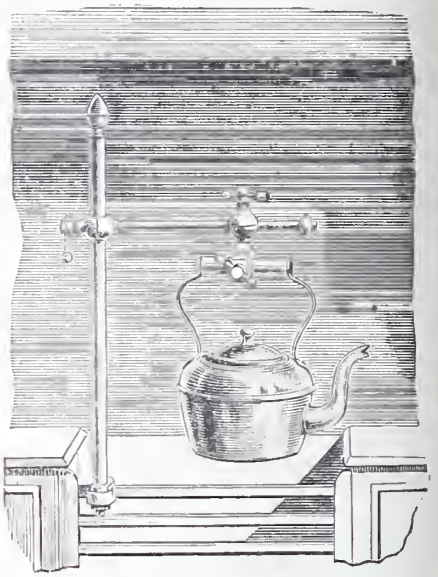
Mr. P. H. Ziedler, Musical Instrument Maker, 50, Bridge Road, Hammersmith, has sent for my inspection a new form of violin manufactured and supplied by himself. The peculiarity in the instrument consists in its having what he terms a "double arched belly," which has the appearance of an ordinary violin with a projecting overlay of wood in the centre of the belly extending as far as the *f* hole on either side, with a margin between the edge of the piece superimposed and the top and bottom of the fiddle. The general look of the violin is not so good as that of one of the ordinary form, as the raised piece on the belly gives a degree of clumsiness and solidity to it, but the tone of the instrument, as far as I dare venture to judge, seemed sweet, full, and powerful. The invention applies to all stringed instruments that are played with bows. Mr. Ziedler says that he was led to the invention by noticing the great rarity of good old violins and the desirability of constructing instruments in such a manner as to obtain in a new violin the quality of tone that is so much admired in the old instruments. He claims to have succeeded, and thinks that in the end his invention "will be recognised by all lovers of this most perfect of all musical instruments, the violin." He tells me that Mr. J. M. Fleming, author of "Old Violins," thus writes of a violin made on his new method:—"I have now had an opportunity of trying your violin. The tone is of a remarkably taking quality, very much freer than that of the high-class new violins of the present day." This opinion, coming from a writer and violinist who thoroughly understands the old instruments, is worth far more than anything I can say about Mr. Ziedler's invention.

76.—Photogravure.

This is the title of a comprehensive work on this subject written by Mr. W. T. Wilkinson, illustrated by Mr. W. L. Colls, and published at 1s. 6d. by Messrs. Iliffe & Son, 3, St. Bride St., E.C. The subject-matter of the book is divided into six chapters, dealing—after the introductory chapter on the six stages of the process of production, the printing press used, and the materials and appliances required—with the preparation of the negative, the carbon transparency, laying the ground, the carbon resist, and printing the plate. The frontispiece affords a good specimen of the results of the process in the reproduction of a river scene with boat, etc., beached on the strand.

77.—Telfer's Patent Victoria Kettle Sustainer.

The nature and purpose of the Patent Victoria Kettle Sustainer, invented by Mr. John Telfer, 73, Palermo View, Seacombe, may be gathered from the illustration of the contrivance given below. The object is to swing the kettle or any other cooking utensil that can be thus suspended over the fire at some little distance from the top of the grate and its burning



Telfer's Patent Victoria Kettle Sustainer.

contents. Of course there are more ways than one of managing this suspension as described in Mr. Telfer's Complete Specification, No. 7,610, A.D. 1889, but it will be sufficient to deal with that mode which is shown in the illustration. First of all there is an upright standard which is clamped to the top bar of the grate. A loose sleeve surrounds this standard for nearly the whole of its length, and on this sleeve a bush or boss slides up and down which can be clamped to the sleeve by a set screw at any required height, the sleeve then affording the means of motion or revolution about the standard. From the boss proceeds a horizontal bar, along which slides another boss also provided with a set screw for clamping, and the boss is filled below with a pair of jaws in which is grasped the handle of the kettle, etc., that it is desired to suspend over the fire. Thus the kettle can be swung immediately over that part of the fire where the glow and heat are greatest. It may be further made available for holding a cross bar with hooks dependent from it for roasting meat before the fire. How cooks might be disposed to regard Mr. Telfer's invention I cannot say, but it is manifestly only fitted for use on open grates, for it would be of little use on the hot plate of a close range. Mr. Telfer will exhibit a model in the forthcoming "Work" Exhibition of 1890-91, and would like to make terms with a respectable firm to manufacture the article, as he is confident there will be a great demand for it.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

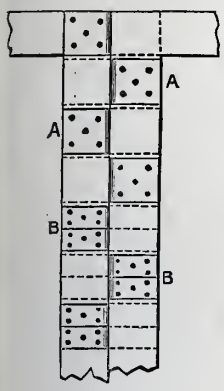
NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Continuous Hinge for Draught Screens.—W. M. (*Birmingham*) writes:—"Some years ago I made an excellent hinge for this purpose by adopting the same method as the old clothes horse; but, instead of a pair of webbings top and bottom, I made a continuous hinge. I used thin oil-cloth cut to, say, 3 in. or 4 in. wide, as at A. I began at the top, and tacked the first flush with top of top rail following on to the bottom, each strap *touching* the one above. It worked admirably, opened and closed either way, cost very little, and the joint was as draught proof as the rest of the screen, and this is a great point gained. These hinges should be nailed on before the screen is covered; the covering will then hide the tacks and make a neat, workmanlike job. This joint is so strong, that thick calico or black buckram would do instead of oil-cloth. Webbing would answer—put two together as at B—but wide strips are less trouble, take fewer tacks, and less time."



Continuous Hinge.

II.—Questions Answered by Editor and Staff.

Violin Wood.—Amateur Violinist.—The necessary materials for making a violin may be purchased from the firms named below. The size is that which is usually termed ⅞ size:—G. Withers and Co., St. Martin's Lane, London; Henshaw and Loebell, Swan Street, Manchester; Briggs & Tarr, Commercial Street, Leeds.—B.

Address.—N. N. D. (*Leeds*).—The small dynamo mentioned by H. G. B. was supplied by Mr. Bottone, electrical engineer, Carshalton, Surrey. This address will find him.—G. E. B.

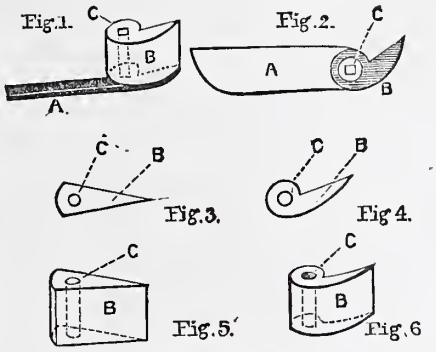
Electric Depilatory.—M. P. S. (*Kingstown*).—Write to Messrs. T. Gent & Co., Faraday Works, Braunstone Gate, Leicester, for their electro-medical apparatus catalogue, and enclose four stamps to defray cost. I suspect you omitted the stamps, and that is the reason you failed to get a reply. Some folks write to me sometimes and actually have the cheek to ask for a reply by post, but do not put in any stamps for postage. They expect me to make them a present of my brains and time, and pay them for accepting the present. Tradesmen are more keen in this matter than a poor author. The address given before was quite correct, but I suspect the stamps were missing.—G. E. B.

Electro-plating.—Subscriber.—The promise still holds good. Full instructions in electro-plating will be given in Work when room can be found for the articles, and the captain of our ship sees fit to take them aboard.—G. E. B.

Cement for Lamp.—F. C. B. (*Battle*).—Presumably you ceased to look in "Shop" after finding your long-looked-for reply to query sent, for on the very day you wrote your letter there appeared the information you seek: viz., in No. 74, page 356, to which I refer you, though I expect you will have seen it in the meantime.—R. A.

Sheet Metal Book.—H. A. (*Birmingham*).—The best book on this subject is undoubtedly that by C. T. Millis, published by Spon, full particulars of which appeared in "Shop" of No. 73, page 340; the price is 9s., not 2s., as there stated. "Drawing for Metal-plate Workers," Cassell & Co., is also a very handy little book, with numerous plates, price 3s. With respect to Warn's book, no wonder you could not find the publisher of it; it is sold by his widow or relatives at 94, St. Augustine's Road, London, N., price 10s. 6d. There is frequently an advertisement in the *English Mechanic*, stating that a few copies are for sale cheap, slightly soiled; probably the demand for the book has greatly fallen off.—R. A.

Clock Matter.—Leo.—The action, size, position, and shape of gathering pallet are as follows:—Action: when the rack falls at the hour the gathering pallet picks it up again one tooth at a time. Size: enclosed drawings are full size. Position is on the long pivot or arbor of the wheel next above the pin wheel; in the English clock it is usually squared on, and in the French merely let on round. The English has a tail, A, which stops the striking when the rack is up, by resting against a pin in the end of it, the French being stopped by an arm pivoted between the plates. For shape, see Figs. 1 and 2. Same letters refer to same parts of all sketches. A, tail; B, body or hook; C, hole where pivot comes through. Fig. 1, top view; Fig. 2, side view. Locking plate striking wrong way may be caused by the arm that drops in locking plate being slightly bent, so that it catches one side of the notch or other, or by the inner part of the arm that catches in the wheel between the plates being worn, or not dropping far enough down to hold it; if the first, bend the hook part back or forward, as the case may be, till it falls fair and clear in the middle of the notch of locking plate; if the second is the cause, bend the outside arm up a little, which will allow the inside arm to go lower. *Clock striking too fast.*—Probably the



French and English Gathering Pallets.

fly is too loose on its pinion, and the train rushes without the fly; if so, strengthen or tighten the spring that grips the pinion deeper in the warning wheel. In French clocks the fly is pivoted in an eccentric bush on purpose to regulate the striking; put deeper to go slower, shallower to go faster; if not sufficient, put a higher number fly pinion to go quicker, lower number to go slower. Watches called horizontal are those that have a cylinder escapement—that is, the 'scape wheel is working directly on a cylindrical staff, so to speak, instead of on a separate pair of pallets, and thence to the staff and balance. *Mainspring gauge.*—The notches and numbers on the edges are the standard size or width of springs; the rings are for gauging the diameter of springs to suit the size of barrel. *Mainsprings.*—In the English watches the outer hook is usually riveted to end of spring. The Geneva only requires a hole in the end of spring, the hook being screwed in the barrel.—A. B. C.

Gold Blocking.—W. H. C. (*Birmingham*).—The lettering on the sample you send is done by printing like hat tips, with hot brass blocks having leaf gold or Dutch metal placed between. See my reply to G. McA. (*Liverpool*), page 192 of Work, No. 64. Write for prices, etc., to G. Le Sage, gold blocker, etc., 10, Fore Street, City, E.C. As to fastening "Glacier" decorations on window glass, did you not inquire for directions for fixing when you bought them? Ask the person who sold them to you, or write direct to McCaw, Stevenson, & Orr (the patentees and manufacturers), the Linenhall Works, Belfast.—J. W. H.

Waterproofing Cloth.—J. R. (*Newton Stewart*).—The sample of cloth you enclose would not only be far above the powers of an amateur—without expensive plant—to produce, but would cost far more than it could be bought for. Write for samples and prices to any waterproof dealer, or to Charles Macintosh & Co., Cambridge Street, Manchester, who would also supply a reliable solution of indiarubber in naphtha, so that you could put the seams together yourself, as also fix the buttons, bind the button-holes, pocket-flaps, etc.—J. W. H.

Trapping Blackbirds, etc.—Hopeful wishes to know how to make a trap without having to use call birds. I advise Hopeful firstly that blackbirds and thrushes do not feed on the ground much; their food is chiefly the aphis, little insects, etc., to be found on large trees; it is, I believe, only at times, such as after showers of rain following dry weather, and "far from the busy haunts of men," that they come to ground for small worms, etc., or perhaps near the edges of some sedgy pool. If very hungry, one may see them pounce down upon the fleecy back of a sheep, just before shearing time, diligently hunting for "sheep-ticks," and that therefore bread as a bait would not be successful. Secondly, that unless Hopeful follows the old method he discards (and which is not very successful except in mating time), he might try "limeing." Bird lime can be purchased at any bird-fancier's shop, or can be made by chewing wheat in the mouth until it is thoroughly masticated into a sticky mass, keeping it as dry of saliva as it can be. Then having previously noted where his intended victims "most do congregate," watch for their temporary absence—early mornings, when they seek some brook or stream for their matutinal bath and their "early purl;" then lime the twigs and smear the boughs you have touched with aniseed, to ensure that you have left no scent behind you. All birds *love* aniseed; pigeons in the West Indies I have known to gorge till they burst on it, whilst growing. This mode will beat traps. In the winter, the old brick trap of one's school-days might be tried, but sparrows, linnets, wrens, robins, and chats, or yellow-hammers, are far more likely to be taken than blackbirds or thrushes, as such traps are too small for these latter. Most birds that are intended for eaging are taken before they can fly from their parents' nest, as, not having learnt what freedom is, they do not as a rule pine from the effect of captivity, which old birds naturally are prone to do, and very frequently die before they become reconciled. Not only does one lose the fruits of one's labour, but one has sundry prickings of conscience when the trapped or limed bird refuses food and dies.—J. W. H.

Writing on Glass.—T. W. V. (*Leicester*).—To write on glass, or, as it is properly called, to etch, as the letters are *eaten out* by an acid, you require either liquid hydrofluoric acid or hydrofluoric acid gas, according to the effect you wish to produce; the former eats away the glass but leaves it clear, the latter gives the part operated on a ground glass appearance. For the first way, clean a piece of glass, warm it, rub over with white wax or beeswax, and trace the letters with a needle or penknife, going quite down to the surface of the glass; make a wall of wax all round the edge of the glass, and pour on hydrofluoric acid, and leave for two or three hours, then clean with turpentine. To produce letters with a ground glass appearance, place in a leaden dish two parts of powdered fluoride of calcium, pour on three parts of sulphuric acid, and with a stick mix into a paste. Prepare the glass as before, except that there is no need for a wall of wax round the edges; cover the leaden vessel with this piece of glass, and by warming the vessel gas will be evolved, which will attack every clear part of the glass. Let me caution you to be very careful indeed in using the acid or the gas; the fumes, if breathed, are highly injurious, causing ulcers on the lungs, whilst drops of the acid on the skin act like a red-hot iron, and produce very painful sores, which are not easily healed. As regards your second question, opal can be heated as described above, and the letters coloured or enamelled afterwards, or you can use china colours, and have the opal fired. White letters on coloured glass may be obtained by using flashed glass, and treating with acid upon the flashed side, which is soon eaten through, leaving the plain glass underneath. An ink for writing upon glass is sold in gutta-percha bottles at 1s. 6d. per bottle (carriage, of course, extra) by Messrs. Townson & Mercer, 89, Bishopsgate Street Within, London, E.C.—W. E. D., Jr.

Shellac.—Hopeful (*Newry*) has not complied with the Editor's rule as to asking separate queries on separate paper. I will excuse him this time, trusting that in future he and other correspondents will observe this rule, or their second queries will not be noticed.—(1) Shellac is the gum of a tree prepared chiefly in India and Ceylon; a sort of resin. (2) Procure the index of first volume of Work, price 1d. You have as much time to look up past articles as I have. If your bookseller has not got it, send 1½d. in stamps to the publishing department, Cassell & Co., for it.—J. W. H.

Sign-writing.—J. S. (*no address*).—You should buy an index to Vol. I. of Work, price 1d., from any bookseller, and then refer to the sign-writing articles. Ascertain the numbers of the pages referred to, and then obtain these of your bookseller, or of Messrs. Cassell & Co., London, E.C., direct.

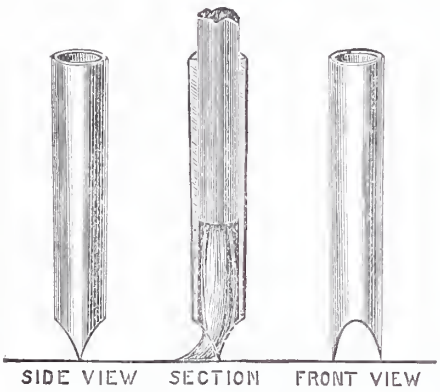
Suction of Fan.—J. B. (*Glasgow*).—You may take it that if your fan is powerful enough to exhaust the four chambers, the distances of the valves will not practically affect the question. The area of the air passage to the fan must be in excess of the sum of the areas of all the valves when opened to their widest. The volume of current passing through the different chambers will vary as the openings of the valves, *if the inlets have openings in the same ratio.* The state of affairs is this: the fan sets up a certain amount of vacuum in the passage into which the valves open, and this vacuum will cause a flow of air at a certain velocity, and, therefore, while the vacuum remains unaltered, the quantity flowing through an aperture into such passage will vary as the size of the opening through which it flows, and the least of the two openings, the inlet and the valve, will determine the quantity passing through the chamber. To determine approximately the quantity of air flowing through an orifice in cubic feet per minute, multiply the area of the orifice in square feet by the square root of the vacuum in pounds per square inch, and by 13,128.—F. C.

Dulcimer Drawings.—J. W. D. (*Manchester*).—If J. W. D. will refer to Nos. 31, 38, and 41, Vol. I. of Work, he will find a full description, with all necessary drawings and details, for the construction of a dulcimer. If, however, he should require any further information on the subject, and will write more fully, I shall be glad to help him in any way, to the best of my ability.—R. F.

Zither.—Musicus.—An article on the construction of this favourite instrument is in the hands of the Editor, and only awaits its turn to appear in the columns of Work. Short paragraphs have from time to time appeared in "Shop," in reply to

queries, but as these have appeared in Vol. II., it is difficult to give page and number without hunting the file through.—R. F.

Black for China Painting.—G. R. (*no address*).—G. R. pays me the compliment because I answered, as he says, a query at page 341, No. 73 of WORK, *re* "Litho Transfer Paper," of J. B. (*Tunstall*), to think I can also help him. He may be assured that I have all the will to do so, but I fear I do not possess the precise experience. The fact is, that every china and glass painter has usually his (or her) own pet recipes for mixing ceramic colours, and mere amateurs like myself (so far as ceramic art is concerned, I am but a tyro) can scarcely aid in a matter like this. I should, however, in G. R.'s place try to let down the black with "oil of tar." To thin it for flowing from a ruling pen seems to me, however, a little visionary. A fine brush, such as the china painters of Sèvres use, would be far more likely to give the body required. With a little practice a brush is as easily governed as a pen, and gives the power of far greater freedom. Ceramic artists in France, both at Sèvres and at Creil (near Chantilly), the one a "porcelaine," and the other a "faïence" establishment, use fine brushes made from the long, fine, taper hairs obtained from the inside of a cow's ear, which are far more springy, more gradually taper to the point, and more lasting in "oil of tar" than the best of sables. It was with one of these I was once honoured in being allowed to see Mademoiselle Robert, daughter of the director of the porcelain works at Sèvres, line in the fine veins of some pencilled geraniums she was introducing in a grand vase, some 175 centimètres in height (about 5 ft. 3 in.). No pen that was ever made could have excelled the delicacy her litbe fingers attained with the most consummate ease with this *cow-hair* brush. G. R. asks where to buy the best ceramic colours. Lechertier, Barbe & Cie., Regent Street, have a very high reputation in France, and, I believe, also in Germany; and if G. R. writes to them, no doubt they will be able to inform him how to use colours, with a pen, that I have only known to be used with a brush. For ruling border lines with a brush the following simple little expedient may serve the purpose of a ruling pen:—Cut a short



Quill cut for Brush-ruling.

quill so that it is open at both ends: *i.e.*, cut away all pith and feather and the closed end. Now a quill tapers at the point, so that you should make sure at what distance the diameter of your quill will be equal to the width of your intended line; at that point, taper your quill both sides until it is V shaped (see diagram); you can then slide a brush that just fits it into this quill; fill it with colour, and rule your line with one of the two V points against your straight-edge, and both in contact with the paper or glass, as the case may be. The quill should be regulated by slipping it higher up or lower down the quill of the brush itself. It forms a nice hard support against the ruler or straight-edge, whilst it confines the hairs of the brush exactly to the width, and prevents spreading. As quills can be obtained any size almost and brushes to fit each size, any line from $\frac{1}{64}$ in. (with a crow-quill) up to nearly ½ in. (large swan) can be readily got. Small taper brass tubes will answer equally well, and would not cost very much; but the quills are the handiest. When done using, always wash out clean, both quill and brush, and save for future use. —J. W. H.

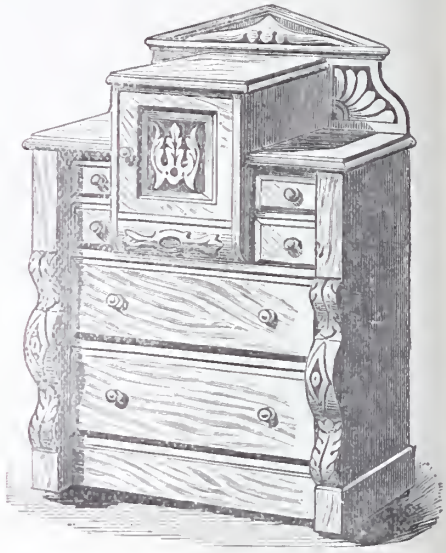
Lantern Lamp.—EXHIBITOR.—EXHIBITOR has purchased a lantern, a sketch of which he has sent. The lamp seems to be a kind of moderator which in some way fails to act, or, as he puts it, "the lamp, owing to some cause or other, won't burn properly." From the sketch I judge it is a French make, as I think I have seen some cheap lanterns lately very similar, which are French. As EXHIBITOR does not give the slightest clue as to what the fault is, it is quite impossible for me, or, I think, anyone, to help him. I must ask a few questions, and perhaps, if he answers them, some help will be forthcoming. In the first place, in what respect does it not "burn properly?" Does the oil fail? If it is, as he suggests, a moderator lamp, there will probably be a spring inside, acting against a kind of valve of leather. The leather has sometimes to be renewed. When the oil is forced up by the winding of a key, does the lamp act for a time, and then suddenly fail? Look at the lamp and see if there is provision made for winding. Again, what kind of oil is used? From a remark made in EXHIBITOR'S letter, I fancy he may be using paraffin oil, but this is useless for a moderator lamp. It must be whale oil or colza. Perhaps the difficulty arises from a badly prepared wick. Or it may be a fault of ventilation. But all this is working in the dark. My advice is, take the lamp to a lamp shop, and get it looked at by a competent man; it may be that the whole affair results from a little bad management. If it is a French make, the probability is that it is perfectly worthless. A lot of cheap and showy lanterns, as well as other things, are thrown into the market to catch the eye. In my judgment there is not a lantern made that comes any way near in quality an English-made lantern of the ordinary type, by a good maker. In saying this I have no interest whatever. England still keeps her place for good honest work, when a fair price is given, though, truth to tell, she can do a bit of scamping if the market requires it. In the present stage of the question I cannot offer any better answer. No reputable doctor will prescribe unless he sees the patient or knows the symptoms. The simple statement that "the lamp, owing to some cause or other, won't burn properly," can hardly be considered a valuable diagnosis.—O. B.

Small Metal Soldiers.—L. A. C. (*Wigan*).—The immense pressure on the "Shop" columns of WORK—which has compelled the proprietors to *give away* a four-page supplement about every six weeks to work off arrears—has crowded out my answer as to metal soldiers. Ere L. A. C. sees this, that reply may have appeared (to reply by post is against my Editor's rules). Parenthetically, I may remark that querists should not ask such questions as, for instance, "Can I make these myself?" How on earth can an expert, without ever having even heard of you before, say what you can or what you cannot do? If I were to assert your incapacity to perform any function whatever, you would be, of course, the first to tax me with prejudging your capabilities without just grounds! Is it not so?—J. W. H.

Picture-frame Making.—W. H. S. (*Nottingham*).—You must not forget practice helps to perfection. If you make your frame with the shooting block, you must be careful your angle is correct. I should advise you to get a truer; it is very easily made thus:—A piece of thin mahogany or oak; cut through it from corner to corner, then you have a correct angle; glue a slip of wood upon your square end, and lay it on your shooting-board ledge upon the side the plane runs, and you can always true it up and make up the deficiency with a piece of card at back or front of angle arm. That is the method adopted by frame makers. In joining slips, a piece of wood is made to fit on moving jaw of vice, so that the teeth or cross cuts do not mark your slips; screw your slips in gilt parts towards you, longest end in vice and shortest end in your left hand, gilt part to your body, mitre pointing to the ground; place it to your part in vice a little off correct fit, and bore hole for brad. Take it off, put brad in hole, and a touch of glue at back edge of mitre, so that it does not squeeze through in front; place them as before, and in knocking nail in you will at the last tap bring the mitre up to its proper level.—G. R.

Etching on Copper.—MONUMENT.—The best kind of etching ground is a matter of opinion; there are two famous makers: Sands' etching ground is 1s. per ball, and Rhind's liquid etching ground in stoppered bottles (quarter pound), price 2s. 9d. (carriage extra). To lay the ground in the old style, first procure a prepared copper plate (which may be bought at from 2s. 2d. to 3s. 6d. per pound weight), and clean with turpentine and whiting, cleaning the whiting off with bread. Wrap a ball of "ground" in new taffetas silk, of such a nature that small particles do not adhere. Fasten a hand-vice to the corner of the plate, inserting a piece of cardboard to prevent it from damaging the copper. Heat the plate over the gas (mind there is no dust) until a sufficient degree of heat is acquired to melt the ground through the silk and spread evenly over the plate. Next comes the "dabber," price 1s. and 2s. each. While the plate is hot, dab the ground all over with the dabber to spread it evenly, cleaning the dabber when it gets full on a piece of coarse canvas. If you have not ground enough, add a little from the ball and dab again. Next is the "smoking" of the plate. Get some two or three wax tapers and twist them together; light them and pass the flame rapidly along the surface of the plate, taking care not to burn the ground. The plate is now ready for the needle. The different light and dark shades are obtained by different processes, for a full explanation of which I refer you to a work which, before you go to any expense, I strongly advise you to procure and attentively read. It is entitled the "Etcher's Handbook," by Philip Gilbert Hamerton, Esq., third edition, Charles Roberson & Co., 99, Long Acre, London; 1881. As to machines, etching proper is all hand-work, except the biting. For information regarding ruling and routing machines, write to Messrs. G. Birch & Co., Islington Tool Works, Salford, Manchester. Space forbids my replying at greater length. Address another letter to the Editor concerning wood engraving.—N. M.

Chest of Drawers.—T. F. (*Wellington-on-Tyne*).—Enthusiasm such as yours merits admiration, but no certainty exists that your claims cannot be refuted. I will quote part of your letter, with the view of giving other readers an opportunity of determining the question. You say:—"As I had the honour of being the first to make the cabinet which was published in No. 1 of WORK, I respectfully beg also to claim the same honour for making the 5 ft. sideboard published in Nos. 24 and 25 of WORK; at least, I have not heard of anyone making it except a joiner in Newcastle." You must recollect, however, that many professionals and amateurs make articles from designs specially drawn for and published in WORK, but all do not trouble themselves to write and inform us of the fact as you have done in your case. Were they to do so, I am sure it would be interesting to publish particulars of their success for the encouragement of their brother readers. The point which deserves most consideration is not the length of time in which you completed your articles, but the soundness of the workmanship, which, I daresay, is satisfactory. To possess a cabinet and a sideboard made from the respective designs in WORK is something for you to be proud of, and I am sorry you are debarred, as you say you are, from placing one or both in the forthcoming "Work" Exhibition, by reason of the cost of carriage and chance of damage arising. I am looking forward with interest to this Exhibition, for it will be the means of proving the utility and pleasure afforded by WORK to the previously antagonistic classes of professional and amateur workmen, and also introduce several readers to each other. I would like to see your sideboard there, and so would the designer of it, no doubt, to whom I must say you "wish to pass a hearty vote of thanks." Your desire now is to make a chest of drawers. As you have made the articles just alluded to, you hardly require a sketch of an ordinary chest, therefore I have designed you something which



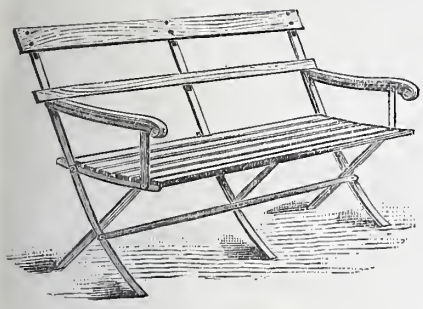
Chest of Drawers.

will, without much extra labour, be a considerable change to the old stereotyped patterns. It is astonishing how little attention designers have given to this class of furniture, for the different sorts could be numbered upon the fingers by only counting along them once. A cupboard is as useful as a drawer in some instances. Mr. Adamson's "Lessons from an Old Bureau," will give instruction to those desiring to make this chest, so I will say but little concerning it here. The cupboard projects beyond the main carcase the same distance as does the moulding of the two lower top boards, and the sides of it will be connected to the first long division of the chest proper. Between the bottom board of the cupboard and this divisional board will be a narrow space, which could either be left as such, fitted with a drawer, or, as I show, have a carved curved piece glued in front. The two sideboards will be of an ordinary thickness, faced up with long blocks or pilasters, between which will be carved brackets or halves of turned columns. The pediment, or, more properly speaking, the back, could be fitted on in a similar manner to that in which the sideboard back was secured. I have shown knobs, because I think these are more preferable to brass handles upon a chest of drawers. Carving here and there and bevelled drawer fronts will give a good effect. Let me know whether you like the design or not. Without being presumptuous, I shall live in hope of you passing "a vote of thanks" to me.—J. S.

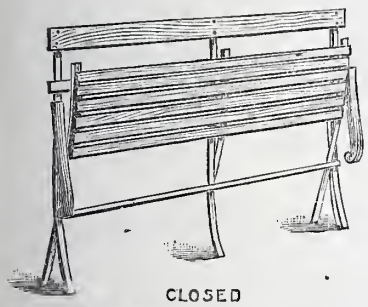
Wet Process Photo.—F. C. (*Finsbury Square*).—There is nothing in the formula given to prevent success. The fault must lie in the use of the formula. You do not say how you have failed, so it is impossible to even guess what is wrong. The process requires learning. The best plan would be for you to see an expert go through with it, or carefully study a thoroughly good handbook on the subject. There is a very good one published by

e Stereoscopic Company, but there are a great mber on the subject by different authors avail-le and reliable, but seeing the thing done would e very much the best plan in your case.—E. D.

Garden Seat.—W. R. S. (*Stratford*).—I am fraid that a folding garden chair to hold three ersons, and made in the way you propose—viz., ood framing covered with carpeting—would arcely be of a sufficiently strong nature to carry afely the weight put upon it. If, however, you vill look up page 96, No. 58, Vol. II. of WORK, ou will find a sketch and instructions for making single folding chair, which, by widening and ncreasing the width and thickness of the wood raming a little, you may adapt to suit your pur-ose, although if I were about to make such a seat s you require, I should endeavour to construct the ramework of iron, or get a smith to do so for you f you are unable to do it yourself. There is a very ompact garden seat which is made to fold, and which holds two persons, made by the Clipsham



OPEN



CLOSED

Garden Seat—Open and Closed.

Chair Co., of Tue Brook, Liverpool; perhaps if you wrote to the Company they would supply you with the iron work, and you could either make the seat of carpeting or of wood splines, as you found suit you best. I give you sketches of this seat open and closed, so that you may judge for yourself of its handiness for the purpose for which you require it, and should certainly advise you to adopt the iron framing, as it is much preferable to any wooden one you can make.—G. LE B.

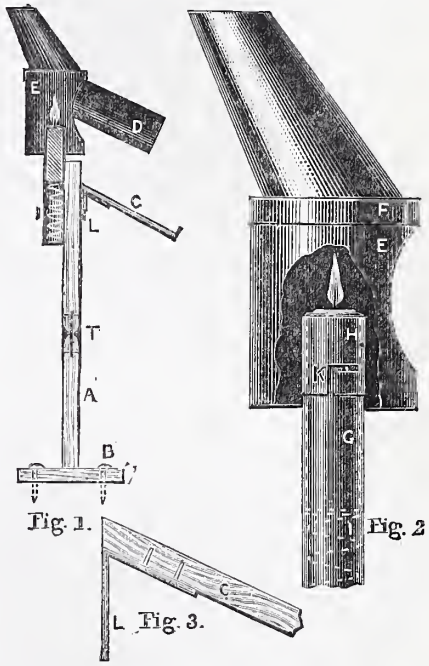
Sheet Brass.—PRACTICAL.—I am sorry for your disappointment, but your first communication did not reach me. Messrs. Tucker & Sons, York Street, Sheffield, will supply you, wholesale or retail, any description of sheet brass you may require in standard length, breadth, and gauge; extraordinary descriptions of brass will require a special order. Your second query as to a polish for brass is so ably answered and illustrated on page 324, Vol. II. of WORK, that I need say nothing. See also "Our Guide to Good Things," page 338, Vol. II., by the Editor. The third question is out of my way altogether. Correspondents should write their queries on separate sheets of paper when the subjects are wide apart; it saves time, trouble, and disappointment.—N. M.

Polishing Marble.—P. McJ. (*Edinburgh*).—This must be done by rubbing with putty powder and water, applied on thick felt stretched over a block of wood. Of course the surface has first to be gritted down with grit, water, and a flat stone, and then made smooth with fine sand and water in the same manner. All the materials, including the felt, which is sold by the pound, are supplied by the marble merchant.—M. M.

Dynamo and Magneto-electric Machines.—E. D. (*Birmingham*).—If I understand your letter aright, you have made a magneto-electric machine which you wish to furnish current and give shocks. You wish to use it as a dynamo and shocking machine combined. To this end you have slightly altered the usual arrangements of such machines, and have put on a two-part commutator as for a Siemens H armature. This does not in itself spoil the machine if you have fixed the commutator in the right position, insulated its ring from the spindle, and its two parts from each other, divided the ring in a proper manner with an oblique slit in the right position, and fixed the brushes at the right angle to take off current when the bobbins cut the lines of magnetic force. I suspect, however, that you have not insulated your brushes from the other parts of the machine by placing them on insulating blocks of ebonite. You must do this if you wish to take off current from the machine. But, in any case, you will not get much current from such a machine, and the shocks will not be very sharp from No. 24 wire. Respecting the small dynamo you made twelve months ago, which you can work as a motor but not as a dynamo, I suspect you have not only reversed the magnetism of its fields by using it as a motor, but have also got the brushes fixed in the wrong position, or the commutator fixed wrongly. You do not say whether you have connected the field magnet coils to the brushes in shunt or in series. This is most important in your machine, which should work fairly well as a shunt machine, with the ends of the F.M. coils connected to the brushes, and wires leading from these to the terminals of the machine. If connected in series, *i.e.*, with one end of the F.M. coils connected to one terminal, and the other end to one brush, you will get very little current from the machine. If connected in shunt and driven at the rate of 3,000 revolutions per minute, it should light up one 2½ c.p. 6-volt incandescent lamp. Connect the coils in shunt, see that the commutator is fixed right as directed above, and the brushes insulated, then try the machine again. If you cannot get it to go right let me know, and I will try to arrange with you to see the machines.—G. E. B.

Copying Busts in Electrotype.—D. G. (*Moorfields, E.C.*).—Many thanks for your kind interesting letter. I will try to give concise replies to the several points raised therein. (1) *Battery.*—Daniell cells are far more constant than Bunsen cells for long runs of over ten hours, the extreme limit of a Bunsen's run on one charge. Bunsen cells are used by gold and silver platers, but not generally by electrotypers. (2) As plaster casts vary in porosity, I cannot say that one coat of boiled oil would be sufficient. The pores must be filled up to prevent absorption of the hot liquid composition, and it may take more than one coat to do this. (3) I have not tried gelatine as a substitute for the elastic composition, but think it would not be so elastic or durable. If you try it, let us know the result. An ordinary galvanised iron pail is a convenient vessel for turning out the cooled composition surrounding the bust. The composition may be melted again when required. (4) *Wax.*—Beeswax of the best quality should be used, so as to get a fine impression from the elastic mould. Harder material, requiring more heat to melt it, would also melt and distort the elastic mould. When the wax is quite cold it will be hard enough to polish with blacklead. (5) The very best blacklead of the finest grain must be employed and used dry on a very soft brush. It must not be mixed with water, but brushed on dry, using scarcely any pressure on the brush. (6) When about to pour in the molten wax, suspend a lead weight in the centre of the mould. This will be enclosed in the wax and act as a weight to keep it in the solution. (7) When the wax is melted out, and the interior oiled and dried, there will be still enough oil left to prevent perfect union of the two coppers. (8) If the metal surface is first warmed, and more than one coat of varnish is applied, I do not think you will be troubled with nodules of copper forming on the varnished surface. These are due to pin-holes in the varnish. I shall be glad to be of any further help to you in the study of this interesting subject.—G. E. B.

Reading Lamp for Magic Lantern.—C. M. (*Perth*) asks if the book on lanterns, mentioned in No. 63, is a book to show how to work the lantern to the best advantage. I am sorry I cannot give any information on the subject; but seeing it is only a shilling work, no one need be in doubt long on the matter. If it does not answer C. M.'s purpose it will not be a great loss in the pursuit of knowledge. His next question is one with which I think I can help him more successfully; for seeing, as he says, he has made a good lantern—on which I congratulate him—I am sure he will find the construction of a lamp not one of great difficulty, and one that, when completed, will meet his need. The drawings will, I think, almost explain themselves. Fig. 1 is a section of the lamp and stand. A is a rod of mahogany 1¼ in. square morticed into a foot. At T it may be cut in two and joined with a toggle joint, which will render it more convenient for carriage. To form the joint, make a saw cut in each half to take a strip of brass; if a pin is riveted in each length the stand can be folded, care being taken that the ends of the stand are rounded off in the direction of the joint. A square ferrule will be needed to slip over the joint, which then will be perfectly rigid. At L a staple must be placed to receive the end of the bracket carrying the reading desk. Fig. 2 shows on a larger scale the lamp. You will see the idea is taken from a carriage lamp. First decide what size candle will best suit your purpose, and work from that. Make a tin tube to admit the candle easily, and about one third longer; the lower end is closed. K is a short collar to fit on the tube, and may be about two inches long. Fit it on a round piece of wood so as to project, say, ¼ in. beyond it. With a hammer knock the end over, so as to reduce the size of the opening—with care it can be done very neatly. Cut a slot as shown at K. Place the collar in the tube and mark where the longitudinal slot is and solder a short pin to the candle tube: this will form a bayonet joint. With stout brass wire make a spring, as shown at I; this, when expanded, must be as long as the tube; a small disc must be soldered to its upper end to bear against the candle. For the body of the lamp we must make a large tube 6 in. in diameter and 6 in. long; one end must be closed with a disc with a central opening to take the candle tube, to which it must be securely soldered. One side must be cut away as shown. A chimney must be fixed to permit ventilation, yet so as to prevent the light escaping. A sheet of tin plate about, say, 8 in. square must be bent to a semi-circle. One end must be hollowed out so as to allow it to pass partly round the lamp; it can be held in position by a couple of small hooks. This forms a reflector, as shown at D, Fig. 1. The desk C may be 8 in. square and ½ in. thick. Bend a strip of stout brass, as L, and screw it to the under side of the desk; the other part fits into a staple screwed to the stand as shown. Through the foot of the stand two screws are shown; these are to secure it, if need be, to the floor. To use the lamp remove F, take off H, force the candle into the tube, replace the cap H and the chimney, fix the reflector and desk, and we are ready to commence. The candle tube can be fixed to the stand by two staples. The height of the stand must be regulated by the height of the reader; it can be adjusted to some little extent by placing the candle tube higher or lower



Lamp and Desk for Lantern Reading. Fig. 1.—View of Lamp in Section—T indicates a Joint. Fig. 2.—Enlarged View of the Lamp, with body partly removed to show the Candle Tube. Fig. 3.—Desk.

on the stand. I trust these hints will enable C. M. to construct a very serviceable lamp and desk. It can easily be modified to fix on a table without the stand, though sometimes a stand will be indispensable. Should the arrangement with the candle be considered too much trouble to make, then a small lamp might be substituted, though the plan given is certainly the more portable and less messy.—O. B.

Small Dynamo Castings.—A. M. (*London, W.C.*).—Small dynamo castings are supplied to amateurs by Mr. S. R. Bottone, Carshalton, Surrey; Mr. H. Jones, 14, High Street, Lambeth; and Mr. A. Crofts, electrical engineer, Dover.—G. E. B.

Zinco Blocks.—ELECTRO.—I refer my correspondent to my previous replies to J. W. S. (*Sheffield*), No. 51 of WORK, page 813; to F. J. T. (*Bristol*), No. 58, page 92; and to INQUIRER (*Portland, U.S.A.*), No. 65, page 208; and again recommend Josef Bock's book on the subject (Wyman's "Technical Series," 2s. 6d.), of any bookseller, or 65, Chancery Lane, E.C. "Shop" is too crowded to repeat.—J. W. H.

Buying Second-hand Lathe.—H. P. (*Didsbury*).—You can watch the advertisements in the *Exchange and Mart* till you see a lathe you think would suit you, which is not too far off to go and see; or get an exact description of it; or get a friend to go and see it for you. The Editor holds the purchase money till you say you are satisfied; if the lathe were not as described, you would return it and have the money back. This I think the best way, especially if you are able to judge whether the lathe is a good one, or have a friend who can do so. Another way would be to inquire of local ironmongers or dealers in machinery; or, again, put an advertisement in a local paper; thus the lathe would be near enough for you to go and see. Take your time and watch till you find what you want, and you will thus get it at two-thirds to one-third of first cost, according to condition.—F. A. M.

Dead Black for Brass.—W. M. (*Shepherd's Bush*).—Perhaps the following recipes will suit your purpose: three pounds of black sealing wax, and one pound of shellac, to one gallon of spirits of wine; or mix fine lamp-black with brown hard varnish or lacquer; this latter recipe is used for the interior of telescope tubes, the lamp-black serving to deaden the bright colour of the former recipe. Another black varnish for metal may be made by fusing three pounds of asphaltum and half a pound of shellac, and adding one gallon of spirits of turpentine. In applying, use soft, clean brushes, and be careful that no dust is flying about. Let the first coat dry hard before applying the second coat, and have the temperature of the room about 72°, especially for spirit varnishing. Spirit varnish requires between two and three hours between coats. Turpentine varnish between six and eight hours between coats. Oil varnishes about twenty-four hours between coats, according to the state of the atmosphere. For bright work before applying the last coat, smooth down with finest glass-paper. Cylinders and flat circular surfaces may be blacked in the lathe. Any further particulars on this subject will be found in Holtzapffel's "Mechanical Manipulation," Vol. III., in a long and instructive chapter on varnishing, lacquering, japanning, and bronzing, etc. With regard to the query as to the dead blacking of the interior of photographic dark slides, I much regret that I am not an expert; but, in the absence of a better formula, you might try the dead black recipe above.—N. M.

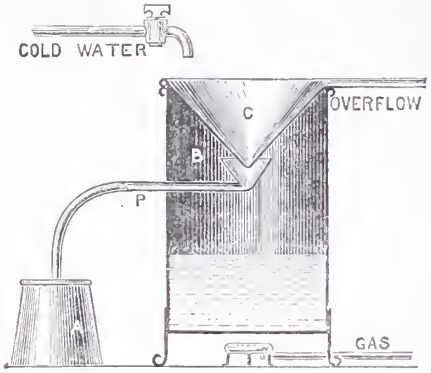
Jug Mending, etc.—E. J. S. (*Maidstone*).—It is a great pleasure to receive such letters as yours, and to know that articles which we have written, in the hope that someone may be helped and benefited, have been of service. I commend you for learning all you can; but, remember, more can be got by practice than by reading, and that to an observant man his failures are turned to service, and help to lead him on to success. As regards mending a jug with a broken handle, you will find that sometimes the only way to make a good job of it is to drill a hole through the side of the jug, and carry the rivet through, and solder it on the inside so that it cannot come out, filling the hole with plaster of Paris in the usual way; but of course this can only be resorted to in some cases. As you say, use "common sense;" and, I may add, plenty of it. In most cases the ordinary rivet into the side of the jug and the handle will be sufficient, if the rivet is put in the right place—*i.e.*, where the greatest strain is met by the turned ends of the rivet; in fact, when you come to perform the work, I think you will be surprised how strong it is if it has been done carefully. With the handle in two or three pieces, it is a great advantage sometimes to drill holes in the ends, and put a straight piece of wire in embedded in cement before riveting outside in the ordinary way. I feel certain that with a little practice you will do it well enough to charge for your work; your wish to better your position does you great credit, and if what little I have done has helped you, I shall be amply repaid. As to charges, you reckon according to the number of rivets you have put into the work, 3d. per rivet being the general charge in the trade, and this, as you will see, allows you a fair profit for your time and expenditure. The suggestions as to the arrangement of "Shop" must be for the Editor to decide; but what might suit one would not, perhaps, please another; personally, I should not consider it such an improvement as would compensate for the extra trouble. Shall be glad to hear at any time how you are succeeding, and if you get into any muddle will try our best to put you straight; it is such as you we want to help.—W. E. D., JR.

Tuning Organ-pipes.—J. H. (*Burton*).—Ordinary metal flue pipes are tuned with a metal, or boxwood, cone which is shaped much like a candle extinguisher. If placed over the top of a pipe (as though extinguishing a candle) and pressed down with a screwing motion it closes in the top of the pipe a little, and causes it to sound flatter. If the point of the cone is inserted *inside* the pipe and pressed down in a similar manner it enlarges the top of the pipe, and causes it to sound sharper or higher in pitch. Square wooden pipes are generally tuned by a lid of zinc, which covers the tops of the pipes; raising the lid sharpens the tone, shutting the lid downwards lowers the tone. Stopped pipes are tuned by means of the stopper or tompion; raising it *flattens*, and lowering it sharpens the tone. Some open pipes are tuned by a tube sliding over the body of the pipe at the top; raising the tube flattens, and lowering it sharpens the tone. Some again are tuned by means of long ears at the side of the mouth; pressing them inwards flattens, and pressing them outwards sharpens the tone. These are a few of the many ways by which the pitch-tones of the pipes can be regulated, and will, I think, be sufficient to indicate the general principles by which you must be guided in tuning.—M. W.

Bicycle Spring.—J. S. (*Crieff*).—With regard to the spring frame idea of our correspondent, it is not by any means new. There are numerous spring devices applied to the frames of safeties with the object of lessening vibration. From J. S.'s sketch, I should say it is almost identical with the "Weston" spring frame. I am not aware whether Mr. Weston has a patent for his frame. At any rate, J. S. will see that his idea is forestalled.—A. S. P.

Lincrusta Decoration.—A. R. B. (*Dublin*).—Lincrusta decorations cannot be produced except by the manufacturers. Expensive machinery and workshops are indispensable for its manufacture. The material is made in a variety of ways. One kind resembles carved wood, and is known as "wood effect;" this answers for door panels, dados, mantelpieces, etc. Another kind represents embossed metals, and is something like the highly raised Japanese wall papers; this goes by the name of "lacquer effect." The simplest sort is like rough-grained thick brown paper. There are two or three qualities of the latter—coarser and finer. These are employed as grounds by artists who paint subjects upon them in oil colours. They are used for friezes, screen panels, and so on, but cannot be much recommended, as the surface absorbs the colours greatly, and is not pleasant to work on. The one advantage is that subjects done on lincrusta need have no background, therefore such decorations are more quickly accomplished than those executed on canvas.—C.

Mint Still.—DISTIL.—I send you a sketch and particulars of a small still that may suit you, at the same time warning you to be very careful how and what you distil, or you will have the Excise on you like the proverbial thousand of bricks. The sketch is taken from one of Vevers' portable distilleries; they are sold at 6s. 6d. each, by C. C. Vevers, Briggate, Leeds. It consists of a round vessel or boiler on three legs, in which is placed the liquid you wish to distil. Heat is applied underneath by means of a gas stove, the steam condenses on the sides of the



Mint Still. A, Receiving Vessel for the distilled Liquor. B, Boiler containing Liquid to be distilled. C, Condensing Vessel. P, Conducting Pipe.

funnel C, which is kept cold by a constant supply of cold water; the condensed liquid runs down the sides of the funnel, and drops into the small funnel at the end of the conducting pipe P, through which it is led to the container or receiver A. This is a brief description, but I think you will easily grasp the idea, and if you want any detailed information as to how to make it, write again and I will gladly help you.—R. A.

Boot Last Iron.—COMPO-SNOBO.—I do not know where you could procure such an article. I have never seen one, but I should recommend you to make one of wood, as you seem rather ingenious. Wood would not be so cold as iron, and would answer all the purposes as well. But for myself I use a stump of wood 3 in. by 4 in. and 24 in. long, with a hole in top for the iron foot to go into. This rests on the ground and I hold it between my knees. It certainly makes a noise on a boarded floor which the other would not. Some people use a vice for holding the iron foot.—J. M.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. E. T. (*Birmingham*); LEROY; L. G. (*Bethnal Green*); A. C. (*Peterboro'*); C. E. D. (*Bradford*); J. W. D. (*United States, America*); G. E. W. (*Sowerby Bridge*); E. P. (*Castleford*); H. H. W. (*Blackheath*); F. A. C. (*Bristol*; J. D. (*Glasgow*); J. H. B. (*Manchester*); CLEAN; J. S. H. (*Stockton-on-Tees*); NORTHERNER; HYDRO; W. W. (*Chelsea*); F. R. H. (*Manchester*); S. H. M. (*Liverpool*); J. S. B. (*Devon*); J. W. (*London, E.C.*); G. E. G. (*Battersea*); J. S. (*Regent's Park*); J. F. W. (*Sunderland*); W. M. (*Southampton*); J. M. (*Edinburgh*); W. D. S. (*Redcar*); J. A. C. (*Essex*); DEAN FREST; F. J. C. (*Bristol*); J. E. S. (*Tamworth*); H. S. (*London, S.E.*); T. C. (*Durham*); WELL-WISHER; E. B. (*Brockley*); T. F. (*Acklington*); T. R. (*Paisley*); E. M. (*Camberwell*); J. K. (*Willesden*); G. F. G. (*Frome*); G. F. B. (*London*); W. R. S. (*Walton-on-the-Naze*); J. S. G. (*Lancashire*); J. P. (*Manchester*); A. T. S. (*New Swindon*); F. C. (*Leytonstone*); W. T. (*Tunbridge Wells*); M. P. B. (*London, E.C.*); F. C. (*Londonderry*); B. A. K. (*Sunderland*); F. J. M. (*London, S.E.*); H. S. (*London, S.E.*); T. C. (*Durham*); T. H. O. (*Dalston*); WORKER BEE; J. B. (*Brigg*); W. T. (*Exeter*); C. C. E. (*Lincoln*); F. H. (*Nottingham*); HOUSE PAINTER; A. V. (*Northampton*); C. H. G. (*Coventry*); S. J. S. (*Acton*); A. W. S. (*London, W.*); RAD (*London, S.E.*); A. R. (*Scorrier Saw Mills*); H. E. (*Brighton*); CONSTANT READER; H. J. E. B. (*Saffron Walden*); F. M. (*Kent*); W. D. G. (*Manchester*); TUNER; W. E. J. (*Wilts*); F. C. J. (*Masborough*); E. (*Carnforth*); E. G. (*Battersea*); W. H. W. (*London, N.*); W. E. G. (*Surrey*); J. T. (*Kensal*); H. B. (*Harrow*); A. M. (*Sheffield*); OLD BRUN; CYCLIST; G. E. (*York*); W. M. (*Salop*); H. B. (*Manchester*); R. J. C. (*Doncaster*); REGULAR READER; CONCAVE; T. B. (*Sheffield*); COUPLER; S. (*Surrey*); R. W. (*Hartlepool*); NAUTICUS; W. J. M. (*Canonbury*); C. F. H. (*Belfast*); E. P. (*Castleford*); B. (*Devon*); H. K. (*Clapham*); J. E. J. (*Huddersfield*); JUNIOR DRAUGHTSMAN; J. L. & CO. (*Birmingham*); E. J. B. (*Kentish Town*); P. M. (*Hoxton*); FOOCHOW ENAMEL; W. A. S. (*Clapham, S.W.*); E. T. (*Dudley*); S. D. (*Clerkenwell*); A. E. S. (*Islington, N.*); S. G. (*Suffolk*); F. E. B. (*Devon*); A. G. (*Plaistow*); H. B. S. (*Liverpool*); D. W. (*Edinburgh*); R. A. C. (*Clerkenwell*); FENDER MAKER; MACK; J. G. B. (*Stratford, E.*); H. S. (*Walworth, S.E.*); P. A. D. (*Canonbury, N.*); W. H. (*London, N.W.*); F. W. (*Birmingham*).

Trade Notes and Memoranda.

MR. SAMUEL ELLIOTT, of Newbury, near Reading, has invented a machine by which he claims that the smoke nuisance can be entirely suppressed. The "Annibilator," which can be easily adjusted to chimney shafts, is a compact machine occupying a standing space of a few feet only. The smoke which we frequently see issuing from a chimney stack instantly disappears when the machine is set in motion. "It is forced into the annihilator where it undergoes a process of washing, and leaves not a trace of smoke or sulphur, but instead thereof chemical products of such a character as will probably find many industrial applications of great commercial value." As all the black carbonaceous matter of coal smoke is removed from the products of combustion, the general application of such an invention in Manchester, for example, would prevent the daily settlement of 300 tons of residuum upon vegetation and house tops.

To make a simple storage battery, get two half-round porous cups, and a round glass jar large enough for the two porous cups to stand in upright. Get two plates of sheet lead $\frac{1}{16}$ in. thick, wide enough to get the half-round side of the porous cups, and deep enough to come an inch or so above the top edge of the cups and jar. Solder a stout copper wire or a binding screw to each lead plate at the top. Place the lead plates in the cups, and fill the cups nearly full with a paste made of red lead mixed with a solution of sulphate of soda, thin enough to run like a cement. The glass jar containing the two cups should be filled to within ½ in. of the top of the cups with sulphuric acid and water—about one part acid to eight of water. The plates should be marked, so that in charging the currents may be sent in the right direction. The cell may be charged by attaching it to a series of a dozen sulphate of copper cells for twenty-four hours, or from a dynamo. A wooden cover may be fitted to the glass jar, and evaporation of the fluid should be replenished by adding water. Two or more cells of this battery will work small motors, lamps, and induction coils; and, if thoroughly charged, will retain a large volume of electricity for a considerable time. After once being well charged, four to six cells of sulphate of copper batter will recharge it.—*American Machinist.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [2 R

Buyers of Lathes and other Tools send 3d. for list of Second-hand Tools.—BRITANNIA WORKS, Colchester; or inspect largest stock in London, 100, Houndsditch. [3 R

Glass Silverer and Beveller, Lead Glazing, &c.—EDWIN HAMMOND, Junction Road, Romford, Essex. Please state requirements. [5 R

Joiners' Tool List free. — BOOTH BROTHERS, Dublin. [6 R

Fretwork, Carving, Brass, Leather, and Poker Work.—Speciality in ornamented ivorine for painting. Illustrated Catalogues of tools, 800 Illustrations, 6d.—HARGER BROS., Settle, Yorks. [7 R

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [1 S

Splendid Violin for disposal; first-class instrument, good bright sweet tone, complete with bow, case, 5s. tutor, mute. No use to owner. Would accept 17s. 6d. for the lot. Good bargain. Worth great deal more.—WOODBRIDGE, 6, Tower Street, Ipswich. [2 S

AMATEUR PHOTOGRAPHY.—**J. H. SKINNER & CO.,** *W Department, East Dereham, Norfolk.*

J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description.

CHEAP SETS FOR BEGINNERS.

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s.6d. If packed in portable wood case, with hinged lid and leatherstrap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6

Including Polished Mahogany Camera, with Folding Tail-board, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at 20 per cent. to 50 per cent. discount to clear. Send post card for Sale List.

Bovril. **Invaluable as a Strengthening and Invigorating Beverage.**

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

SEND 3d. IN STAMPS
FOR LIST OF
SECOND-HAND ENGINES
(Gas or Steam),
AMATEUR TOOLS, &c.
Cash or Easy Terms.

FULL CATALOGUE, 6d.

BRITANNIA CO., 100, Houndsditch, London.

All letters—BRITANNIA WORKS, COLCHESTER.

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,
TOOL MAKERS,
DUBLIN.

ESTABLISHED 1851.

BIRKBECK BANK,
Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Post Free.

Cassell's Classified Catalogue.

New Serial Issue, in Monthly Parts, price **7d.**

Cassell's Natural History. Edited by Prof. P. MARTIN DUNCAN, M.B., F.R.S., assisted by eminent Scientific Writers. With about 2,000 High-Class Illustrations. **Part 1** ready **Oct. 27**, price **7d.**

"A work of unending amusement and valuable instruction."—*Scotsman.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets, containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

SPRING CLEANING.

? How do you do? WITHOUT JUDSON'S DYES? 6d. POWDER AND LIQUID.

Now ready, Part I, price 3d.

Heroes of Britain in Peace and War. With 300 Illustrations.

"An intensely interesting work for young and old."—*Broad Arrow.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Serial Issue of Fyffe's "History of Modern Europe."

In Monthly Parts, price ***6d.***

A History of Modern Europe. By C. A. FYFFE, M.A., Fellow of University College, Oxford. With a Series of **Full-Page Original Illustrations**, expressly executed for this Edition. **Part 1** ready **Oct. 27**, price **6d.**

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

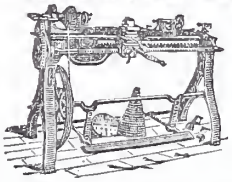
C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6d. OR FOR 7 STAMPS BIRMINGHAM. [33

London Warehouse: 124, NEWGATE STREET.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.

The enormous sale and general satisfaction which our Goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet	4s. free.
12 Finely Lithographed full-sized Patterns	1s. ,,
Sets of 12 Carving Tools	10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

NOTICE.—Cassell's Illustrated Almanac and Companion

for 1891, ready Oct. 27, price 6d., will be *Greatly Enlarged and Improved.* It will consist of no less than 96 Pages, Fully Illustrated, and will contain A Complete Novel, entitled "Missing—a Young Girl," by **FLORENCE WARDEN**, Author of "The House on the Marsh," etc. etc. *Fully Illustrated.* Particulars, with Portraits, will be given of the Champions of the Year in various Sports and Pastimes, together with a record of their achievements.

*** *A largely increased demand for the forthcoming issue is anticipated, and those desirous of securing a copy should at once order from their Bookseller.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 83.] SATURDAY, OCTOBER 18, 1890. [PRICE ONE PENNY.

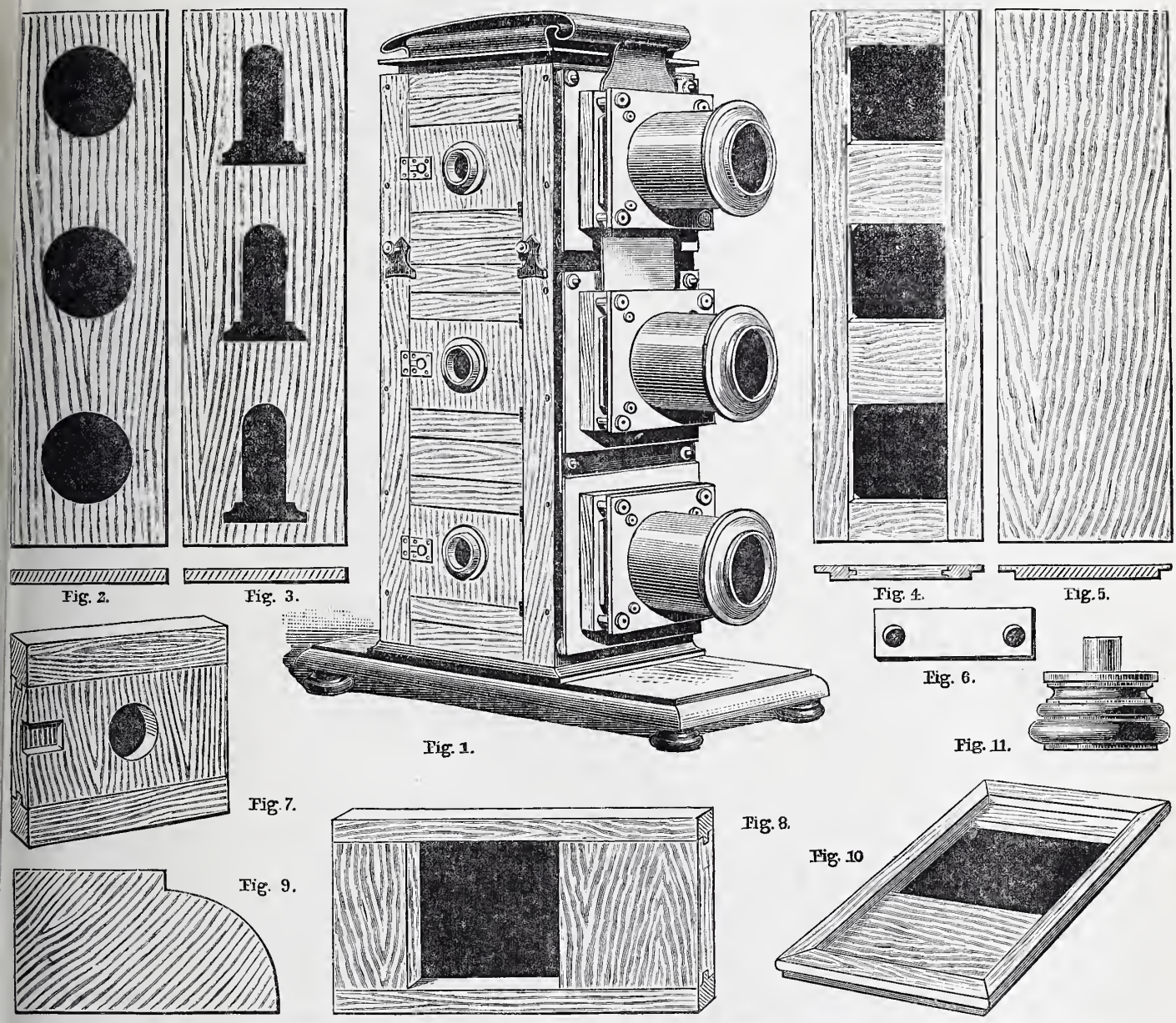


Fig. 1.—Triunial Lantern complete. Figs. 2, 3, 4, 5.—Plans and Sections of Front, Back, and Side of Lantern Body. Fig. 6.—Brass Angle Plate for Door Openings. Fig. 7.—Plan of Door. Fig. 8.—Plan of Baseboard. Fig. 9.—Moulded Bead for Baseboard. Fig. 10.—Baseboard complete, showing Under Side. Fig. 11.—Turned Foot for Baseboard.

THE TRIUNIAL OPTICAL LANTERN: HOW TO MAKE IT.

BY CHARLES A. PARKER.

THE DISTINGUISHING FEATURES OF BIUNIAL AND TRIUNIAL LANTERNS—EFFECTS OBTAINED BY THE TRIUNIAL—THE CONSTRUCTION OF THE TRIUNIAL—ADVANTAGE OF A ROLLING CURTAIN DIAPHRAGM — SELECTION OF SUITABLE WOOD FOR BODY OF LANTERN—MARKING THE FRONT OF LANTERN BODY — CUTTING THE CONDENSER OPENINGS — PREPARATION OF BACK OF BODY—CUTTING OUT APERTURES—TONGUEING TOGETHER LEFT SIDE OF BODY—SCREWING TOGETHER LANTERN BODY—SEPARATION OF TOP LANTERN—PREPARATION AND HINGEING OF DOORS—BASE OF THE LANTERN.

THERE are few instruments of a scientific nature better calculated to entertain and instruct than the optical lantern, which has been steadily progressing in favour for some years past, and has now taken a high rank as a social entertainer and public instructor. It may be said that whereas other instruments, such as the microscope or telescope, appeal but to the educated eye, the effects obtained by means of the lantern are of such a nature that they can be understood and appreciated by a great number of people at the same moment. It is not my intention, however, to enter into a dissertation upon

the history and applications of the optical lantern, but to describe the practical construction of a really serviceable instrument, suitable for home or exhibition purposes. And, in doing this, the various methods of lighting and preparation of the gases will be described, together with suggestions as to the best forms of oxyhydrogen jets, gas bags, etc.

Amongst the better class of limelight lanterns most generally used, the biunial is perhaps the most popular, the usual form of this instrument consisting of a vertical mahogany or metal body enclosing the two sources of light, together with the optical system; the two lanterns being divided by a metal floor or partition, upon which the trays carrying the jets may be slid. The triunial system, which is a still further improvement on the biunial, is an instrument in which three lanterns are placed one above the other, only differing from an ordinary biunial in the addition of the third lantern, which fits on to the top of the other two in place of a hood. The effects obtained by the use of a triple lantern are of such a character as it would be impossible to secure with an ordinary biunial; in fact, it will be generally found that the most successful exhibitors are those who employ a triple lantern; the value of being able to produce three coincident discs on the screen at the same time placing this form of lantern before all others for high-class effects.

It may not be out of place to point out a few of the advantages attending the use of a triple lantern. This instrument, which is illustrated in Fig. 1, consists essentially of three lanterns placed one above the other, as before stated; and it is generally constructed so that the top lantern can be removed and fitted on to a separate baseboard, if required to be used by itself as a single lantern; the lower portion of the instrument with the addition of an extra top will then form an ordinary twin or biunial lantern. By an intelligent use of the triple, various complex effects may be shown which could not be manipulated in an ordinary biunial, as the following examples will serve to show; taking, for instance, the well-known set illustrating the soldier's dream with its five effects. The principal slide of the series depicts the soldier asleep by a camp fire on the battle-field, and presently his dream of a happy home is made to appear in the smoke arising from the fire by placing the slide on which it is painted in the second lantern; this in turn being dissolved into another slide representing the departure for war, which afterwards gives place to scenes on the battle-field, and ultimate victory; the first picture of the soldier asleep remaining on the screen all the time. The first and second effects are placed in the second and third lanterns, and alternately dissolved without disturbing the sleeping soldier.

The set of eight slides depicting the emigrant ship forms another fine series of effective slides for use with a triple lantern. The foundation slide represents a ship toiling over the waves in a calm sea, which is shortly changed to a stormy one with an angry sky and flashes of lightning striking the masts of the vessel, these slides giving place to others showing the ship on fire, and the rescue of the passengers and crew. Effects such as these, which are by no means the only kind that can be exhibited, always meet with the approval of an audience; and although the manufacture of a triple will involve an extra expenditure of time and trouble, it will not be regretted, as this is the exhibition instrument *par excellence*. It will be seen from the foregoing that the reader requiring a single lantern may follow the measurements and constructive details given for the top lantern; and those who desire the more convenient biunial will find their want supplied by the twin lantern without the top one; but the operator wishing to give exhibitions of the highest class should employ the triple lantern as illustrated.

It will, perhaps, clear the way for the more minute details which will soon occupy our attention, if a careful description is first given of the triple lantern about to be described, which is illustrated in Fig. 1. This consists of a vertical wooden body constructed of well-seasoned material and provided with a protective sheet-iron lining, which is kept entirely independent of the wood, with a clear air space all round to ensure perfect ventilation. The body of the instrument is provided with nine openings, which are disposed in the following manner: three each at the back and front to receive the jets, trays, and the condensers; and three on one side fitted with small doors, which are framed together so that the heat cannot cause the wood to warp, each of these doors being furnished with a darkly coloured glass centre, through which the operator can watch the jet during exhibitions without straining the eyes, or requiring to open the door. The front stage plates and slide stages, which should be made of brass, are fitted with regulating screws and milled nuts to enable the entire front, with condensers, stages, and objectives, to be lowered or tilted to any desired angle, in order that the discs from the top and bottom lanterns may be made to exactly coincide when thrown upon the screen. As the condensers are attached to a collar fitted to the stage plate, they consequently move with the objective, and thus ensure the optical axis of one agreeing with the other. The slide stages are entirely open both at the top and sides, and a light tight plate, provided with a spring, is so arranged as to keep any form of slide or tank securely in position. It will be found a great advantage having the stages open all round, as it permits the slides to be inserted from the top or sides, the latter course being absolutely necessary when a tank is employed for the performance of chemical experiments. The lantern is divided into three separate chambers by means of three metal partitions, which form the supports for the jet trays to slide along, each of these chambers being, in fact, a separate lantern, having its own jet, condenser, stage plate, slide stages, and objective. The top lantern, which is removable, is retained in position by four brass straps and milled nuts which screw into the woodwork on either side, and secure it to the body of the instrument. The two lower lanterns are of course attached to a suitably moulded plinth, but an extra plinth can be made for the top lantern, supposing that the operator intends using it occasionally as a single lantern. A rolling curtain effect, which is now considered to be an almost indispensable fitting for all high-class lanterns, forms a very agreeable change from the ordinary dissolving arrangement; and as it is of simple construction, its addition to the lantern under description will not be found very difficult. A long thin strip of brass, having a rectangular aperture at its upper end, is so arranged as to slide up and down between the condensers and the slides, from one lantern to the other, this action causing the light from one lantern to be obscured while the other is exposed. In use, a slide representing an arrangement of curtains similar to the act drop of a theatre is placed in the slide stage of the second lantern, and the first slide of the lecture set or series of views to be exhibited is put in the stage of the upper lantern with the curtain diaphragm drawn up so as to obscure the slide, and only show the painted curtain on the screen, both lanterns meanwhile being fully lighted. If the diaphragm is now steadily pushed downwards, it will shut off the light from the second lantern, and at the same time expose the view in the upper one, making it appear as though the curtain were being rolled up.

Having obtained a good general idea of the materials, construction, and relation of the various parts of the instrument, it will now be advisable to enter into the manipulatory details involved in constructing the same, and in doing this it shall be our endeavour to follow some regular plan, or at all events to treat the various parts in the sequence in which it would appear most convenient to handle them. The most suitable timber to employ for the outer wooden carcase of the lantern will be a piece of sound dry bay mahogany ¾ in. thick, preferably a piece that has been previously worked up—for instance, the panel of a disused sideboard or wardrobe; or, better still, a leaf out of an old dining-table. If the wood is obtained from a timber yard it should be kept in a warm, dry atmosphere for a few days prior to using, in order to entirely free it from all traces of moisture. The necessity for employing thoroughly well-seasoned wood cannot be too strongly impressed upon the reader, as the lantern, unlike a great many optical instruments, has to bear a considerable amount of wear and tear; and unless it is constructed of properly seasoned material the great heat will certainly cause it to warp and shrink.

Assuming that a suitable board, or a couple of boards for a matter of that, have been selected upon which to commence operations, it will be necessary in the first place to provide each side with a perfectly smooth and level surface by means of careful planing, after which three of the four sides of the body are drawn out upon the wood by the aid of a marking gauge. For convenience in working, it will be seen that the body is made in the first instance the full height of the triple, but after it has been put together the top lantern may be separated from the others by sawing the body in two. The first proceeding will be to make the front, which is shown in Fig. 2; this is formed of a single piece of wood sawn off to measure 26½ in. by 8 in. when finished, care being taken in sawing not to encroach upon the gauge line, but to leave this plainly visible on the wood after it has been sawn; it will then allow the edges to be shot in order to bring it to the required size. Thus prepared, the wood must be provided with three 4½ in. circular apertures placed at equal distances apart, as will be seen in the illustration. With a pair of compasses first strike out the lower circle, the axis of which is situated at exactly 4½ in. from the lower end of the wood, and 9 in. above this mark the axis of the second circle, with another 9 in. between the axis of this and the axis of the third or top circle. These circles may now be cut by means of a keyhole saw or fret saw, which is inserted through a hole bored in the wood by a centre bit, the sawn edges being afterwards smoothed with a

pokeshave, care being taken to keep the circle true. In sawing these apertures it is important to try and work the saw in a uniform direction in order that the sawn edges may be square with the face of the wood, as an irregular opening would impart a very slovenly appearance to the work. They may, of course, be sawn with a greater degree of accuracy if the reader possesses or has access to a fair sized fret-sawing machine. It may be worthy of mention that at Mr. Fletcher's steam saw works, 161, City Road, London, E.C., wood of this kind will be sawn accurately to pattern by means of a steam fret saw for a few pence.

The next thing to be considered is the preparation of the back of the lantern with its three apertures for the reception of the jets, as shown in Fig. 3. Select a good sound piece of wood, and after having sawn it to a suitable size shoot the edges with a plane until it measures 26½ in. by 8 in. The black portions of Fig. 3 represent the wood which must now be cut away to form the jet apertures, each of which should be 6 in. in height and 4 in. in width at the lower part, tapering to 2 in. at the top, the lower aperture being planted at an inch from the bottom of the wood, with a ¾ in. space between each one. The cutting may be easily managed by the aid of a stock and bit, and a keyhole saw, or by a fret saw as above advised. First mark the extent of the opening, then bore a hole by means of the stock and bit at each of the lower corners. These holes will render the introduction of the saw and the subsequent removal of the central portion a very simple and easy matter. When the apertures have been cut, the sawn edges will require to be smoothed with a spokeshave and afterwards rubbed down smooth by means of a piece of glass-paper, which should be wrapped round a piece of cork or wood in order to prevent the edges of the apertures from becoming rounded.

The front and back being finished so far, it behoves us to turn our attention to the preparation of the two sides which are illustrated in Figs. 4 and 5, each of these measuring when finished 26½ in. by 8½ in. Fig. 4, which is the left side of the body, is formed of six pieces of wood tongued together in such a manner as to leave three square openings for the reception of the doors. The longitudinal side clamps are a couple of strips of wood 26½ in. by 2 in., each of these having a ¼ in. projecting tongue formed along one edge for the entire length by means of a tongueing plane for ¾ in. wood. A 12 in. by 5 in. piece of wood will next be required for the central clamps. This should be furnished with a ¼ in. groove run across the grain along each of the long sides, into which the tongues of the side clamps may be fitted. When this groove has been run the wood may be ripped into four strips, two of them being 4 in. wide, with the grooves at each end, and the others half this width. After the edges have all been carefully shot until quite true and square with the face, the six pieces may be fitted together to form the side, as shown in Fig. 4, by applying some hot glue to the tongues and grooves, and clamping the whole together; the projecting tongue within the squares to be occupied by the doors being afterwards pared away neatly by means of a sharp chisel.

The right side of the body, shown in Fig. 5, will require no further preparation after squaring up beyond a ¾ in. rebate run to half the thickness of the wood along each of the long sides, a similar rebate being run longitudinally along each edge of the left side of the body, as will be understood by reference to the sections of Figs. 4 and 5. Thus prepared the body will be ready for screwing together; but before doing this it will be found advisable to affix a couple of small brass plates, similar to Fig. 6, to the top and bottom angles of the door openings, to form stops for the latter to shut against. A couple of strips cut off the leaves of an old brass butt hinge will answer capitally, as the holes for affixing to the woodwork are ready drilled. As soon as this has been done, the four sides forming the body of the lantern may be screwed together with 1 in. brass screws, the holes for which should be countersunk by means of a rose bit. A square should be occasionally applied to the inside of the body in order that it may be put together quite true; and it must be remembered that the scores of the screws always run in the direction of the grain of the wood.

The next proceeding will be to saw the body into two portions, if it has been decided to occasionally employ the top one as a single lantern. Run a line all round the body, 9 in. from and exactly parallel with the top edge; then by means of a fine tenon saw very carefully cut through one side at a time, being particular to saw it to the line, after which the smoothing plane should be run round the sawn edges a few times in order to remove their roughness.

The carcase is now ready for the doors, and before cleaning up the wood it will be advisable to make and fit these. Each door is composed of three pieces of wood tongued and clamped together to form a door 5 in. square, the central portion measuring 5 in. by 3 in., and the top and bottom rails 1 in. by 5 in. The latter should be 1¼ in. wide at the outset, in order to allow for a ¼ in. tongue to be run along the full length of each rail, the centre clamp being provided with a corresponding groove run along both the 5 in. sides, into which the tongue may be fitted, the whole being glued and clamped together to form the door shown in Fig. 7. Each door should be furnished with a small sight hole about an inch in diameter, bored through the wood by means of a suitable brace and bit, and when the lantern is finished a small brass eyepiece, fitted with a piece of coloured glass, is to be screwed on to the outside of each hole. These eyepieces can be obtained from any manufacturing optician at about one shilling each.

The doors are now ready for hingeing with ¾ in. or 1 in. brass butt hinges, which are sunk into the door stiles at about an inch from the top and bottom, with the round or pin edge on the outside. The door should first be hung with only one screw to each hinge in order to facilitate any alterations, as it will be necessary to see that they hang without springing open, or rubbing against any part.

Nothing remains to be done but to call attention to the base to which the body is affixed. The top of this is formed of four pieces of ¾ in. wood tongued together as shown in Fig. 8. The longitudinal outside clamps measuring 18 in. by 1¼ in. are furnished with ¼ in. tongues that fit into corresponding grooves cut in the middle clamps, which measure 7¼ in. by 7 in. and 7¼ in. by 3¾ in. respectively, the whole being clamped together in the usual manner with hot glue to form a board measuring 18 in. by 9¾ in. When the glue has set, the outer edges should be moulded by means of a bead plane, in order to improve its appearance; and a moulded bead of mahogany, similar to Fig. 9, should be sawn into two 11½ in. and a couple of 19½ in. lengths, which are mitred at each end and glued and screwed round the under edge of the base, in the position shown in Fig. 10. The baseboard is affixed to the wooden body by means of screws driven through from the under side of the baseboard; a narrow moulded bead being afterwards glued round the junction of the lantern body with the baseboard.

The ball feet with which the four corners of the base are provided are about 2 in. in diameter, and should be furnished with tenons turned on them to fit into holes bored for their reception at the four corners of the base by means of a suitable brace and bit. Fig. 11 is a good example for one of these turned feet. Finally the whole of the woodwork should be surfaced until every speck of roughness has disappeared, after which it may be carefully gone over with the finest glass-paper, when it will be ready for polishing after the inner metal lining has been fitted.

The next paper on this subject will be devoted to a description of the metal lining. In the meantime, however, our readers will find abundant occupation in constructing the wooden carcase herein described.

HOW TO PACK FRAIL ARTICLES FOR TRANSIT.

BY J. WHITFIELD HARLAND.

As secretary to the forthcoming "Work" Exhibition, 1890-91, I find from the correspondence that many readers of Work who have lavished time and care in making articles only too well worth exhibiting are afraid to trust them to carriers, lest they be damaged in transit. To such and to other readers I think it worth while to give a few hints as to the packing of frail articles, and "how to do it," so that carriers cannot shirk any responsibility; and I hope this will be the means of persuading everyone who is wishful to enter the arena with the most valuable pieces of work they have done not to be deterred by any idle fear of consequences, should an accident happen.

Again, the work of packing is quite as, if not more, important a subject for an article as that of making anything. All labour, when reduced to first principles, can only be defined as moving particles or atoms of matter. Man cannot create matter, but he can alter form, position, and arrangement thereof. He cannot destroy matter itself, but he can destroy its relative combination with itself, either in the shape of one body composed of matter, or an aggregate composed of several different bodies; and can construct other combinations either of one or more bodies by moving their atoms into different positions. Man cannot annihilate, but he can and does *waste* material matter. Burning, for instance, does not destroy matter; it simply converts the form and substance it takes into a perhaps less useful form.

In attacking the subject of packing safely for transit, the careful work of hundreds of hours' labour, let me at once point out that in point of constructive strength a good strong back is the first consideration. Even in a fight with desperadoes, two or three to one, the odds are that, if one can only get one's back to the wall, they are greatly equalised. One then faces one's foes and one's difficulties, and can be certain that no attack from behind can succeed.

Hence readers will follow me when I say

that for protecting goods from damage, the first thing is to provide a strong backboard, that will neither give nor take, as a basis, and to screw the article firmly to it, as to a wall. Then, to take further precaution, build up sides to protect its edges, and a front to prevent facial damage. On this principle depends "good work" in packing. Mere boxing up anyhow, without thought or design, is no use at all; there must be a governing principle in all a man does, or his efforts are no more likely to produce success than a monkey's; perhaps not so likely, since monkeys obey instincts which men have not, as, being a superior being, he has furnished to him, instead of instinct, what monkeys have not—reasoning powers and the analogies inherent in thought and the knowledge resulting from experience. Without further preamble, the safety during transit of any article depends entirely upon supporting the back, or the top, in case of tables, by a strong foundation; and then preventing all possibility of side strains, which might otherwise break the structure ordained to stand ordinary strains, though incapable of resisting strains that might incidentally occur in transit: which, be it remembered, are not to be foreseen and provided for in the progress of construction, and must therefore be relegated to the art of packing for transit, which is, after all, no part of the purpose for which their primary construction was ever undertaken. A man designs a piece of workmanship to be "a thing of beauty and a joy for ever" in its own sphere and place, adapting the strength of its construction for the resistance of such strains as are likely under ordinary circumstances to come into play; but if he finds it has to travel, he naturally has to supplement his provision for ordinary strains by measures for counteracting extraordinary strains: viz., those likely to occur in transit. For these strains as above mentioned, construct a strong backboard, rather larger than the object to be packed, leaving room for sides, top, and bottom that shall not touch the object. Let your only contact be with the back, to which firmly screw the back of the object, or the top of your table or washstand, etc. This back should be made of strong stuff jointed together, and further strengthened by battens on its outer side. If the article to be packed weighs 1 cwt. and upwards, 1 in. stuff should be used; for lighter things, ¾ in. will be sufficiently stiff; but for 3 to 4 cwt., nothing under 1½ in. stuff should be thought of for the back; and then a batten every two feet, 4 in. wide, and same thickness as the back itself, should be nailed on. The sides may be half the thickness of the back; they should be dovetailed (but may be merely nailed together), as they derive support from the back, and, as will be presently shown, from the front or lid.

These sides, which include top and bottom of course, should be of a width to allow the front or lid to fit on without any contact at all with the front or face of the article to be packed—that is, about 1 in. wider than the extreme depth of it. In the case of a chiffonnier, cabinet, piano, organ, bracket, frame (glazed or otherwise), sideboard, etc., and similar articles, the sides may consist of simple boards; but in the case of tables, washstands, etc., and other like articles, the backboard being the top of such when packed, the sides should be strengthened, according to the width of them, by either battens or cross-battens, to stiffen them in case of rough usage. (See sections of corners, Figs. 3 and 4.)

Here let me allude to cases where it would spoil the exhibit to put screws into the back. I would suggest the means of getting over this difficulty, as shown in Figs. 5 and 6, by buttoning the back down to the backboard, and then, to prevent the buttons turning, putting a nail or screw through the extreme end of the buttons into the backboard, and thus securing them from any possibility of turning.

There is also another danger from what I can best describe as "concussion" in packing for transit. Even a firm back having the object, whatsoever it be, firmly screwed tightly to it, is apt to undergo unforeseen strains in shunting, marshalling trains, and other processes; to obviate all danger from which I suggest pads of vulcanised india-rubber, or "washers" of rubber (which can be purchased at any ironmonger's), between the article and the backboard to which it is screwed: that, being resilient, may take the shock of any such strain.

I must now just glance at a very important consideration before explaining how to make the lid or front of the case.

Railway companies and forwarding agents are what the law terms "common carriers" in respect of most articles they undertake to convey, and have a uniform tariff of charges for conveyance of each class of goods. They are liable for all breakage or damage, unless either the sender chooses by paying less freight to contract himself out of this benefit by sending at "owner's risk," or in the case of goods of higher value than the law permits him to recover from the carrier under the various Acts of Parliament, being sent without being insured. In order to recover loss or damage, however, it must be clearly proved that such damage is not in any way due or attributable to the act of sender, either by reason of improper or careless packing, or not correctly declaring contents or value of enclosures. Of course, if a case be nailed up, the various processes of loading, transhipping, and unloading by the Company's servants, even

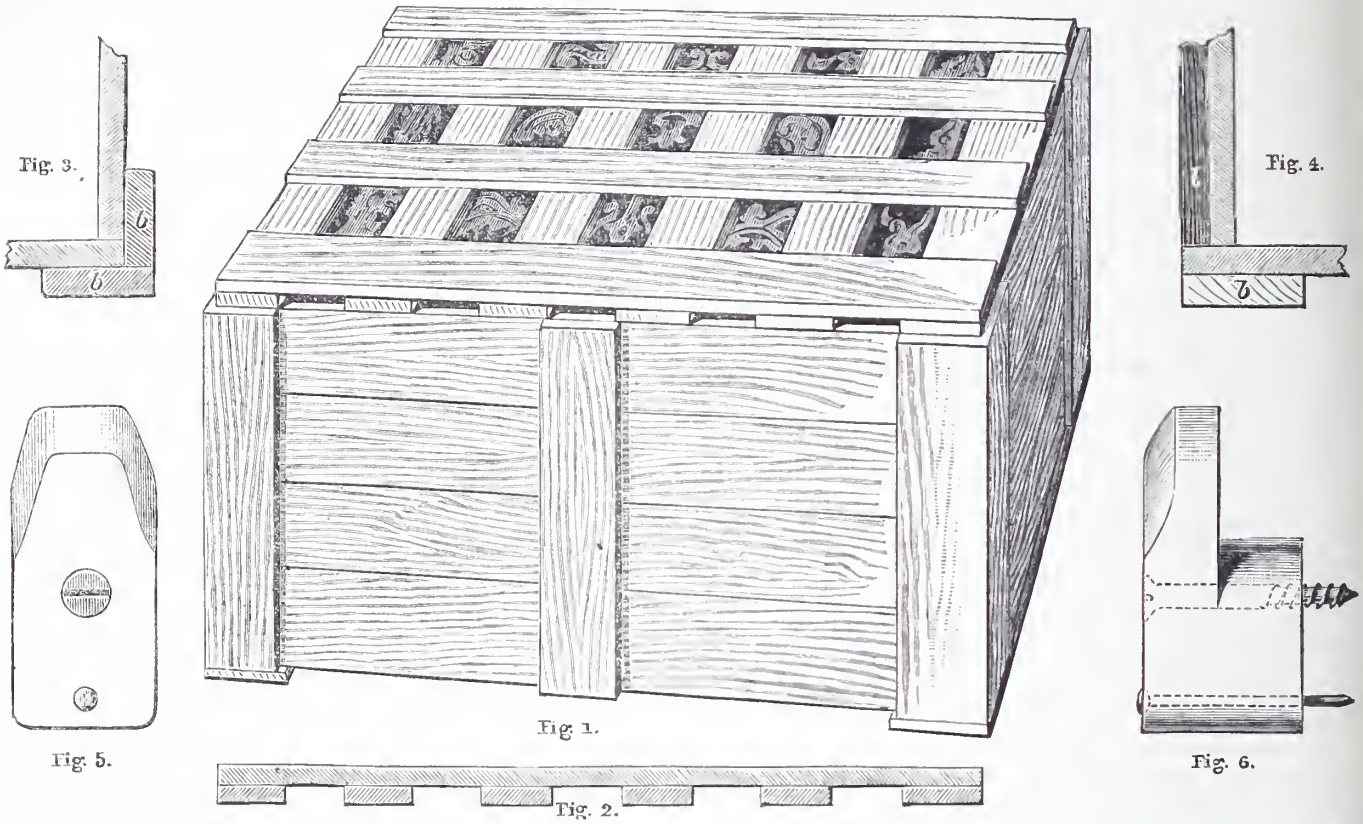


Fig. 1.—Perspective View of Packing Case with Open Lattice Lid, showing Carved Work inside. Fig. 2.—Longitudinal Section of Lid. Fig. 3.—Section through Corner, showing Overlapping of Battens *b, b*. Fig. 4.—Section through Backboard, showing Battens on End and below Backboard. Figs. 5, 6.—Plan and Side View of Batten for fixing Articles to Backboard when screwing would spoil them.

when "Glass, with Care," "Fragile," "This side up," etc., are written on the lid, do not command any extra care from them; and the onus of proving that the packing has been properly done falls on the sender. But if the lid consists of open lattice-work, strong enough to protect the contents from breakage, yet permitting the interior to be fully seen by all through whose hands it passes, any accident would be at once perceived. The Company's servant that receives and signs for such a case and package cannot deny that it was properly packed, or that it was injured when he got it. When it is transferred to another Company or a carter for delivery, it will be noticed at once whether it is still in good condition, and the consignee can also see if it is injured at all, and if it be, he can refuse to accept delivery.

This may be compared to the two means of securing shops, banks, etc., from burglars' attacks—the old style of putting up shutters, strongly made, lined with sheet-iron, barred and double-barred and barricaded from within, which burglars dearly like to see; or the modern style of open iron railings to protect the glass, and leaving the whole interior visible from the street, and burning a jet of gas all night, which practically defeats the burglar.

I therefore advise the lids of all packing-cases (see Fig. 1) for frail goods to be made in strips, nailed on width-wise pretty close together; and nailing to and over them, lengthwise, other strips or battens, also leaving spaces between them, like hatchways. Having cut the stuff to the right lengths, I should nail the pieces together first, and clinch the nails (see Section, Fig. 2) before nailing them to the sides and ends; and short pieces of hoop-iron should, if the package is heavy, be nailed to the back, bent round, nailed to the sides, and then turned over the ends of the battens of the lid and nailed to them—say two, three, or four, according to circumstances—at each side and end of the case. This plan affords sufficient protection for the article inside, and yet allows of its being clearly seen at every change of position during its transit; and thus any damage would be detected at once, the blame thrown on the right shoulders, and any claim for compensation would hold good; as neither the defence of bad packing could be pleaded, nor that of improper declaration of contents or value. I have been led into making these remarks by the correspondence arising with intending exhibitors, who write that they are afraid to trust their exhibits to "the tender mercies of railway carriers." I conclude by suggesting that such exhibitors should pack their exhibits as above shown, and obtain the receiver's signature to a written form, thus worded:—

Received from.....
one package containing.....*visible from front*, of the value of £ s. d. *Insured* (or if uninsured, add the words "*not at owner's risk*"). Per.....
(here insert carrier's name or Company's name), (1) Goods Train, (2) Passenger Train, or (3) Van (if no railway transit is necessary), in good condition. Consigned to.....
.....
Date..... Signature.....

Not only would this receipt place the carrier out of court in any proceedings that might be taken for compensation, but would probably prevent any necessity for proceedings, as the claim would be allowed and settled without that trouble.

In conclusion, I think I can promise that the proprietors of Work would, in case any article was injured in transit, instruct the Jurors to consider it as if it had arrived in a perfect state, whenever time happened to be too short to repair it in, leaving the exhibitor entirely free to claim from the carrier the cost of the damage; and, as secretary, I shall instantly advise the exhibitor, *by next post*, of the receipt of every exhibit he sends, and state whether safe or damaged.

THE GASSNER PATENT DRY BATTERY.

BY GEORGE EDWINSON BONNEY.

It is not many years since we were content with an ordinary system of house-bells, with their wires, cranks, and pulls. Electric bells were then unknown. They are a modern innovation, and were thought most wonderful things when first introduced. The novelty has now worn off, and their use has become quite common since M. Leclanchè invented the battery which bears his name. This useful battery has quite revolutionised the electric bell trade, on account of its known reliability, cleanliness in working, and cheapness. But we live in an age of

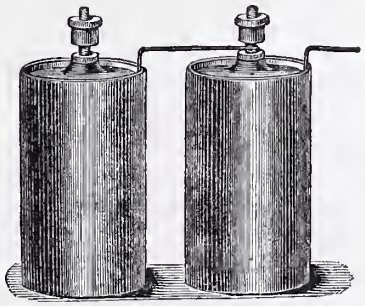


Fig. 1.—Gassner Dry Battery: Round Cell.

progress, and move on from one stage to another at such a rate that the excellent things of to-day may be condemned as antiquated curiosities to-morrow. Those who sighed for a cleanly working battery, giving little trouble, to use with electric bells, and rejoiced in the invention of M. Leclanchè, now find his excellent cell messy, troublesome, and lacking in portability. The ammonium salts creep up and destroy the wires and terminals; the solution evaporates and leaves the elements dry; or the cells get broken or capsized, and the solution gets spilled. The cells must therefore be kept in a cool place, and are not at all admissible where the solution is likely to be slopped or jerked out by jolting motion.

These little inconveniences led electricians to turn their attention in the direction of a dry battery, or one in which there should be no danger of spilling the solution. This desired condition has been obtained by various devices, such as the employment of some porous absorbent for the liquid; and in this way, sawdust, paper, felt, peat, moss, and other porous and bibulous substances too numerous to mention, have been employed. All have failed, from some cause or causes unthought of at first by their inventors. In *Cassell's Magazine* for 1885, on page 639, there appeared the following paragraph:—

"A DRY BATTERY.

"According to recent researches of Dr. Onimus, voltaic batteries containing ammonium chloride and zinc chloride can be converted into dry piles by mixing these solutions with plaster of Paris, and allowing the mixture to solidify. If the mixtures of ferric oxide and manganese peroxide with plaster of Paris are employed, the electromotive force is slightly higher than with plaster of Paris alone; and when oxide of iron is used, the battery quickly regains its original strength on breaking the circuit. When the battery is exhausted, the solid plaster of Paris has simply to be moistened with the solution."

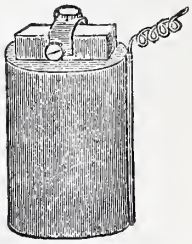


Fig. 2.—Oval Cell.

In 1886, an able physician and electrician, named Dr. Gassner, residing at Mayence, introduced a dry battery, resembling that ascribed to Dr. Onimus in *Cassell's Magazine*. As this battery met with a favourable reception on the Continent, it was forthwith patented in Germany, Austria, France, Belgium, Italy, England, the United States of America, and in Brazil. It was also tested by able electricians in Belgium, England, and America, who pronounced the battery the best of its kind for all such work as electric bell ringing, telephones, and electric telegraphs.

The Gassner Patent Dry Battery is composed of cells made entirely of thick zinc, which serves the double purpose of an unbreakable case for the contents, and the positive electrode of the battery. These zinc cases may be made in any form and of any size required; but the sizes and shapes now in general demand are as follows:—

No. 03.	Small oblong cells, $3\frac{1}{2}$ in. × 2 in. × $1\frac{3}{8}$ in.	
,, 15.	Tall circular cells, 7 in. × 3 in.	
,, 16.	Tall oblong cells, $6\frac{1}{4}$ in. × $3\frac{1}{4}$ in. × $1\frac{3}{4}$ in.	
,, 17.	Tall square cells, $6\frac{3}{4}$ in. × $3\frac{3}{4}$ in. × $3\frac{3}{4}$ in.	
,, 19.	Tall oval cells, $5\frac{1}{16}$ in. × $3\frac{1}{16}$ in. × $1\frac{3}{4}$ in.	

A pad of rubber, or some similar insulating material, is placed in the bottom of each case to insulate the zinc from the carbon element; and the case is then packed with a mixture composed of gypsum and protoxide of zinc, specially prepared, made into a paste with a strong solution of sal-ammoniac and chloride of zinc. A plate, block, or hollow cube of special porous carbon is then soaked in a depolarising liquid and pressed into the pasty mass above mentioned, which soon sets hard and firm around the carbon. The square cell (No. 17) is divided by a zinc partition into two equal parts, each containing a block of carbon. This increases the exposed surfaces of the two elements, and ensures a corresponding low internal resistance to the cell. The small cell (No. 03) is furnished with a cube of hollow carbon. The tall oblong cell (No. 16) is enclosed in a case of vitrified iron, which gives it additional strength and adds an attractive exterior appearance. Each carbon is furnished with a terminal binding screw, as in the Leclanchè battery, but a piece of stout copper wire is soldered to the zinc case for connecting purposes. The top of each cell is sealed with a resinous composition, and this is stamped with the letter G.

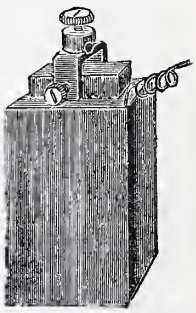


Fig. 3.—Flat Cell.

It will thus be seen that the Gassner dry

battery possesses an advantage over those enclosed in cells made of glass or stoneware, as there is no danger of breakage of cells. There is no liquid to spill, its place being taken by the deliquescent salts of zinc and ammonium chloride combined with gypsum. The cells can therefore be placed in any position—on their sides, or even upside down if necessary, and packed away on a shelf if required—without injury to the battery. There are no fumes given off whilst at work, nor any corrosive salts formed, nor any porous cells to be choked with salts. It may be carried about in any position, and subjected to the motion of a boat, ship, or carriage, without any inconvenient results. It will work in the high temperature of boiler-rooms and in hot climates, and is not affected by severe cold, because there are no liquids to be evaporated or frozen. As no chemical action or short circuiting can take place in the cells, they may be packed away for months or years, and be always ready for use when required.

Such are some of the advantages claimed for the Gassner battery; but the crowning peculiarity remains to be noticed. It will yield a current having an electro-motive force of 1·60 volts per pair of elements for a much longer period than the Leclanchè cell, and when exhausted, can have its strength renewed by charging it with current from a dynamo or from a powerful battery, much the same as an accumulator is charged. In fact, it is a primary battery and an accumulator in one. A cell tested at the Liège University, under the auspices of Professor Gérard, was placed on short circuit for 18¼ hours, when its electro-motive force gradually diminished from 1·508 volts down to 0·1015 volt. It was then charged with an 0·5 ampère current for thirty minutes, during which time its electro-motive force rose from 1·13 volts to 1·680 volts. The current was then augmented for the next thirty-five minutes to 0·8 and 1·0 ampère, when its electro-motive force rose to 1·89 volts. During 4 hours and 20 minutes, 0·75 ampère of current was sent through the cell, and its electro-motive force was raised to 2 volts. It was then put on a closed circuit for another 18¼ hours, during which time its current gradually failed until it reached 0·100 volt. The battery has also been tested at the General Post Office in London, and at other places, with most satisfactory results.

Through the kindness of Mr. P. C. Brewster, of 12, Addle Street, London, E.C., who is acting as Dr. Gassner's representative in this country, we have not only been furnished with the foregoing particulars respecting the battery, but have also had several of the cells placed at our service to be tested for endurance and capacity for recuperation. The tests made with these fully verify those made at the Liège University. A No. 16 cell was connected up to a 2 in. bell day by day, working continuously during a day of nine hours, and resting at night. During the first four days its vigour was fairly maintained, and it was disconnected at night in good condition. During the remainder of the time whilst it was being tested, it ran down during the day and stopped ringing the bell, because it had not enough energy to continue the action; but after a night's rest, it came up to the work fresh the next morning. As the daily tests went on, its period of spirited activity grew shorter, until, after doing 118 hours' work, it was found to be quite run down. This was a severe test for an electric bell battery, and would have ruined a Leclanchè cell. We then connected it to a small dynamo, and sent a current of electricity through it from carbon to zinc for a few hours, until its vigour was completely restored. The electro-motive force of each cell entrusted to us was about the same as that of the Leclanchè, but the internal resistance varied with the sizes of the cells. The larger cells have an internal resistance of from 0·50 to 0·21 ohm.; the smaller cells have an internal resistance of over 1 ohm. As the volume of current obtainable from a battery cell is largely affected by its internal resistance, the larger cells will furnish a much larger volume of current than the largest Leclanchè, and should be more suitable than these for lighting small electric lamps. To jewellers doing a small electro-gilding and electro-silvering trade in their own workshops on small articles of jewellery, the larger-sized (No. 17) double-carbon Gassner cells would be a boon, since the battery would not require any cleaning, and would be ready for work at any time. One or two of those cells in series would furnish sufficient current for gilding and silver-plating a few small articles, such as brooches, studs, pins, and rings.

It should be understood that the constancy of a battery depends more upon the depolariser employed in the cell than on the exciting liquid or paste acting on the zinc. If the depolarising substance is present in the cell in sufficient quantity, its action will be long sustained; and if this substance yields up its oxygen freely to the hydrogen formed at the surface of the negative element, a constant electro-motive force is ensured. When the hydrogen clings as a film to the surface of the carbon plate, or gets shut up in its pores, the electro-motive force of the cell falls, and is not restored until the hydrogen is thrown off or absorbed. In the Leclanchè this polarisation of the cell is most marked, hence it can only be employed for such intermittent work as bell-ringing, telephones, telegraphs, medical coils, etc. The Gassner cell does not so readily polarise, and its depolariser soon absorbs the hydrogen determined to the negative element.

The exact composition of the excitant and of the depolariser is kept a secret by the makers, so we are unable to state what may be the action going on in the cells when the battery is placed on a closed circuit.

We have pointed out to the makers a defect in the construction and finish of the cells. The absence of a terminal binding screw to the zinc cylinder is a source of inconvenience when the connecting wire is broken off. If the makers can solder a small screw to the zinc case in addition to the copper wire, the battery would receive more favour from English customers. Complaints have reached us of inability to get the cells recharged. There should be no difficulty about this. Anyone having a shunt wound dynamo can recharge the cells by connecting the carbons to the positive pole of the machine and the zinc to the negative pole. Any number of cells may be charged at once in series if the electro-motive force of the charging current is kept above that of the combined counter-electro-motive force of the fully charged cells—viz., 2 volts per cell. A Bunsen or bichromate battery will serve the purpose of recharging the exhausted Gassner cells. The recharging current must exceed that of the current expected from the battery by at least 10 per cent.—that is to say, if we require the battery to furnish a current of 0·5 ampère during a period of eighteen hours, making in all 9 ampère hours of current, we must send a 0·5 ampère current through the cells for twenty hours, or a 1 ampère current for ten hours. Having exhausted the chemical energy put into it at first, we must put into it an equal amount of energy to restore its strength.

Mr. Brewster informs us that the battery has a host of imitators, and imitations of the Gassner cell are being sold. The real cell bears Dr. Gassner's name on the carbon and on the wrappers around the cells. Only a few agents have been appointed for their sale in England, but several thousand cells have been already sold. The price is 4s. 6d. per cell.

THE ART OF FAN PAINTING.

BY E. CROSSLEY.

WOMEN who have leisure time which they can spend in painting fan mounts for their own amusement are to be congratulated. It is a most fascinating occupation. Some may start with the idea that it is an easy job to paint a fan. So it is if we know how to draw well, how to design, how to paint, and how to combine and blend our colours so as to produce perfect harmonies. Granted one knows all this, those who have tried their hands at fan painting will own there is yet more to learn. The treatment of fan mounts is an art in itself; quite different is it from ordinary water-colour drawing. The designs, unlike as they may be to each other, must all be specially suited to the purpose. Without question, the only way to become a thoroughly good fan painter is to study the old French artists' works. What modern can equal the grace, vivacity, brilliance of tone, and delightful harmonies in the subjects of Boucher, Watteau, and Lebrun? There are a few who, by continued close following in the footsteps of Louis Quatorze and Louis Quinze times, have made the spirit in which they worked their own, and these are the most successful. They are no mere copyists, but they are followers of those who lived when the art had attained its highest perfection, and who, in fact, made it what it was. The method, too, of colouring subjects on fan mounts is very different to that we should adopt when painting a picture—that goes almost without saying—but it also varies from that employed in decorative art work generally. This we shall see later on.

Our first consideration shall be the requisites for fan painting. As I am writing this article to assist those who have never before attempted fan painting, it will be best to go fully into detail. Of course, I take it for granted that those who intend to try know how to draw, and have, at least, had some practice with the brush; but of *fan painting* I shall take it for granted they have no experience. Now as to colours. These should be fresh and of the best quality. Body colours, viz., colours mixed with white, are sold in tubes by some of the best artists' colourmen. It is as well for those who think of making a study of decorating fans to invest in these. But for a beginner, who may only make a trial of it and perhaps not care to follow it up, the wisest plan decidedly is to purchase ordinary water colours, and to add Chinese white when using them. A short list will be useful. Yellows—Naples, cadmium, Indian, lemon; blues—cobalt and ultramarine; reds—crimson lake, burnt sienna, and carmine; greens—sap, Hooker's, chromium, and emerald; browns—sepia and Vandyke; greys—neutral and Payne's

rey; ivory black. These, with the indispensable bottle of fresh Chinese white, orm quite a sufficiency, though more can be dded at discretion when some progress has een made. It is not in the number of olours at hand that success is secured, but ather in combinations of a few that harmonise well: this shows the real artistic kill, the power to get good effects by simple neans.

Next come a few words about brushes. These should be thoroughly good and new; t is impossible to paint fans that need such nicety of work if the tools are of inferior nake, too much worn, or have been used for oil painting. The hairs of the brush must come to a good point. One large, one medium, and two small brushes will be ound enough.

For sketching the design and for transferring it, a drawing-board, pencils, drawing-paper, tracing and transferring-papers, will be required. The first of these papers is not needed if the worker is a fair draughtsman, as the sketch can be made on the tracing-paper at once.

For preparing materials such as paper, silk, and all textiles, a stretcher, isinglass, and a soft broad brush must be obtained. I will describe the manner of preparing these, as some may wish to know how to do it themselves, but I advise generally the purchase of fan mounts ready prepared. They are kept at the best shops where fans are sold. It saves the trouble and the time that would be spent in preparing, and also saves the expense of procuring a stretcher. Certainly it is wisest to buy the mounts ready if only a few are to be used. If anyone intends to make a business of fan painting, it will probably be less expensive personally to prepare the mounts.

To make the size, an ounce of isinglass is to be put in a pint of water and left to soak for a night. The vessel containing it is then placed in one holding hot water until the isinglass is thoroughly dissolved. The size is used warm. Cut the material of convenient length and breadth for the stretcher; lay it on the stretcher, after having brushed the size over both sides; stretch it whilst wet. When dry, cut out the fan mount the size and shape you require, but allowing half an inch margin beyond all round. The selvedge of the fabric must run lengthwise. Some artists do not prepare their mounts at all: they use a medium such as Miss Turck's.

There are many materials suited for fan mounts. Vellum stands first; nothing equals the beauty of it when it is decorated by a clever artist. Satin, silk, gauze are all more fashionable for the time being, but vellum is the most artistic, and as it always has been, so it always probably will be, the favourite mount of the best fan painters. On it can be executed real works of art; paintings are capable of being worked up to the perfection of ivory miniatures; it is hardly possible to obtain too high a finish, and the most elaborate subjects can be carried out with perfect success. The very best practice one can have is to copy once, twice, or thrice, if needs be, an old fan painting on vellum, until something like a fair replica is produced. But the old fan should be a really good one, done by a French master of the art, if it is possible for the student to beg, borrow, or steal such an example. Another good plan, if one does not wish to make a servile copy, is to adapt, say, one of Watteau's subjects, and then to have an old French fan at hand from which the right tone of colouring may be learnt. On the harmony of colour, on the soft, reposeful, satisfying *tone*, more of success depends than on anything. The subject might be all we could desire, the drawing might be irreproachable, but if the colouring was harsh, crude, or gaudy, the fan would be a failure.

Next to vellum comes silk—faye and taffeta. On silk mounts elaborate subjects may be attempted, but fewer details will be introduced than when vellum forms the ground on which the painting is done. After silk, satin may be tried, but it is more difficult to work on. Simpler subjects are chosen for it—in fact, flowers tell best on it, as they require no background. Then there is gauze, which makes the lightest, daintiest mounts of all. On it a *grisaille* is simply charming. Areophane can hardly be known from gauze at a little distance; it is fashionable just now, and very pretty paintings of figures or flowers can be executed on it with but slight labour. They must be quickly done to be artistic; it is quite impossible to work up a painting on these two fabrics. Of paper fan mounts there is no end. We are inclined to look upon them as common, because there is such a large supply of them now in the market. But beautiful paintings may be done on paper fan mounts. It is a mistake to think that because slap-dash paintings on paper fans are turned out wholesale, all such fans must be inferior and inartistic. The paintings can be worked up to a high state of perfection, and the India-paper and fan-paper will be found easy to decorate. For this reason a beginner had better employ it than satin or gauze if a real study of the art is to be made. This is in all probability advice thrown away; amateurs are specially fond of trying the most difficult things; they hope to find a royal road, and to overcome obstacles at a bound. However, it is as well not to be too humble-minded as to our powers; if we think we are going to produce a masterpiece, we shall be sure to do our best, whereas if we only expect to turn out a daub, we shall in all likelihood do just that and no more. A little vanity is a great help towards success.

To stretch the mount ready for sketching and painting, moisten the edge with gum, then press it down on a drawing-board, making it lay as smooth and taut as possible; then leave it to dry. Many workers fix their mounts with a few drawing-pins; but this is not a satisfactory method.

Artists who understand fan painting well, and who have had much practice in it, often sketch in the subject on the fan mount without even making a preliminary sketch on paper. Beginners will do wisely if they make a correct drawing first on paper, and copy it or trace it on to the fan mount.

To trace the correct drawing, which has, we will suppose, been made on drawing-paper, lay a sheet of tracing-paper over it and "take off" the drawing by going over all the lines with a fine lead pencil. To transfer this drawing on to the mount is the next process. Take a sheet of red transferring-paper and rub off all the colour you can, otherwise it will soil the fan mount; enough will remain on to answer your purpose. Lay it, colour side downwards, on the mount. Over it place the tracing you have made, taking particular care to get it in the right position. Now go over every line with an ivory tracer, holding it upright, and not pressing too heavily, or the lines made on the mount will be thick. The tracing must be firmly fixed with needles before commencing. Another plan that gives less trouble, but needs a good draughtsman to follow it, is to make the sketch direct on the tracing-paper; this saves "taking off" the sketch from the drawing-paper.

On vellum or fan-paper the sketch can be made with a soft pencil, but it should be used lightly. Vellum requires no sizing or preparation of any kind. To stretch it, wet the parchment with a sponge dipped in water; whilst damp, fix it to the board by gumming the edges, and pressing it down until it adheres.

As much the chance of success depends on the subject chosen as on the manner in which it is carried out. There is great scope for the designer to show his skill; seascapes, landscapes, national sports, and *genre* pieces are all suited for fan decoration, whilst the worker who copies or adapts from masterpieces has countless excellent subjects ready to his hand. From engravings of the works of old and modern French artists, and several of the English too, charming *morceaux* may be obtained, and as for suggestions, they can be had without limit. Allegorical and mythological themes are specially admirable; these are always painted on vellum, chicken-skin, or paper. They are executed with all the care bestowed on a miniature, with much elaboration of detail, and the fan sticks are highly ornamented. Water looks especially well on silk and satin mounts, when introduced with a slight background of trees and a peep of an old castle. More often than not in such a subject two or three figures occupy the foreground in costumes of the olden time; or maybe, a nymph disports herself on the water's edge, whilst others rest on the grass beyond. Sprays of well-arranged flowers are beautiful decorations for satin and silk mounts, but they need to be well done, otherwise they can only be regarded as commonplace. Lilac makes a charming decoration for a mount of a lighter or darker shade of lilac-tinted silk. The rarer kinds of orchids have not been "commonised" so far.

Now we will consider the method of carrying out our chosen subjects, whatever they may be, always supposing they are artistically designed and correctly drawn. Monochromes are done in one colour only, but with lighter and deeper shades of the same colour to "bring out" the subject, and to heighten the effect. Say we are painting a spray of flowers. The darker petals of the flower are laid in first with a deep shade, then lighter ones are put in, and, lastly, the lightest petals are filled in. Then all are touched up with washes, and the high lights added. All lights are rendered with Chinese white, and all colours have Chinese white added to them on the palette. On delicately tinted pink, green, or yellow gauze, or areophane, *grisailles* are most attractive. These and monochromes are easy for beginners, for they have not to consider the blending of different colours into a harmony—a most important consideration in fan painting generally. In a *grisaille*, black, grey, and Chinese white are employed; the shadows are warmed with brown, or a little pink is touched in here and there. Imagine a bewitchingly costumed damsel of the eighteenth century is represented in this method on a silk or gauze mount; all her costume will be done in black and grey, and white touches for the high lights, but the rosettes on her shoes, the ribbons at her elbow and throat, will be given in a delicate shade of pink.

In painting a *genre* piece or a landscape, a thorough knowledge of painting is a vast assistance to the student of the art of fan painting. Those who understand the combination of colours so as to produce without

trouble good harmonies, those who understand how to contrast colours to secure pleasing effects, have but little to learn, and only need some practice to perfect themselves in the art, although it differs, as has been said, from the painting of pictures. Take landscapes, for example. First the skies are put in, next the distance, lastly the foreground. For trees, emerald green and pink if they are in the distance; if in the foreground, they are painted in a quiet shade of green. For castles, and so on, in the distance grey tints are used, with slight touches of yellow. Water is represented with bluish-green tints, with white added to the colour, and the lights with Chinese white. But all this is most easily accomplished if the worker has a well-painted fan to copy; once done, practice will make him proficient. In *genre* pieces the flesh tints will be given with lemon-yellow, just a mere touch of vermilion, and Chinese white. Silk and satin need the addition of more Chinese white to the colours than vellum, paper, or skin. The use of too much white is altogether detrimental to the painting, as it will cause the colours to crack; this is always specially noticeable in the portions of the painting that come just in the folds of the face mount; to avoid this, due care must be taken: still, a certain amount of white is absolutely necessary to give substance and a surface that will permit the laying on of finishing washes and touches.

Gauze fans are extremely attractive, and are also most fashionable. For the time being gauze and such-like semi-transparent materials are more popular than anything else for fan mounts. On gauze, and materials resembling it, drawing or tracing the subject is out of the question. The only method possible of indicating the outlines of a subject is to sketch them in with a brush filled with colour or Chinese white: the latter is employed for a *grisaille*; lake for a painting. Gauze is now dyed the most delicate and lovely tints imaginable, to suit all the newest materials used for costumes.

Novelties even in fan decorations are constantly appearing. Here is one of the very latest. A pink silk fan mount has three oval medallions of lace inserted. Spreading out irregularly and carelessly round the medallions are groups of tiny roses of a deeper shade of pink: these are arranged somewhat in the style of a wreath, but stand up much higher, and spread out more broadly at the sides than at the bottom of the medallions. On the right half of the fan mount a further ornamentation of ribbon is introduced. Two lengths of ribbon half an inch in width, corded, and with plain satin border on both sides, are arranged as follows: One ribbon is blue, one pink, and both are snipped out to leave two points at each end. A long end of the blue ribbon is gummed to the mount, then it is turned sharply over and forms a flat bow; the ribbon must be turned over inside out three times to manage this, and the bow is of triangular form; then comes another bow; then the blue ribbon is tied to the pink one, which meanders over the silk till it reaches the outer stick much in the same way. All the ribbon is gummed down, and over it is placed a fine lace insertion.

I will conclude by saying that if any of our readers wish at any time to receive suggestions for subjects suitable for fan painting, or to hear of novelties in this direction, I shall be glad to give them an answer in "Shop." Like the rest of the contributors to WORK, I am always ready to lend a helping hand whenever I am able to do so.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

CASTING IN PLASTER.

WORKING ON PLASTER—PLASTER TOOLS—WAX MOULDING.

As regards working upon models after casting, the majority of those best qualified to speak with authority do not greatly recommend it as a thing to be practised. Most good modellers will tell you that it is rather desirable to finish a model so thoroughly in the clay that nothing may remain to be done in the plaster.

We incline very much to this opinion ourselves, but it is not a matter on which any hard and fast rule can be laid down. The small accidents of casting frequently render some little plaster work imperative, and there is a very respectable minority among modellers who prefer leaving a great deal to be done in the less plastic material. The great Flaxman, when making his wonderful reliefs, such as his "Shield of Achilles," is said to have merely roughly sketched the figures in clay, and to have elaborated all detail and finish in the plaster. Continental modellers work much more in this material than we do, and with some of them it is not unusual to entirely build up and work even life-sized figures in it. We might also instance a living English artist of high repute who prefers plaster to clay for modelling the details of works on a large scale. Plaster work is not therefore a matter to be left unnoticed.

Work on plaster, as Flaxman and some others have worked, may be said to be somewhat akin to carving, from which, however, it differs in this respect—that it is almost as easy to add as to cut away. The actual modelling in it—the building-up of forms with spatula and trowel—is only possible in that short space which elapses before the plaster sets; consequently, whoever attempts much in it needs to know what he is about, to have a clear conception of the form he wants, and to have the knack of producing that form quickly. It is hardly work for a feeble modeller or a novice. Indeed, except for very rough purposes, it is scarcely to be recommended to the ordinary figure modeller. In producing ornament, it may, however, often be resorted to with advantage, as saving time and giving good results.

To most figure modellers plaster work is merely supplementary to their work in clay. Pleased as the tyro usually is when he sees his work come from the mould a snow-white cast, he will probably find, as he examines and turns it to different lights, that this brilliant material reveals many faults which had escaped his notice in the dull clay—much of his modelling which he had before thought soft and finished will now look crude, and what seemed to him well-curved surfaces will now prove "lumpy:" naturally, he will desire to correct these shortcomings.

Before he does so, he must be warned that if he once begins working on a cast, he can scarcely stop till he has worked all over it—so different will be the surface from plaster work to that left by the clay. But if he resolves to touch-up, he should do so whilst the model is fresh from the mould; for if allowed to dry, the plaster gets hard and works badly, and will have a scratchy look.

Some of the most useful tools for the present work are scrapers. One of these, combined with a spatula, is given in Fig. 23 (p. 399). This has serrated edges—edges with minute saw teeth—and this is the ordinary form of such tools. A much improved scraper is, however, that shown in Fig. 26. This has a tooth more resembling a saw-set; it works better, and leaves a far better texture on the plaster than the last-named tool. Small gouges of various sizes and curves, of which examples are given in Figs. 27 and 28, will also be found handy. Other plaster tools are "riffles," one of which is shown in Fig. 29. These are diminutive rasps, and they would be more desirable if their tendency were not quickly to choke, and then to rust and become useless. They are good for working in hollows, but over most parts of the cast a piece of glass-paper makes the best riffle, and this, as soon as choked, can be thrown aside and a new one taken. Glass-paper is invaluable for plaster work. For removing lumpiness upon broad surfaces nothing else should be used. The sizes to be bought are Oakey's fine and middle No. 2; coarser scratches and finer do not bite enough, and choke too soon. Before using, two pieces should be lightly rubbed together: this takes off any unduly projecting particles of glass, which otherwise might make ugly scratches. For fine work—small medallions and the like—very small spoon-shaped ivory or bone modelling tools will be found of use on plaster. Any of the tools above-mentioned will probably cost from 6d. to 10d. each.

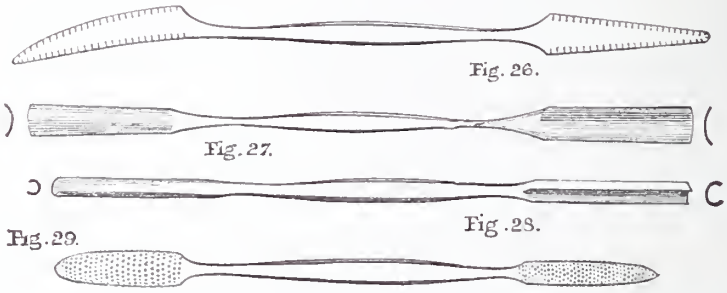


Fig. 26.—Saw-set Plaster Scraper. Figs. 27, 28.—Plaster Gouges. Fig. 29.—Plaster Riffle.

Whilst we are on the subject of plaster work, mention may be made of a method recommended for rendering this material more plastic, and therefore better adapted for modelling in: this is by the addition of marsh-mallow root (*Althea officinalis*). Two to four per cent. of this root finely pulverised and mixed with plaster is said to retard the setting of the latter for about an hour, and it may during that time be modelled like clay or wax. The root may be added up to eight per cent., the larger quantity retarding setting still longer, but making the mass more tenacious. When set, this mixture is reported to be so hard and tough as to admit of being turned or worked, and polished like ivory. The method is one which recommends itself for fancy and

namental purposes, though it has not been opted by figure modellers.

In order that these papers may be as mplete as possible, I propose to show w casts are to be made from many other jects than clay models, and this will be ne by the same process of waste moulding ith which we have thus far had to do. But fore speaking of casting from Nature, it ill be well to speak of another kind of aste moulding sometimes used for mould-g from clay. This is *wax moulding*. In ry delicate models, more particularly odels of ornament, the character of the ork sometimes depends on sharp points d edges, with deep undercuttings beneath em, and these would be ruined by any tempt to chip a mould from them in the rdinary way. The moulder, therefore, pours coating of melted wax over his model, and is forms his inner mould. He then makes is outer mould of plaster in the ordinary ay. When the mould has been filled and he outer mould broken off, the cast is placed efore the fire: the wax mould softens in he heat, and can be presently peeled off, eaving all the delicate modelling uninjured.

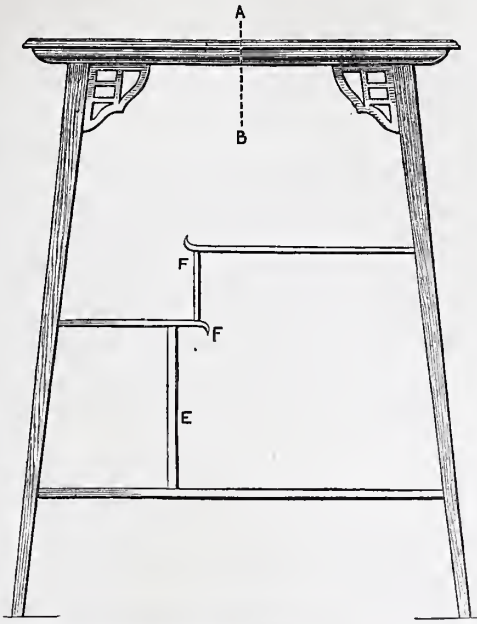


Fig. 6.—Front Elevation of Table. (Scale, 1½ in. to 1 ft., or one-eighth size.)

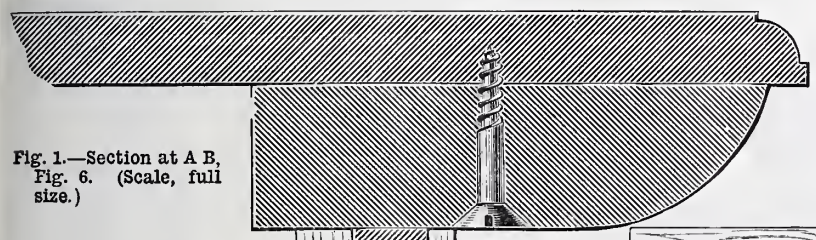


Fig. 1.—Section at A B, Fig. 6. (Scale, full size.)

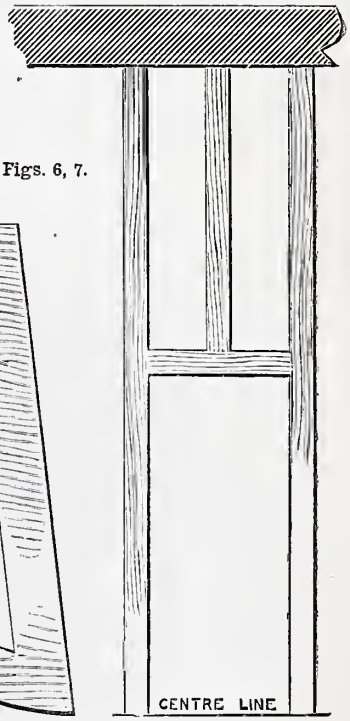


Fig. 5.—Elevation at E, Figs. 6, 7. (Full size.)

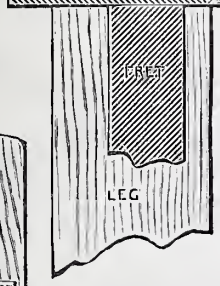
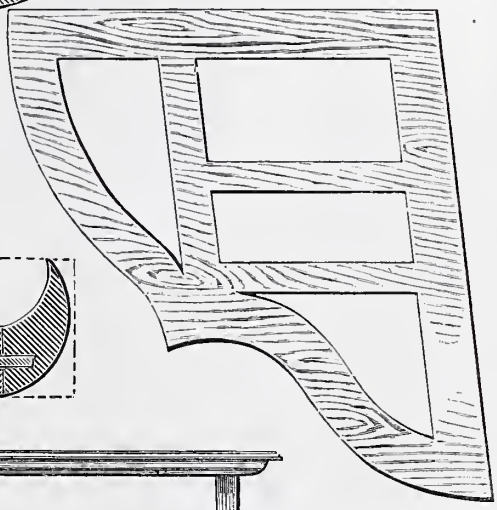


Fig. 4. — Fretwork in Corner Angles. (Full size.)



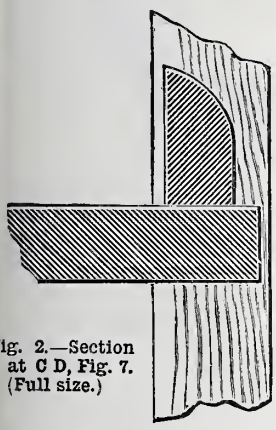


Fig. 2.—Section at C D, Fig. 7. (Full size.)

Fig. 3.—Section at F, F, Fig. 6. (Full size.)

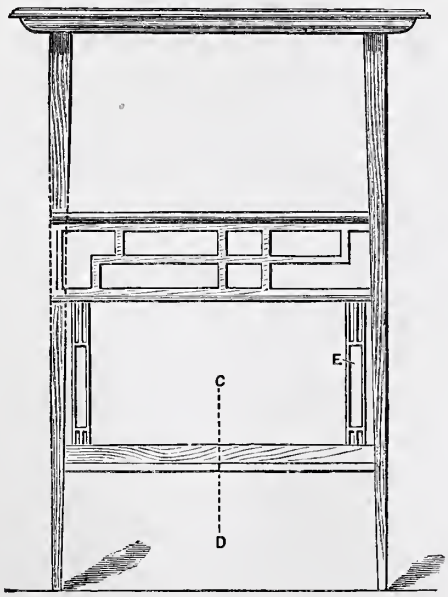


Fig. 7.—Side Elevation of Table. (One-eighth size.)

A USEFUL TABLE FOR BRIC-À-BRAC.

BY EDWARD C. ROE, JUNR., SILVER AND HONOURS MEDALLIST, CITY AND GUILDS OF LONDON INSTITUTE.

"What a pretty, useful little table!" This expression came from a friend upon viewing a table very similar to the one about to be dealt with; and certainly I must agree with that opinion, and do not for a moment hesitate to believe that such will be the general verdict. In addition to its neatness and utility, we have the further beneficial fact, that such a table is very easily made, and is well adapted for construction by either amateur or professional workmen, for experience has taught that the latter fraternity dislike a too lengthy, and therefore probably tedious, job equally with their amateur brethren, and prefer a job which is capable of being produced in a few hours, but at the same time will reflect credit upon the maker.

The original is made of American white wood, stained and polished in a very charming lake-vermilion tint, if such a term may be used; however, I think it will bear my meaning. It is not my intention to enter into the details of the polishing process, preferring to leave the description of procedure to my *confrères* more learned in such matters. Many, however, will prefer, and with good reason, to construct the table in walnut wood, most probably of the American variety; should this course be adopted, the whole should be simply dull polished, and, if neatly made, nothing would look better.

The drawings are to the scale of 1½ in. to a foot, or one-eighth, and full size, namely: Figs. 6 and 7 to the former, and the remainder full size.

To proceed with the actual construction. We must first set out the work full size; it is really only necessary to set out half elevations of side and front, the main requirement being the spread of the legs, and the consequent bevel of the shoulders on top of legs. Let us first prepare the legs: they require to be got out not less than 2 ft. long, preferably a little more; the thickness and width at the top is ⅞ of an inch, and then tapered off to half an inch at the bottom: these are dimensions of finished work.

Should the top be taken in hand next, be careful that the stuff is free from shakes, etc., and above all quite dry; the extreme dimensions are 1 ft. 5 in. by 1 ft. 6 in. Plane up, taking out of winding carefully, for if this is not properly attended to it will lead to disastrous results. The ovolo (Fig. 1) should be worked on after carefully squaring the edges. Either a plane or a router, such as has been described in this Magazine, may be used for forming the moulding.

Be very particular when planing the top for a finish how your plane-iron is ground and sharpened; an iron sharpened square with merely the corners taken off is an abomination, and the result of work terribly disappointing, especially when ebonised or enamelled. What is required, and moreover is necessary, for the production of good work is an iron whose cutting edge forms a perfectly symmetrical curve from side to side, or in other words from corner to corner.

Another minor, though important, matter, often passed lightly by, is the face of the iron, which very often, even in the case of the best quality iron, will be curved; such curvature is an unending and often unsuspected source of trouble, and such a serious defect should be sought out and remedied. An iron may be tested upon a surface plate, or in its absence by a small steel straightedge; the blade of a square will answer admirably if in good condition. These remarks apply more particularly to the varieties of planes used for finishing purposes, but should be kept in view always.

The pieces forming the round under the table top also act as clamps, and serve to keep the top from curling; they are in length finished 1 ft. 4½ in. and 1 ft. 5½ in.; two of each are worked to section (Fig. 1), then mitred round and screwed to under side of top. It is preferable to work all four pieces in one length. Let them be screwed on in a perfectly substantial manner, as the mortice for the legs will penetrate the joint. These mortices must be cut one way on the bevel; this will be readily seen upon reference to the full-size setting out; the mortice should be ⅝ of an inch square, thus allowing ⅛ of an inch shoulder on each face of legs. When carefully fitted, glue well, and then prepare the bottom shelf, which is shown in section in Fig. 2; the size is 1 ft. 6 in. by 1 ft. 2 in. approximately, the actual size being taken from the setting out or the table itself. Be sure to keep the grain lengthwise, so that the ledge (Fig. 2) may assist to keep it straight.

Doubtless the fitting of this shelf will cause a little trouble, but as great strength is not necessary, a method of fixing is to notch the shelf into the legs one way only, that way being the end where the legs are vertical, and on the sides where the legs spread to simply scribe to the bevel of legs. A thin screw run in skewwise will give strength quite sufficient for the purpose. The same remarks will apply to the remaining shelves, which should now be prepared. The curved edges, which serve to give a little character, are made in the manner shown by Fig. 3, the dotted lines representing the piece of stuff tongued on, and which is afterwards worked into the curves shown by the thick lines.

Note that in no case do the edges of the shelves come flush with the face of legs (see Fig. 2). Before fixing the minor shelves we must prepare the two vertical supports, as shown full size at Fig. 5, and cut the fret which comes between the second and third shelves. Some may possibly prefer to frame this fret together; such a method would certainly be neater, but is of necessity a much more tedious job. A portion of one leg in end elevation is removed in order to make clear the method of finishing end of fret.

The two ledges (see Section C D, Fig. 7) may be prepared and fixed with three or four fine screws from the under side of the shelf. By the way, an alternative and possibly a better method suggests itself for the purpose of fixing the bottom shelf. If the ends of the ledge be morticed and tenoned into the legs previous to fitting the shelf, it can then be fitted down on to the ledges without cutting into the legs, and then secured by screws.

The four angle frets, as in full-size elevation, Fig. 4, are ⅜ of an inch in thickness; the angle given (Fig. 4) must not be taken as perfectly correct, but the precise angle must be obtained from the table. The brackets may be attached with a few small French pins, preferably of the description having countersunk heads. I trust that my description will prove sufficiently definite, but should eager minds desire further enlightenment the "Shop" is open for their use, and any query addressed there shall have due attention.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

78.—Hunter's Patent Extracting Cowl.

Mr. Charles J. Hunter, 11, Countess Street, Whitley-by-the-Sea, sends me a very nicely-made working model of a chimney cowl, to which he has given the name of the "Patent Extracting Cowl." A rough illustration of the appliance is given in Fig. 1, and from this and my description combined, the reader may be able to form some general idea of its appearance.

Fig. 1.—Hunter's Patent Extracting Cowl.

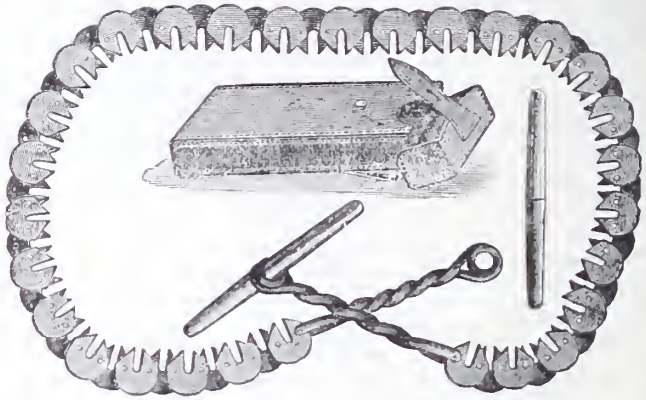


Fig. 2.—Stanley's Portable Saw.

The shaft of the cowl is square at the base (I am speaking of the model before me), and assumes a rounded form about half-way up, which form is preserved up to the top. Immediately over the top, supported by three projecting stays, is a shallow saucer-shaped cap, open at the top, and having its lower edge nearly on a level with the top edge of the shaft. Above this is another cap of the same form, with an interval between its lower edge and the top edge of the cap below, and above this, at the same distance between, is a cap in the form of a very low cone, with a broad base, which covers the opening. The construction, which is certainly simple enough, and contains no working parts to get clogged with soot or otherwise put out of order, is said by the maker to be most effective, and preventive of down draught and strong up draught, and is easily swept. Mr. Hunter gave me some directions for testing the model, as follows:—"To test, place the cowl over some scrap paper (some enclosed), blow with the rubber tube in all directions about the caps, and you will find the paper drawn out at the top. Or place the cowl over a lamp-chimney, turning the light *very* low, and you will find that the light will nearly be drawn out." Blowing as hard as I could about the caps, I raised a miniature hurricane around them—and I think Æolus himself could not have done it better—but the paper provokingly refused to come out at the top, and the lamp test was with me equally unsuccessful. But possibly I am getting stupid, and did not go to work the right way: in which case, without doubt, Mr. Hunter will set me right. I have only to say that prices may be had on application to Mr. Hunter at the address given above, and if any reader gives the cowl a trial, I should like to know the result, for it seems to be a good thing, though I could not make the model work.

79.—Stanley's Patent Portable Saw.

Who would ever have thought that a saw could be folded up and put in one's pocket? I never did until I saw Stanley's Patent Portable Saw, I must confess; and I daresay there are not many readers of WORK who thought the thing feasible, or, perchance, ever gave it a thought at all. Nevertheless the saw exists, if I may use the term, and will be found of the utmost value to all saw users, as, owing to its extraordinary portability and, I may say, flexibility, it can be used for many purposes where an ordinary saw could not be used or carried. For military purposes, surveyors, emigrants, railway pioneers, miners, engineers, and settlers beyond the range, or on the fringe, of civilisation, the qualities already mentioned, and its compactness, will strongly recommend it. It will be found of great use in felling trees, especially as by its aid they can be cut level with, or, it is said, even below, the surface of the ground. The illustration of the saw given in Fig. 2 will at once show its nature and construction. It consists of a number of hardened steel plates, deeply notched at one part of the circumference up to the centre, and these are riveted together in double series, the rivets being sufficiently loose to form joints, on which the plates easily turn. The notching already referred to causes each plate to be shaped on one side to form a pair of saw teeth cutting in opposite directions. At each end of the saw is a short length of stout twisted wire, with a loop or ring at its outer end, into which a cross handle is slipped. These handles are withdrawn from the rings for packing. For inaccessible trees, branches, etc., ropes may be attached to the rings in place of the cross handles. The saw, when pulled out straight, is 6 ft. in. length, and therefore equivalent to a 6 ft. cross-cut saw; but it has this advantage over the ordinary cross-cut saw, namely, that it can be used by one man, who, of course, takes a handle in each hand. Its weight is only 2 lbs. 4 oz., including case, as shown in Fig. 2, which is 8 in. by 4 in. by 1¾ in. This, however, is the leather case used for Government purposes. Otherwise it is supplied in a wooden case, slightly larger, at 35s. It will be seen that the steel discs of which the saw is composed are plates circular in form, or very nearly so. The diameter of the plates may be put approximately at 1¼ in., their thickness being that of an ordinary cross-cut saw or thereabouts. The width of the notch is ¼ in, and the length about half the diameter of the disc. It has been said that it may be used by one man in cutting down a tree, but I should not like to be the man who was using it single-handed, for the cut would have to be commenced on the side of the tree furthest from him, and trees thus felled have a nasty knack of falling in the direction towards which the saw is working, and when the end came the sawyer might not have time to get out of the way.

The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

In consequence of the great pressure upon the "Shop" columns of WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Colouring Photographs.—F. M. P. (*Cockermouth*) writes:—"I see in your August number of WORK, Vol. II., page 278, *àpropos* of colouring photographs, E. B. S. recommends licking the photo to make the colour lie. I have seen it stated by very clever men on this subject that the saliva rots and eats away the albumen. I think a much better way is to use a preparation prepared by A. N. Rintoul, which will answer the same purpose and do no harm to the photo. It is easily applied, not expensive, and obtainable from, I believe, any artists' colourmen. I believe instructions accompany each bottle, but it is only necessary to wash the photo over with the preparation (twice if a very firm surface is required), and then to cleanse with a sponge and cold water; it also acts as a preservative to the photo."

How to fret a Banjo.—R. H. H. (*Crewkerne*) writes:—"F. H. (*Streatham*) is quite right in saying that to divide the neck of a banjo into eighteenths will not produce the correct notes. The only correct method is first to decide exactly where the bridge is to be placed—3½ to 3 in. from edge of hoop is best; next divide the distance from the nut to the bridge by eighteen, and the first eighteenth is the place of the first fret; then divide the distance from the first fret to the bridge again to the bridge, and so on. Unless this is very accurately done, it is quite impossible to play correct chords with certainty high up the scale."

Correct fretting for Banjo, usual size—finger-board, 18 in.; hoop, 11 in.; nut to bridge, 26 in.

Distance from nut	to fret	Distance from nut	to fret	Distance from nut	to fret
inches.		inches.		inches.	
1·45	1st	9·55	8th	15·07	15th
2·82	2nd	10·46	9th	15·68	16th
4·10	3rd	11·32	10th	16·25	17th
5·32	4th	12·15	11th	16·80	18th
6·47	5th	13·00	12th	17·31	19th
7·56	6th	13·72	13th	17·80	20th
8·58	7th	14·41	14th		

Correct fretting for Brewster's grand orchestra-size Banjo—finger-board, 20 in.; hoop, 12½ in.; nut to bridge, 29 in.

Distance from nut	to fret	Distance from nut	to fret	Distance from nut	to fret
inches.		inches.		inches.	
1·61	1st	10·75	8th	16·89	15th
3·13	2nd	11·76	9th	17·48	16th
4·72	3rd	12·72	10th	18·12	17th
6·06	4th	13·63	11th	18·72	18th
7·34	5th	14·50	12th	19·29	19th
8·54	6th	15·30	13th	19·83	20th
9·67	7th	16·07	14th		

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Roof Strains.—STRAINS.—I give you a copy of Tredgold's rules and tables for finding the direction and amount of the strains on various parts of a roof, and the weight of the various coverings, which I think will give you all you want to know.

TREDGOLD'S RULES FOR SCANTLINGS OF ROOF TIMBERS.

B=breadth of piece in inches. D=depth of piece in inches. A=area of section of piece in inches=B×D. L=length of piece in feet. S=span of roof in feet. Tie Beam.—v=length of longest unsupported part in feet. When the tie beam has to support a ceiling only—

$$D=\frac{v}{\sqrt[3]{B}} \times 1{\cdot}47 \text{ for fir, or } \times 1{\cdot}52 \text{ for oak.}$$

Ceiling joists 12″ from centre to centre.

$$D=\sqrt[3]{\frac{L}{\sqrt{B}}} \times 0{\cdot}64 \text{ for fir, or } \times 0{\cdot}67 \text{ for oak.}$$

King post.—$A = L \times S \times 0{\cdot}12$ for fir, or $\times 0{\cdot}13$ for oak. King bolt.—Diameter in inches $=\sqrt{S} \times 0{\cdot}2$. Queen post.—$t$ = length in feet of part of tie beam suspended by the queen post. $A = L \times t \times 0{\cdot}27$ for fir, or 0·32 for oak. Queen bolt.—Diameter in inches $=\sqrt{t} \times 0{\cdot}29$. Struts and braces.—$r$ = length of part of principal rafter, supported by the strut, in feet.

$D = \sqrt{L \times \sqrt{r}} \times 0{\cdot}8$ for fir. $B = \frac{6}{10} D$. Principal rafters.—Supported by struts, over which the purlins rest.

$$\text{In king-post roof—}D=\frac{L^2 S}{B^3} \times {\cdot}096 \text{ for fir.}$$

$$\text{In queen-post roof—}D=\frac{L^2 S}{B^3} \times 0{\cdot}155 \text{ for fir.}$$

The thickness is generally the same as that of the tie beam and king or queen posts. Purlins.—C= distance in feet that the purlins are apart.

$D = \sqrt[4]{L^3 \times C} \times 1{\cdot}0$ for fir, or 1·04 for oak. $B = \frac{6}{10} D$.

Common rafters.—$D = \frac{L}{\sqrt[3]{B}} \times 0{\cdot}72$ for fir, or 0·74 for oak.

Straining beam.—In the best form for strength, the depth is to the breadth, as 10 to 7.

$$D=\sqrt{L \times \sqrt{S}} \times 0{\cdot}9 \text{ for fir.} \quad B=\tfrac{7}{10} D.$$

TABLE OF ROOF COVERINGS AND INCLINATIONS, ETC.

The weights of coverings will vary according to the thickness, etc., of the materals used.

Kind of covering.	Inclinaiton of sides of Roofs to Horizon.	Height of Roof in parts of span.	Weight on a square of Roofing in lbs.
Asphalted Felt ..	3° 50′	$\frac{1}{30}$	30 to 40
Copper ..	3° 50′	$\frac{1}{30}$	80 to 120
Corrugated Iron, 16 B.W.G.I. ..	4° 0	$\frac{1}{29}$	350
Sheet Iron, 16 B.W.G. ..	18° to 20°	$\frac{1}{9}$	250
Lead ..	3° 50′	$\frac{1}{30}$	550 to 850
Slates (Large) ..	22°	$\frac{1}{7}$	900 to 1,100
,, (Ordinary) ..	26° 30′	$\frac{1}{6}$	550 to 800
,, (Small) ..	30° 0′	$\frac{1}{5}$	450 to 650
Slabs of Stone ..	39° 0′	$\frac{2}{5}$	2,380
Thatch (Straw) ..	45° 0′	$\frac{1}{2}$	650
Tiles (Plain) ..	30° 0′	$\frac{2}{3}$	1,800
,, (Pan) ..	24° 0′	$\frac{2}{5}$	1,200
,, (Taylor's Patent)	30° 0′	$\frac{1}{3}$	830
Zinc ($\frac{1}{32}$in. thick) ..	4° 0′	$\frac{1}{29}$	150
Boarding (⅞in. thick	26° 30′	$\frac{1}{4}$	250
,, (1in. ,,)	29° 30′	$\frac{1}{4}$	350

N.B.—The additional pressures to be taken into account in practice are the following:—Pressure of wind, 2,500 to 5,000 lbs. per square of 100 ft. Pressure of snow, 500 lbs. per square. I think the above will answer all your queries. Do not be startled at the formulæ, as they are only letters instead of words, and can be worked out by ordinary arithmetic. If you have the least trouble write again, but state clearly whether you want to know what weight the roof will carry, or what scantlings are required to carry a certain covering, or merely which members are in tension or which in compression.—E.D.

Size and Speed of Pulleys.—DICK.—A simple formula for the calculation of the speed and size of pulleys is $V \times D = v \times d$. V = velocity of driver—v = velocity of driven; D = diameter of driver—d = diameter of driven. For example, suppose a shaft runs at 80 revolutions, and carries a pulley 24 in. diameter, it is required to run another shaft from it at 100 revolutions, then the diameter of driven pulley will

$$=\frac{V \times D}{v} = \frac{80 \times 24}{180} = \frac{1,920}{180} = 10\tfrac{2}{3} \text{ ins.}$$

If you want to find v, $\frac{V \times D}{d}$ will give it, or if $V = \frac{v \times d}{D}$, or $D = \frac{v \times d}{V}$. If you have the velocity of a shaft, and want pulleys to drive another, first put down the revolutions per minute of driving shaft, and above place the revolutions at which the other is to be driven (in a practical form). This will give the ratio of pulleys, for if driving shaft = 50 revolutions and driven = 150 revolutions, then $\frac{150}{50} = \frac{3}{1}$, or driving pulley will have to be three times the diameter of the driven. When one or more counter-shafts are used between a driving shaft and a machine, as in your first question, the sizes of the various pulleys have to be surmised, and so substitute one for another until you get what is required to do the work. Your question says the shaft runs at 140, and carries a 26 in. pulley, size of spindle pulley 3½ in., and speed required 3,500 (which, by the way, I think is too high; the limit should be about 3,000, because the wear and tear of machine and belts would be very great, and the finish on the work would not equalise it). Cut down in the form of a fraction the diameter of all the driving pulleys, together with the speed of the driving shaft on the top line, and underneath put the diameters of the driven pulleys—the result will be the number of revolutions of the last driver's shaft, or in your case the polishing spindle. I will give an example or two. (1) $\frac{140 \times 26 \times 28}{9 \times 3{\cdot}5} = 3,235$ revolutions. You see I have surmised for the 26 in. pulley to drive a 9 in., which is fixed upon a counter-shaft with a 28 in., which drives the polishing spindle. Again (2) $\frac{140 \times 26 \times 30}{10 \times 3.5} = 3,120$; or (3) $\frac{140 \times 26 \times 28}{8 \times 3{\cdot}5} = 3,640$; or (4) $\frac{140 \times 26 \times 32}{10 \times 3{\cdot}5} = 3,328$. Thus you can vary the pulleys and speed in any way you require. If two counter-shafts are wanted (but in your case it would not be advisable on account of the friction) add another driving and driven pulley, and alter sizes to suit. To find size of any particular pulley, or speed of driving or driven shafts in any train of pulleys.—For example, take (2) above, when speed of driven is given at 3,120 revolutions. The equation stands as follows—

$$140 \times 26 \times 30 = 10 \times 3{\cdot}5 \times 3,120.$$

Suppose the speed of driving shaft is wanted, then $\frac{3,120 \times 10 \times 3{\cdot}5}{26 \times 30} = 140$. Or that a pulley is wanted on the driving shaft, then $\frac{3,120 \times 10 \times 3{\cdot}5}{140 \times 30} = 26$. Or a driven pulley is wanted on the counter-shaft. then— $\frac{140 \times 26 \times 30}{3{\cdot}5 \times 3,120} = 10$. Thus the figures can be changed about to find any required size or revolution. It would be advisable to drive on to the counter-shaft with a crossed belt. If this is not clear to you, write again, giving particulars as to position of shaft, room for counter-shaft, and polishing spindle.—BRASS.

Flow of Water through Syphons.—NERO.—The flow of water through syphons, you refer to, is a case that is covered by the formulæ for the flow of water through pipes wherein friction has to be considered. The gravitating force varies as the head of water divided by the length of pipe. The head of water in your case is the difference of level between the water surface in the cistern and the outlet of the syphon. Let h=head in feet and l = length of piping in feet; then the accelerating force varies as $\frac{h}{l}$

The frictional resistances vary, 1st, as the square of the velocity of flow in feet per second ($= v^2$), as twice the number of molecules pass over the surface of the pipe twice as quickly if the velocity be doubled. 2nd, the friction will vary as the circumference (c) of the pipe, and inversely as the sectional area of the pipe—that is, as the weight of water passing. Let s=area of pipe in square feet, and c, a constant to be determined by experiment; then the resistances,

$$= v^2 \times \frac{c}{s} \times c$$

As accelerating and retarding forces must be equal when uniform velocity is established, it follows that

$$\frac{h}{l} = v^2 \times \frac{c}{s} \times c$$

and,

$$v^2 = \frac{h}{l} \times \frac{s}{c} \times \frac{1}{c}$$

Let d= diameter of pipe in feet, then

$$\frac{s}{c} = \frac{d^2 \times 0{\cdot}7854}{d \times 3{\cdot}1416} = \frac{d}{4}$$

Replacing $\frac{s}{c}$ in the foregoing equation, we have

$v^2 = \frac{h}{l} \times \frac{d}{4} \times \frac{1}{c}$; c has been found by experiment to be = 0·0001. Therefore,

$$v^2 = \frac{2500\, h\, d}{l} \text{ and } v=50\sqrt{\frac{h\, d}{l}} \ (a).$$

To find the gallons discharged per *minute*.—Let Q=gallons per minute, then (as one cubic foot=6·25 gallons)

$$Q = v \times S \times 60 \times 6{\cdot}25$$
$$= v \times 0{\cdot}7854 d^2 \times 60 \times 6{\cdot}25$$
$$= 294{\cdot}53\ v,\ d^2$$

Therefore $v = \frac{Q}{294{\cdot}53 d^2}$ replacing v in equation (a)

$$\frac{Q}{294{\cdot}53 d^2} = 50\sqrt{\frac{h\, d}{l}}\ ;\quad Q = 14,726\sqrt{\frac{h\, d^5}{l}}$$

I would mention that in using the formula $8\sqrt{h} = v$, you should qualify it by a co efficient, which depends upon the form of adjutage it flows through. This is given in good note-books, and in treatises on hydraulics for various proportions.—F. C.

Stationery Holder.—E. M. (*Peterhead, N. B.*).—Your letter and one from another correspondent, asking simultaneously whether I would supply full-size working drawings of my stationery holder design (see supplement to No. 66, page 228), I must deal with together. I have, therefore, replied more fully to your brother reader, on page 504. Take one of the best pieces of advice that was ever given to me—"Keep your eyes open."—J. S.

Flexible Glass.—F. C. J. (*Masborough*).—I am afraid you will not get any flexible glass so large as you want it, but you could try writing to Messrs. J. Powell & Sons, Whitefriars Glass Works, Temple Street, London. Explain clearly what you want it for, and the exact size, and they would give you an idea if it could be obtained; they are a very good firm to deal with for all sorts of glass, and I have found do not mind selling amateurs small quantities.—W. E. D., JUN.

Silvering Glass.—C. H. G. (*Liverpool*).—To silver glass for a mirror, procure as perfect a piece of glass as possible; clean thoroughly (merely rubbing it up will not do, as the smallest speck will show only too plainly when finished); get a piece of tinfoil a little larger all round than the glass. Cover the tinfoil with mercury (quicksilver), and lay a piece of clean white paper on, and the glass upon that, then with a quick motion, holding the glass firmly, draw the paper from underneath, leaving the glass upon the tinfoil; weight it down, so as to squeeze as much of the mercury out as possible, and leave for a little time. Finally rear it against a wall, so that all the mercury possible may drain out, and let it remain so for, say, a day or two, according to the state of the weather. Do not attempt to silver large pieces. Amateurs without experience or proper appliances and places

cannot hope to do it either so well or so cheaply as manufacturers, but with very small work you will be able to succeed, with care. I do not in the least wish to discourage you, as I know the pleasure of doing every part of the work yourself, but do not aim too high at first.—W. E. D., JUN.

Jensen Electric Bell.—E. T. (*London, N.E.*).—The "rough sketch" originally made of this bell in reply to C. D. (*Rochester*), has been made into a finished picture by the Art Department of Messrs. Cassell & Co. Hence the picture of the interior of this bell, as given on page 227, Vol. II. of WORK, is very clear, and should mislead no one wishing to fit up a bell of this pattern. There may, however, be a few details of this picture, which will be more clearly understood by a few words of explanation. Above and below the bobbin carrying the coil of wire, but close to its ends as if clipped between them, you will see two white patches: these represent two pieces of soft iron, into which the soft iron core o fits tightly. They may be regarded as the pole pieces of the electro-magnet, and are magnetised equally with the core when the current passes through the coil of wire. The piece of soft iron which forms the coil also serves the purpose of a support to all the interior works of the bell. The upper part of it is therefore turned to pass through the top of the bell, and screwed to receive a holding-up nut, which also forms one of the terminal binding screws. To prevent this part of the core from coming into contact with the metal of the bell, it is insulated therefrom by means of a sleeve or tube of ebonite or boxwood, as shown in the engraving. At A D is also shown in section an ebonite disc or washer, which insulates the lower part of the core from the gong, and also serves as a support to the contact spring. In the engraving, this spring is shown as touching the core; it must not touch the core, but must be fixed by small screws to the insulating washer. The armature, and also the shank of the hammer, are fixed to a loose oval sleeve on the core, and this sleeve is hung on a brass pivot passing through the core. I have complied with your request, and have sent detailed instructions and illustrations showing how to make the fittings for such a bell as you require.—G. E. B.

Parquet Flooring.—A. A. (*Lincoln*).—You will find that ordinary glue will suit your purpose very well, providing the floor underneath is fairly flat, and free from large cracks and projecting knots. Do not be under any apprehension as to nailing, but use what are known as panel pins; about 1 in. long will suit the thickness of stuff you mention. Likewise, do not fail to put in sufficient, for a little beeswax will effectually stop the holes, and when the whole is waxed or polished will not show at all. I may say, by the way, that panel pins are similar to French nails, with the exception that they are thinner and the heads are very much smaller and countersunk.—E. D.

Book on Surveying.—A. H. (*Manchester*).—You should get Merrett's "Practical Treatise on Surveying," price 12s. 6d., published by Spon & Co., 125, Strand, London.—K.

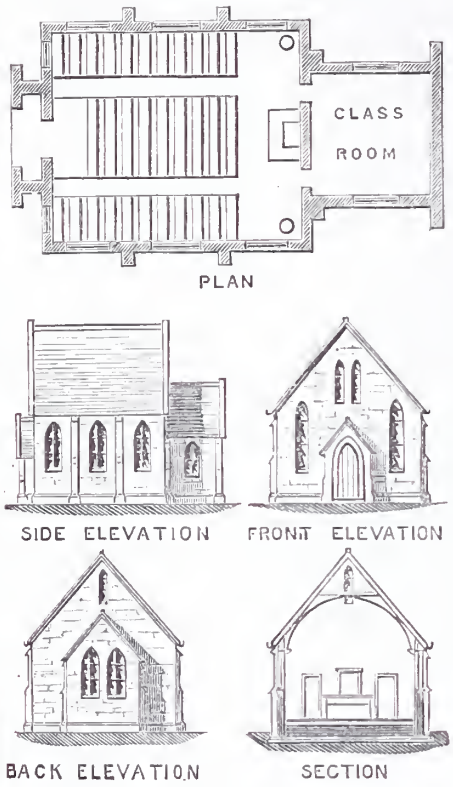
Black for China Painting.—G. R. (*London*) is impatient. G. R. asked the question three weeks ago, and complains it is not yet answered! I did answer it, enclosing diagrams, which required to be drawn and engraved and then wait for their turn in our crowded "Shop," and ere this appears he will have seen it. More than this it would be scarcely fair to expect.—J. W. H.

Cork-cutting Machine.—AB UNO DISCE OMNES, whose very apt quotation as a *nom de plume* I hereby beg my Editor to adopt as the motto for "Shop," and thus stereotype it for ever, desires to know who can supply him with a machine that will cut cork into strips, stating that such a machine exists on the Continent. I rather think that in my wanderings years ago in the Faubourg St. Antoine, in Paris, I have seen a sort of drawknife bread-cutting machine used for this purpose. I am, however, not quite clear as to the locality—it might have been in America or even in the "East" (of London). However, if a tool be wanted for any purpose, my conviction is that that tool can be made or found ready-made, so we will consider what it has to do. Cork is like indiarubber—susceptible of being cut only one way, namely, by a drawing cut; not by a direct sharp cut, like wood. Hence a diagonal guillotine paper-cutting machine, such as Salmon's, The Parsonage, Manchester, would be most likely to answer the purpose. The knife, like a cork-cutter's or shoemaker's knife, does not require to be a razor-edged tool, but rather a scythe-edged tool; the edge when viewed through a microscope showing serrations like fine saw-teeth, rather than an edge produced by finely rubbing on an oilstone, all the grinding scratches out of it. If AB UNO DISCE OMNES will ask some local printer or stationer to try cork under such a paper-cutting machine, he will see if it answers, and perhaps pick up from some printers' broker one of a size to cut strips up to even 60 in. long. A double demy machine cuts 37 in. across. James Salmon, Printers' Broker and Engineer, St. Mary's Parsonage, Manchester, would no doubt give our correspondent the best information on the subject.—J. W. H.

Rubber Shoes for Crutches.—A. S. (*Musselburgh*) writes for the address of Messrs. Macintosh and Co., Limited, Indiarubber Manufacturers, Cambridge Street, Manchester. I do not know if they still make these useful articles, but no doubt they would make them to order, as they did thirty years ago for me. Any rubber manufacturer, however, is at liberty to make them, as they are not patented or protected in any way. A. S.'s letter has been sent on.—J. W. H.

Wood-carving Patterns.—W. J. H. (*Redhill*).—First-class patterns for wood carving are very difficult to obtain; though there are many published, they are as a rule very inferior as designs. I think the best way is to get good photographs or prints of old or good modern work, and adapt it to your own purposes; these may be obtained from Batsford & Co., 52, High Holborn; they have, amongst other things, a portfolio of photographs of Professor Frullins's carvings, which are very beautiful and full of suggestions. Mr. Sutton's new publications of photographs from the carved work in the South Kensington Museum, sold in folios of eighteen plates, 13s. post free, with descriptive letterpress, or in single sheets, 9d. each, are first-rate, and are to be had at the School of Wood Carving, South Kensington. Two books, one by W. Bliss Sanders, entitled "Carved Woodwork of the Sixteenth and Seventeenth Centuries," and the other by A. Marshall, "Specimens of Antique Carved Furniture and Woodwork," will also be found very useful.—M. E. R.

Design for Chapel and Class-room.—H. W. (*Lancaster*).—In compliance with your request I herewith send you a design for a chapel with class-



Design for Chapel and Class-room.

room as requested for insertion in "Shop" of WORK. The estimated cost will be about £150, and the place will seat 100 persons comfortably.—W. B.

Engineers' Tools.—ENGINEER.—I do not know of any book up to date embracing modern practice in these tools. The best information is to be obtained in the workshops, but useful papers appear from time to time in the technical journals, and I should advise you to read these. If the Editor is willing to spare space, I will give a couple of papers on these subjects.—J.

Castings.—DELPH.—Unless your patterns are made well and mouldable, no founder will look at them. In any case, it is almost a favour to get very small castings made. Try Lee, High Holborn, or Lucas & Davies, Hatton Garden, London, E.C.—J.

Stationery Holder Design.—J. B. (*Darlington*).—Pleasure is experienced by me at the complimentary reception of my Stationery Holder design (Vol. II., No. 66, supplement). Yours is not the first communication I have received, requesting me to forward full-sized drawings of the same. This I shall be very glad to do, and, with the Editor's permission, I will prepare you a set as soon as business will permit.—J. S.

Book on Dynamo.—W. C. (*Manchester*).—I have been favoured by Mr. Bottone with a copy of the sixth edition of his book, "The Dynamo: How Made and Used." In this edition there is a useful addenda of twenty-four pages, describing the winding of other armatures besides that of the H girder form, and giving rules for calculating the output of dynamos. The addenda is illustrated with twenty-one additional illustrations of such machines as the Gramme, Manchester, Simplex, and Alliance dynamos, and their various parts. The book may be obtained direct from the author, Mr. Bottone, Electrician, Carshalton, Surrey, by post, for 2s. 6d.—G. E. B.

Lantern Stands.—MAGIC asks for the names of one or two places where he can get "stands for magic lanterns." As I am not aware that any special stands are designed for this purpose, I must "give it up." It is possible that MAGIC has not expressed himself as clearly as he imagined. All parts and appliances used with the lantern may be obtained of the makers, whose name is legion, and their addresses may be found advertised in a hundred magazines. In the meanwhile, apply to Mr. Lancaster, Colemore Row, Birmingham. If anyone can meet your want, I think he can.—O. B.

Whetting Graver.—J. L. (*Wigan*) sends me a graver to be whetted. The graver, I am sorry to say, was received broken, so as to be completely useless to anyone. I have, however, supplied another, one of Seller's best, of about the same length, but much stouter than the one sent, which is much too light for a beginner, who, generally speaking, is not very delicate in his first attempts at engraving. You will see that I have made the facets on the *belly* of the graver very long, so that the graver will last you a good while, and all you have to do when the graver becomes dull is to sharpen it on the *back*. I have only to wish you every success.—N. M.

Bicycles.—ONE WHO WOULD LIKE TO KNOW.—I would like to know what would make the bright parts of bicycles shine like silver plate, as I know of nothing that will do it except silver or nickel plating. It is possible to give steel a high polish looking as shiny as plating by bestowing much labour on it, but the shine will not remain, as the moisture of the atmosphere dims it immediately. [Bright polished steel may be protected against the atmosphere by coating it, when newly brightened, with "Silico Transparent Enamel." To be had from the Silico Enamel Company, 97, Hampstead Road, London, N.W.—A. S. P.]

Walking-stick Gun.—ZERO.—Walking-stick guns vary considerably in their make and the distances they will carry a charge effectively. Some are simply a breech chamber and a brass lining for tube to carry a shot or pellet, the whole encased in malacca cane, with a buck-horn handle, weighing about a pound and a quarter; the calibre is 7 M, or about ¼-in. pellet; penetration, a ¼-in. pine board at thirty or forty feet; the price about 28s.; ammunition, 5s. per hundred. They may be bought of Bland & Co., Strand. A more efficient weapon is made, walking-stick shape and finish, with hook handle, made to receive a proper gunstock screwed into the handle hook. The stick is solid gun-barrel, breech-loading, and takes special ammunition, about ⅜ in. diameter, either ball or shot; will kill rabbits or rooks at 60 yds. Price complete, 45s.; ammunition, about 8s. per hundred. The old muzzle-loading walking-stick gun, requiring a ramrod, is not now made. Air-guns have much less force of penetration, and are useful for practising aiming and shooting at a mark. They may be bought at novelty shops in most large towns from 5s. 6d. up to 42s. Requiring an air-chamber in the stock, they are not made as walking-stick guns generally, though some are to be bought. A combined air or powder charge gun is made and sold for 38s. by Richford & Co., 149, Fleet Street, London. The best walking-stick guns are by Cogswell and Harrison, 226, Strand, London. Any of the firms named will send their circulars and illustrated price lists to you on application. Any further information required will be gladly given.—J. C. K.

Obtaining a Patent.—A DELUDED INVENTOR.—Burnt children, it is said, dread the fire, and this is true generally, but not always, for many who have been burnt, whether physically or in pocket, foolishly try again, only to come second-best off once more. You, however, are among the wiser ones who are content with one scorching, and, more than this, you wish to render your experience a source of benefit to others. If you can possibly avoid doing so, it is better not to stir up muddy water, and therefore I do not publish your letter *in extenso*, but merely the commencement of it, in which you say:—"Will you allow me to give a few words of advice to your correspondent X. W. (*Crowle*) respecting his desire to obtain a patent for his invention. I would advise him, first, to get a copy of the Patents Act, costing 2s.; study it a little, and he will then be able to draw up his own specification on forms to be got at any post office without the aid of"—and here I had better drop your own words, and simply substitute—"the middleman." I cordially and completely agree with you in all you say, but the comic papers teach us that there are things which it were better to have left unsaid, and, *pari passu*, unprinted. Let the middleman "imagine it," as the song runs.—ED.

Home-Made Lathe.—J. R. D. (*London, N.*).—You wish to know how to make a lathe to suit the "overhead" described in WORK, No. 75. Now this is like asking how to build a house to suit some chimneys, or how to make a locomotive to suit a funnel which has taken your fancy; surely you must hail from the antipodes or some other upside-down country. No, no, friend, don't put the cart before the horse, nor expect to be told how to make a lathe in a few lines. If you watch the columns of WORK you will by degrees get the information you

want. Whole pages would be required to teach a beginner how to make the simplest kind of lathe. You will get it all in good time; but begin with the lathe, not the "overhead;" when you have used a lathe for a year or two, and can do plain turning, then it will be time enough to make an "overhead" to suit your lathe, and not a lathe to suit an "overhead."—F. A. M.

Polish to Shells.—A. W. B. (*Swansea*).—You do not say what shells you wish to polish, or I should have known better how to advise you; but shells as a general rule are not polished, and if it is to bring out the markings as you see them when wet, you will find that gum-water, or white of an egg, brushed over will do this; or as it is for fancy work which will be handled, you might use varnish; if, however, you would rather try to polish them, scrape or file them, then rub down with emery paper, and finish with rotten-stone or tripoli; but if the shells are very small, I do not think it will repay you for your trouble. Many shells which look very plain at first may be greatly improved by steeping in warm water, and then scrubbing with a brush; this removes a thin coating, and brings out the markings which are underneath.—W. E. D., JUN.

Blocking.—NEMO.—If NEMO knows anything about blocking he will have no difficulty in working his Mackay. If it is heated with gas it is used in the ordinary way, same as any other blocking press; the type is set up and tightened in the forme and fastened to the little plate with the handle, the work is laid on to the gauges, the forme is drawn out, and the gold or silver laid on the top of type; the forme is placed in again, the lever at the side is brought down and raised, the work taken out, and the letters or design will be blocked upon it. Care must be taken not to have too much pressure or too much heat. I cannot give the maker's instructions; but if NEMO has the address, which will be on the brass plate of the machine, he can easily write and procure them. I hope this will be of value to our friend.—G. C.

Lenses.—TRIPOD.—Good work may be done with almost any double convex lens, provided the user knows how to do it. A quick-working lens must work with good definition and a large opening. This has been a problem for skilled opticians from the beginning. Much depends on the quality and refractive power of the glass; B and D in the diagram sent would be most likely to work satisfactorily; but as to rapidity, testing them could only find out; A would be useless for the purpose. The curves of the lens are the principal factors in the effects obtained by them. The greater the curve the shorter the focus, and, generally speaking, so is the rapidity: but rapidity is regulated by the amount of light passing through the lens, and the form of the lens is designed to give the largest amount of light with the best definition over a surface of determined size. The diaphragms have considerable influence on the image; the smaller the aperture the better the definition. Their position with respect to the lens is very important, causing or reducing distortion of the image. I should advise TRIPOD to get some handbook on photographic optics and study that.—D.

Negative Developing.—W. R. O.—Merely pour the developer over the negative in a dish, using sufficient solution to cover the plate perfectly, and keep it in motion by rocking the dish until it is sufficiently dense. Remove and wash under the tap and place in fixing solution, made of one ounce of hyposulphite of soda to five ounces of water. Well wash, and place in the alum solution for a few minutes, then wash for a few hours in frequently changed water, and dry. Always use the alum after fixing.—D.

Telephone.—MICROPHONE.—You will have some little difficulty in procuring telephone transmitters, as the apparatus is generally sold in sets. However, you can easily make a pair from the instructions given in WORK. I am sorry that I have not my back numbers beside me at present, so I cannot tell you which to look at; but almost every week from No. 28 you will find something. If you want any special form of transmitter, write again, and I will try and help you.—W. D.

Gesso Work.—A. R. B. (*Dublin*).—To employ a mould for gesso work would be to reduce the art to a mere mechanical process. You can only trust to your eye to keep the height of the design regular. A slight difference in the repeat is never undesirable, since it shows the work is done by hand. Practice will soon help you to make the repeats sufficiently accurate to be artistic.—C.

Camera.—G. D. P. (*Aberdeen*).—If the enlargement is to cover the whole space, the 8 in. R. R. lens is the most suitable for the purpose. If only the centre of the space is to be filled, as in a portrait head, for example, the ½-plate portrait lens may be used. The best lens for the purpose is a 5 in. rapid rectilinear, as the longer the focus of the lens the greater must be the extension of the camera. With very wide angle lens, the nearness to the picture to be copied is a drawback.—D.

Waterproofing.—J. R. (*Newton*).—There is no such article as you require in the market at present; all the materials now used for the purpose are quite unable to fulfil your requirements, and possess so many objectionable features that we should not recommend you to try them for what you propose, as we are sure the only result would be failure, with injury to or destruction of the article to which they are applied. We have lately seen just the thing that will suit you for all you want, but as it is at present under severe tests—all of which it has so far passed satisfactorily—arrangements are not yet completed for bringing it on the market. One great thing we particularly noticed—its perfect freedom from any unpleasant or other odour—should recommend it; whilst its freedom from cracking and peeling off, or injuring what it is applied to, are not the least of its advantages.—C. E.

Table Roller Lever Escapement.—TIME.—Put your plates together with the train in—that is, fusee, centre wheel, third wheel, fourth wheel, 'scape wheel, and pallets; leave the barrel out and chain off; cut a thin and narrow wedge of cork and place between the lever and top plate; put your maintaining power on and gently move the lever (pallets) till the 'scape wheel drops off one pallet on to the other; the distance up the locking faces the tooth should drop is just the thickness of the tops of 'scape teeth; it should then have the same amount of run after before touching the banking pins, which will allow the guard pin to free the roller; and also make sure of the teeth falling in the case of some being slightly longer than others, or the wheel being out of truth, so if you allow freedom of about the thickness of tissue paper between the

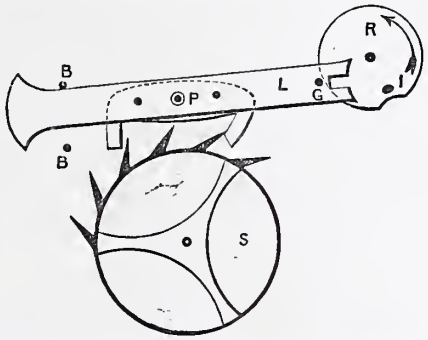


Table Roller Lever Escapement—L, Lever; P, Pallets; B, Banking Pins; G, Guard Pin; I, Impulse Pin; R, Roller; S, 'Scape Wheel.

banking pins and the sides of the lever after the 'scape teeth have fallen from one pallet to the other, also the same amount of freedom between the guard pin and the roller, when the lever is resting against the guard pins, I think you will be safe. The proper depth for the impulse pin is so that it shall be fair in the lever notch; it must not touch the bottom of the notch or you will get no vibration, and in positions will stop, and you must see that it does not butt against the corners going in and out; also see that all your holes of the 'scape wheel, pallets, and staff are well fitting; if at all wide put new ones; if brass ones, well burnish them to make them hard, and where jewel ones put new. See that your hairspring is properly in circle, and quite flat, and free everywhere. See that your pivots come well through the holes, and where endstones, see that they rest on them; round up the pivots' ends nicely, and if the endstones are marked put new ones.—A. B. C.

Bookbinding.—J. C. (*Birmingham*).—Surely this correspondent has only started to take in our paper. I cannot think that he has had it for any time, for the information which he seeks concerning bookbinding has been given again and again. He has also been guilty of a slight act of indiscretion, inasmuch as he has not confined one question to one piece of paper. He will please note that questions on different subjects should be written on separate pieces of paper. However, the Editor has marked the portion with red ink which he wants me to notice, so I will proceed. You want to know how to fasten your numbers of WORK together for binding, the best way to do this, and the tool required for the purpose. Well, now, really this does look a childish question, and I am very near feeling that you are poking fun at us. The tool required is simply a needle. And the best method is simply to take the volume and knock it up straight and saw five grooves upon the back at equal distances from each other and the two outer edges; this done, if you have not a sewing-bench, or have not seen the dodge described by a correspondent a few weeks ago, tie three cords to the top and bottom rails of one of the kitchen chairs in such a position as will suit the three centre grooves in the centre of the back of the book. Now take up one number and lay it down upon the bottom of the chair or bench with the back up to the cords, and put the needle with a thread in it in at the bottom, and bring it out at the top side of first band, put it in at the under side of the same, bring it out at the top side of the second, put it in at the under side, carry it to the upper band, and then out at the top; take another number and go down this one, sewing until you come to the bottom; fasten up, and go on in the same way until the whole book is sewn. You might look up your back numbers for more information. I have not mine beside me at present, and so cannot assist you in the search.—G. C.

Iron Roofing.—A. S. (*Ayrshire*).—The iron you require for roofing purposes is quite a different thing from the common sheet iron mentioned in my article; this is mostly used for stove piping, buckets, skeps, scuttles, etc. What you want is called galvanised corrugated iron; the gauge you speak about—viz., No. 13—is far too thick: 18 gauge would make a very strong roof, but there would only be about four or five sheets to the cwt., and not so many as that if they were 9 or 10 ft. sheets. If your house is, as you say, a small one, I should advise you to use 22 gauge; you will find that plenty heavy enough—in fact, we sell more of that and 24 gauge than any other thickness. With regard to how many yards there are in a cwt., that, of course, depends on the thickness, but, taking 22 as an example, you would get about 16 sheets per cwt., covering 6 ft. by 2 ft.; in reality they are 2 ft. 3 in. wide, but as 3 in. go for lap, they only cover 2 ft. in width, so 3 sheets would cover 4 square yards, so you can easily calculate how many cwt. you would want. The length of the sheets will depend on your roof; supposing it is 6 ft. 6 in. from ridge to eave, you would want to get sheets of 7 ft. long and cut a trifle off the ends, as you would not require it to overhang 6 in.; supposing your roof 11 ft., then use two 6-ft. sheets, giving about 9 in. lap. In this case you would want a purlin half way up the roof to fix the first row of sheets to. Now as to price and where to buy. Messrs. Daws, Brothers, & Co., Limited, Crown Works, Wolverhampton, supply at the following rates:—16, 18, and 20 gauge, 5 to 8 ft. long, £10 10s. per ton; 22 gauge, £11 5s. per ton; 24 gauge, £11 10s. per ton, net, at the works; carriage to buyer's station extra. Black corrugated sheets for painting, about £3 per ton less. Messrs. Hill & Smith, Twidale, Tipton, Staffordshire, supply 5 to 8 ft. sheets, 22 gauge, £13 per ton, with 20 per cent. off. This firm also supply a patent self-adjusting sheet, requiring no riveting or fixing at the sides, for which they claim many advantages; they are, however, considerably higher in price. I am unable to say if these firms would supply a cwt. or two, but I should think they would, or, at any rate, a quarter of a ton. Messrs. Hill & Smith have an office at 73, Elmbank Street, Glasgow, but I do not think they keep stock there. I shall be pleased to give any further information required.—R. A.

Perspective.—STUDENT wishes to know—"Is there any method of determining by the relative size of a sketch with the actual size of the object the distance I am from the object? If so, what is the rate of decrease in any given space, say 10 or 100 yards?" In other words, this amounts to the query, "Can perspective drawings be done to scale?" No; and for this reason: that the apparent decrease in size of every object as it recedes from the eye is not at the same rate at any two different equal parts of that distance, but is in the inverse ratio of the squares of the distances. Again, the size a distant object appears to one eye, is not the same it would appear to another eye at the same distance from it; just as two cameras at any point photographing the same object at same distance would give pictures in correct perspective but of different sizes; this is because the lenses through which the rays of light pass are reflected at different angles; and so it is with the eye, which is a lens itself. All that perspective can do is this: it can determine with minute exactness the relative sizes of objects in the same picture according to their relative distances from the eye, by construction geometrically from the plan and elevation drawn to scale. In other words, just as one can draw to scale an object maintaining the same proportion between every dimension, whether that scale be $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{10}$, or $\frac{1}{100}$ of the full size; so by using the plan and elevation in our construction of the perspective, those dimensions will be preserved in true perspective proportion. But as they diminish in different ratios, you cannot measure them in the perspective drawing as you can in plan and elevation with your scale. Another point which I have never seen alluded to in books on perspective, and which should be clearly and distinctly borne in mind, is that all perspective drawings are *one eye* pictures. In natural vision, one eye sees further round one side of an object whilst the other sees further round the opposite side of the same object, which is the reason of that effect of rotundity which one sees in nature and not in perspective drawings. The stereoscope presents two pictures at the same time, and when they blend—one being a right-eye view and the other a left-eye view—their combined effect is that of natural vision, and rotundity is the result. Therefore, in sketching from nature, close always one and the same eye when viewing and comparing objects in different planes—never look with both at your view—and keep your eye as nearly as possible in one spot. In measuring with a pencil perspective distances (which you allude to as your method and I disapprove of as almost impracticable, because it is almost impossible always to keep the pencil one exact distance from the eye), you will find that after measuring one apparent dimension you will never be able, however you try, to get it exactly the same again, and you should therefore discard it as not accurate enough. Your eye can be trained by practice to compare lengths and heights, etc., far more accurately than by such methods, which, indeed, if relied upon at all, will retard the education of the eye instead of assisting it. Space in "Shop" being too limited to permit of my going thoroughly into the wide subject of perspective, I can only recommend you to obtain Weale's manual on the subject (Lockwood & Co.), by G. Pyne, 2s., by order from any bookseller, and with the above hints you will find it a delightful study. I may add, that whilst

apparently very complicated, it is as simple as A B C, if you clearly fix in your mind the true meaning of the terms used, and never confuse the actual and real with the representation of them you are producing. As an instance, the picture plane—an imaginary surface between your eye and the view itself—may be anywhere between. You have to imagine the points at which the various rays of light passing from the objects to your eye cut this picture plane—if you are merely sketching—and you must never allow yourself to regard this imaginary plane as the picture you are making. You are simply copying on your picture a reduced view, to any proportion you like, of what would appear on this imaginary plane. Perspective teaches you how to project with unerring accuracy on to such a plane these points of intersection.—J. W. H.

Polishing.—AMATEUR.—Yes; treat the wood as if it were mahogany.—D. D.

Furniture Wood.—OXGALL.—Unless you can give the name of the process, it is impossible to say how the decorations you ask about were done. There are several methods of imitating marquetry work, many of them the subjects of patents, but none that I have seen are to be compared with the real thing.—D. D.

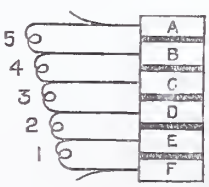
Oak Carving. — A. C. L. B. (*Norwich*).—You can darken new oak carvings either by fumigating—that is, subjecting them to strong ammonia vapour—or by staining them with any of the ordinary liquid stains. The former method is to be preferred, as the grain of the wood is not raised, but everything depends on the colour you want.—D. D.

Leclanchè Battery for Electric Lights.—G. A. B. (*Sunningdale*).—(1) A Leclanchè battery of four cells, each 5 in. by 4½ in. by 2 in., specially fitted with flat carbon plates and large bent plates of zinc, will light up a 2½ c.p. 5-volt lamp for ten minutes at a time and yield current for twelve months with little or no attention. These will cost about 5s. per cell. The lamp will cost 4s. 6d. The Gassner is superior in point of cleanliness, portability, and constancy. It would require no attention whatever for two years if used for ten minutes or a quarter of an hour morning and evening. (2) There would be no appreciable difference in the light if used at the ends of a line of No. 18 wire, 3 yards from the battery. (3) The two samples of wire sent are: Large size, ·083, equal to No. 14 B.W.G.; small size, ·064, equal to No. 16 Standard Wire Gauge, or about the same in B.W.G. I have communicated your questions to D. O. W. (*Ipswich*) as you desired, and will let you have his reply when I get it.—G. E. B.

Battery for Electric Light.—W. C. (*Hulme*).—Your battery of six cells, each furnished with a zinc plate 4½ in. by 1¾ in., enclosed between two carbon plates of the same dimensions, should, when charged with chromic acid solution (composed of three of chromic acid dissolved in each pint of water and acidulated with three of sulphuric acid to each pint of solution) and arranged in series, light up a 5 c.p. 12-volt lamp for half an hour at a time. One charge will furnish light for six half hours. If you use 2½ c.p. lamps, get two 6-volt lamps and place them in series to get the 5 c.p. light. Such a battery as yours will not fully light a lamp of low resistance taking a current volume of 3 ampères, nor will it light a lamp having a higher resistance than 12 volts.—G. E. B.

Book on Electric Lighting.—S. M. S. T. (*Glasgow*).—I think I have said before more than once that Mr. Bottone's book on the "Dynamo: How Made and Used," is suitable as a guide to any student or amateur making his first dynamo. The latest edition contains a valuable addenda showing how to wind several different types of machines. It may be obtained of the author (who lives at Wallington, Surrey) by post for a 2s. 6d. postal order. If you wish to study electric lighting, you may find the following books of some use to you:—"Arc and Glow Lamps," by J. Maier, price 7s. 6d.; and "Management of Accumulators," latest edition, by Sir D. Salomons, price 5s.: both published by Whittaker & Co., London. If you want something more costly, get "Electric Lighting," by J. E. H. Gordon, price 18s., published by Sampson Low & Co.; or "Electric Illumination," two vols., at 30s., published at the *Engineering* office, 35 and 36, Bedford Street, Strand, London. If you find any difficulty in getting books, I will try to get them for you, if you write and enclose your address.—G. E. B.

Connecting Coils of Machine.—GOOD OLD JEFF.—Suppose the commutator of the machine to be spread out on a plane surface and part of it represented as shown in the annexed figure. Coil 1, on the first ring of the armature, will have its commencing end connected to the bar F, and its finish end connected to the commencing end of coil 2, which will then be connected to bar E, and so on until all the ends of each coil on the five rings have been connected to all the bars. Follow on with each set of coils in this way, until one end of each coil has been connected to each bar of the commutator, and the remaining ends soldered to the leading wires as shown in the figure.—G. E. B.



Polish. — S. S. (*Salford*). — Mahogany may be darkened either by fumigation with ammonia or by staining. For obvious reasons, the former method is generally adopted in the kind of furniture to which you allude.—D. D.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Picture-frame Moulding. — H. R. (*Bacup*) writes:—"Can any reader of WORK tell me where I can get picture-frame moulding, etc., in Manchester?"

Hot-water Engineering. — L. S. (*London, S.E.*) writes:—"I shall be very pleased to be informed of any class or classes held in London in the evening, in which hot-water engineering is taught. I have some knowledge of the work, but want to get a theoretical, as well as practical, knowledge of it."

Telephone District and Sections.—INQUIRER writes:—"I shall feel obliged to any reader for an opinion as to my position. I have a district two miles by one mile, and I wish a section in the centre, and ten other sections surrounding this centre section to be in telephonic connection with this latter. I have been in communication with some firm to make me such a plant: some say they can make it, and guarentee me free from any claims that the National Telephone Company might make upon me; other firms say that they cannot make me such a plant, neither can any other firm make it to give satisfaction and free me from the claims of this National Company. I would like to know the opinion of our readers or yourself, and, if agreeable, I would like the address of some good firms to supply me with such a plant."

Glaze for White Shirts. — NED (*Lynmouth*) wishes for a recipe for making glaze for glazing white shirts. He has tried several mixtures, but all to no avail. Anyone who will send a good recipe will have the love of all the laundresses.—[Surely this ought to be an inducement.—ED.]

Grinding and Setting Razor.—X. Y. Z. wishes to be told how to grind and set a razor.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—R. R. G. (*St. Peter's Park, W.*); R. W. (*London, S.E.*); AMATEUR; S. D. (*Brixton*); CUPBOARD; E. P. J. (*East Dulwich*); A. W. S.; H. E. C. (*London, S.W.*); A. E. S. (*Islington*); A READER FROM THE FIRST; R. R. (*Walsall*); APPRECIATIVE READER; BREVITY; J. D. (*Manchester*); J. R. (*Watford*); MARKWELL; J. F. M. (*Wolverhampton*); N. A. F. (*Hackney*); J. M. (*Edinburgh*); J. L. (*Wimborne*); A. W. L. (*Bilston*); J. P. S. (*Hertford*); P. A. D. (*Canonbury*); W. H. (*West Kilburn*); F. W. (*Birmingham*); H. S. (*Walworth*); C. E. M. (*Devonport*); G. W. (*Lancaster*); A. L.; J. S. (*Blackburn*); E. S. (*Aldershot*); H. H. (*Rochdale*); J. P. (*Peckham*); F. S. S. (*Enfield*); F. S. (*Clapton*); S. E. (*Camberwell*); W. E. H. (*London, W.C.*); S. J. S. (*Frome*); H. F. (*London, W.C.*); R. H. B. (*Hants*); E. T. (*Bolton*); A. A. (*Hawkesbury*); H. G. (*Lancashire*); R. F. S. (*Sunderland*); E. S. (*Huddersfield*); W. D. (*Newcastle-on-Tyne*); ARGENT; E. C. M. (*Ipswich*); E. H. (*Manchester*); E. R. T. (*Egremont*); W. S. (*London, S.E.*); J. G. (*Wilts*); W. J. W. (*West Bromwich*); A. S. B. (*Midlothian*); A. A. S. (*Leeds*); BLACKBIRD; M. T. W. (*Wirbleton*); T. E. G. (*Redhill*); H. G. (*Dulwich*); MECHANIC; R. W. R. (*Ambleside*); A. M. A. (*Bradford*); F. W. B. (*Derby*); J. S. W. (*Kendal*); S. F. (*Surrey*); J. G. (*Manchester*); D. L. (*Blairgowrie*); H. T. (*Huddersfield*); W. C.; F. S. M. (*Huddersfield*); M. N. W. (*Wells*); S. R. (*Newry*); J. M. T. (*Bylands, Australia*); AMBITIOUS; L. A. M. C. (*Ipswich*); S. D. (*Lifford*); A. V. (*Northampton*); R. R. (*Belfast*); E. G. C. (*Stockport*); G. A. (*Pembroke Dock*); H. S. (*Regent's Park, N.W.*); WORKING JOINER; T. G. (*Attoxeter*); G. B. (*Stoke-upon-Trent*).

IMPORTANT TO INVENTORS AND DESIGNERS.

"WORK" EXHIBITION.

THE Proprietors of WORK are gratified to be able to announce that under the PATENTS, DESIGNS, AND TRADE MARKS ACT, 1883, they have applied to, and been granted by, the Board of Trade, a CERTIFICATE, as required by the Act cited, that the WORK Exhibition is an Industrial Exhibition, as defined by the Act, and that therefore any exhibitor, on giving notice to the Registrar of Patents, Southampton Buildings, shall be entitled to protection for any design or invention which is not the subject, as yet, of any application for Provisional Protection or of any Registration of Design. The protection thus afforded will extend to the duration of the Exhibition and six months afterwards, its effect being that workmen and others may, without prejudice to their future claims for Registration of Design or for Letters Patent for Inventions, exhibit drawings or models, and thus bring them safely before capitalists, as the following extracts from the Act will show. Forms for notice and full information as to fees may be had from the Great Seal Office, Southampton Row, London, either on personal application or by enclosing stamped directed envelope by post.

PATENTS, DESIGNS, AND TRADE MARKS ACT, 1883.

Section 39.—The exhibition of an invention at an industrial or international exhibition, certified as such by the Board of Trade, or the publication of any description of the invention during the period of the holding of the exhibition, or the use of the invention for the purpose of the exhibition in the place where the exhibition is held, or the use of the invention during the period of the holding of the exhibition by any person elsewhere, without the privity or consent of the inventor, shall not prejudice the right of the inventor or his legal personal representative to apply for and obtain provisional protection and a patent in respect of the invention or the validity of any patent granted on the application, provided that both the following conditions are complied with, viz.:—

(*a*) The exhibitor must, before exhibiting the invention, give the comptroller the prescribed notice of his intention to do so; and

(*b*) The application for a patent must be made before or within six months from the date of the opening of the exhibition.

Section 57.—The exhibition at an industrial or international exhibition, certified as such by the Board of Trade, or the exhibition elsewhere during the period of the holding of the exhibition, without the privity or consent of the proprietor of a design, or of any article to which a design is applied, or the publication, during the holding of any such exhibition, of a description of a design, shall not prevent the design from being registered, or invalidate the registration thereof, provided that both the following conditions are complied with, viz.:—

(*a*) The exhibitor must, before exhibiting the design or article, or publishing a description of the design, give the comptroller the prescribed notice of his intention to do so; and

(*b*) The application for registration must be made before or within six months from the date of the opening of the exhibition.

I therefore give notice that the time specified for the receipt of applications for space, previously fixed for October 30th, will now be extended to November 15th, in order to enable inventors and designers to take advantage fully of this privilege.

JOHN WHITFIELD HARLAND, Secretary.

La Belle Sauvage,
Ludgate Hill, E C October, 1890.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [2 R

Buyers of Lathes and other Tools send 3d. for list of Second-hand Tools.—BRITANNIA WORKS, Colchester; or inspect largest stock in London, 100, Houndsditch. [3 R

Glass Silverer and Beveller, Lead Glazing, &c.—EDWIN HAMMOND, Junction Road, Romford, Essex. Please state requirements. [5 R

Joiners' Tool List free. — BOOTH BROTHERS, Dublin. [6 R

Fretwork, Carving, Brass, Leather, and Poker Work.—Speciality in ornamented ivorine for painting. Illustrated Catalogues of tools, 800 Illustrations, 6d.—HARGER BROS., Settle, Yorks. [7 R

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [3 S

Twist Drills, best quality, slightly soiled, 1/16 in., 3d.; ⅛ in., 4½d.; 7/16 in., 6d.; ¼ in., 10½d.; 5/16 in., 1s.; ⅜ in. 1s. 4d., post free.—BRITANNIA CO., Colchester.

Circular Saws, slightly soiled, none the worse for wear, 4 in., 1s. 2d.; 6 in., 2s. 4d.; 8 in., 3s. 2d.; post free. —BRITANNIA CO., Colchester.

The Best Book on Lathe Work, explicit instructions for learners, 3s., post free. Soiled copies, 2s.—BRITANNIA CO., Colchester. [2 S

Electric Bell, Battery, Wire Push, new, warranted, value 12s. 6d. Exchange for anything same value.—HALL, 73, Sewardstone Road, London, E. [1 S

Picture Moulds, 9 ft., 2½ in., gilt, 9d.; others equally cheap. Special Trade Terms.—DENTS, Importers, Tamworth. [8 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [1 S

PURITY OF BLOOD ENSURES A GOOD COMPLEXION.

A GOOD COMPLEXION is an attraction every woman wishes to enjoy for herself.

This boon may be readily attained by all, save, perhaps, some f those who are the victims of hereditary Blood or Skin Disease.

To ensure a good complexion Nature's own processes must be ollowed.

Nature endeavours to throw impurities out of the blood, and to ject them from the kidneys and pores of the skin.

But, being heavily handicapped by the conditions of modern ife, Nature cannot always succeed in doing this, and even when he can, the process is apt to be attended with breakings-out, ashes, and eruptions.

But Art working with Nature may, in the form of "Frazer's Sulphur Tablets," effect that which the former cannot do alone.

That is to say, the poisonous and irritant properties of the outhrow may be masked or covered by a purifying and curative power stronger than the evil forces at work.

Further assistance is also given by "Frazer's Sulphur Tablets" possessing a similar expulsive power to that possessed by Nature herself.

Thus impure elements in the blood are first rendered harmless, and then, lest they decompose and fester again, are ejected out of the body.

"Frazer's Sulphur Tablets" follow Nature also in their preparation.

The Garden Rhubarb is one of the best natural Blood Purifiers, because it contains a proportion of Tartaric Acid and Potash.

But in taking Rhubarb as a Blood Purifier it is necessary to eat a large quantity to gain a necessary proportion of Potash and Tartaric Acid.

"Frazer's Sulphur Tablets" are natural in that they contain Bi-Tartrate of Potash, which, as the name indicates, is a compound of Potash and Tartaric Acid, the Bi-Tartrate being combined with purified sulphur. Sulphur is the oldest and most esteemed of Blood Purifiers, and a constituent, in minute quantities, in healthy blood itself.

Hence it is clear that "Frazer's Sulphur Tablets" are produced and act on the lines of Nature herself, as such are bound to be as purifying and curative as they are found to be in practice.

Furthermore, "Frazer's Sulphur Tablets" cause no shock, no hurt, and no interference with other functions; but rather benefit and tone by gentle action on the blood-vessels, almost every organ of the body. They are positively safe, both for women and children.

For the ailments of children "Frazer's Sulphur Tablets" are especially noteworthy, for they are pleasant alike to the eye and taste, and correct costiveness, allay feverishness, disperse inflammatory and eruptive matters, and purify the blood. For Eczema, Erysipelas, Nettle-Rash, Sores, Ulcers, and Eruptions, and for Rheumatism and Constipation, they will also be found of great service.

DO I NEED THEM?

If you have Rheumatism, Yes! They will kill the decomposed and poisonous excess of uric acid in the blood, causing the disease.

If you have Constipation, Yes! They are a gentle, safe, and simple laxative, as suitable for children (in smaller doses) as for adults.

If you have Hæmorrhoids, Yes! They relieve the congestion of venous blood at the affected parts, and afford relief.

If you have Ulcers, Scrofula, Scurvy, or other Impurities of the Blood, Yes! They neutralise the blood poisons causing the diseases, and expel them out of the system.

If you have Skin Disease or Eruption, Yes! They have a specific curative effect on all such, as they open the pores from internally, and free them from obstruction and disease taint. They likewise "scotch" where they do not kill the disease principle from the blood which causes Eczema and other diseases.

TEST THEM FREE OF CHARGE.

Wishing to have "Frazer's Sulphur Tablets" judged on their merits, we will send samples gratis and post free, on brief written application being made for same. *Name* "WORK."

"FRAZER'S SULPHUR TABLETS" are put up in Packets, price 1s. 1½d. (post free, 1s. 3d.), and are for sale by Chemists and Medicine Vendors. Every Tablet stamped "Frazer's Sulphur Tablet." Beware of fraudulent imitations.

Sole Proprietors—FRAZER & Co., 11, Ludgate Square, London, E.C.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of ***Muscular*** and ***Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,*** etc. Also most efficacious in ***Bronchitis*** and ***Throat*** and ***Chest Affections.***

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes: "Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

From all Chemists, 1s. 1½d. *and* 2s. 9d. *per Bottle, or* 3*d. extra for postage, from*

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A Work on the "Home Use of Pumiline" sent free on application.

Cassell's Classified Catalogue

Will be sent on request POST FREE TO ANY ADDRESS.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

The FIRST PART of a NEW VOLUME of CASSELL'S

New Popular Educator,

With New Coloured Plates, New Maps, New Text, New Type, and New Illustrations, will be ready *Oct. 27,* price *6d.*

"A school, an academy, and a university."—*School Board Chronicle.*

Vols. 1 to 4 now ready, *5s.* each.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design. No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

SALT REGAL.

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores; or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

SEND 3d. IN STAMPS FOR LIST OF

SECOND-HAND ENGINES

(Gas or Steam),

AMATEUR TOOLS, &c.

Cash or Easy Terms.

FULL CATALOGUE, 6d.

BRITANNIA CO., 100, Houndsditch, London.

All letters—BRITANNIA WORKS, COLCHESTER.

AMATEUR PHOTOGRAPHY.—J. H. SKINNER & CO., *W Department, East Dereham, Norfolk.*

J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description.

CHEAP SETS FOR BEGINNERS.

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6

Including Polished Mahogany Camera, with Folding Tailboard, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at 20 per cent. to 50 per cent. discount to clear. Send post card for Sale List.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for enriching Gravies, preparing Soups, Entrées, &c.

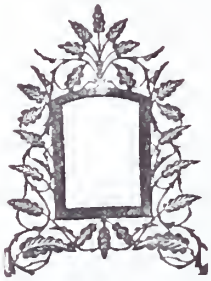
Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.



The enormous sale and general satisfaction which our Goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

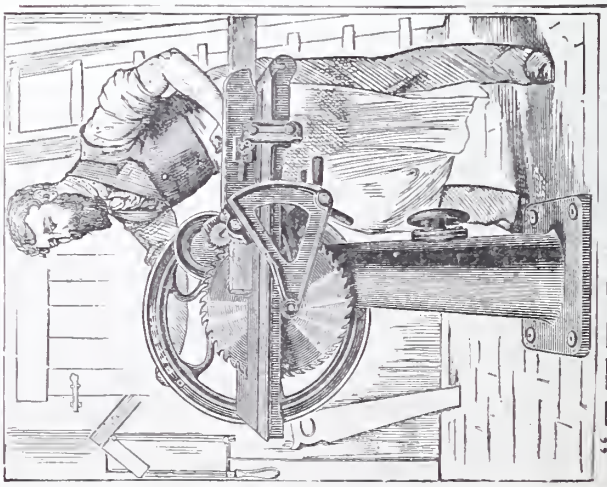
HARGER BROS., Settle, Yorks.

NEW AND CHEAP EDITION.

CASSELL'S CONCISE CYCLOPÆDIA.

Edited by WILLIAM HEATON, assisted by C. H. Bothamley, F.C.S., Assistant Lecturer on Chemistry at the Yorkshire College, Leeds, W. Eagle Clarke, F.L.S., joint author of "A Handbook of the Vertebrate Fauna of Yorkshire;" Alfred Denny, Assistant Lecturer on Biology at the Yorkshire College, Leeds; Alfred J. Read, B.A., Barrister-at-Law, formerly Science Lecturer at the Mechanics' Institution and Literary Society, Leeds. With numerous Illustrations. Royal, 8vo, price 7s. 6d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*



"THE LEYTON"

New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 84.] SATURDAY, OCTOBER 25, 1890. [PRICE ONE PENNY.

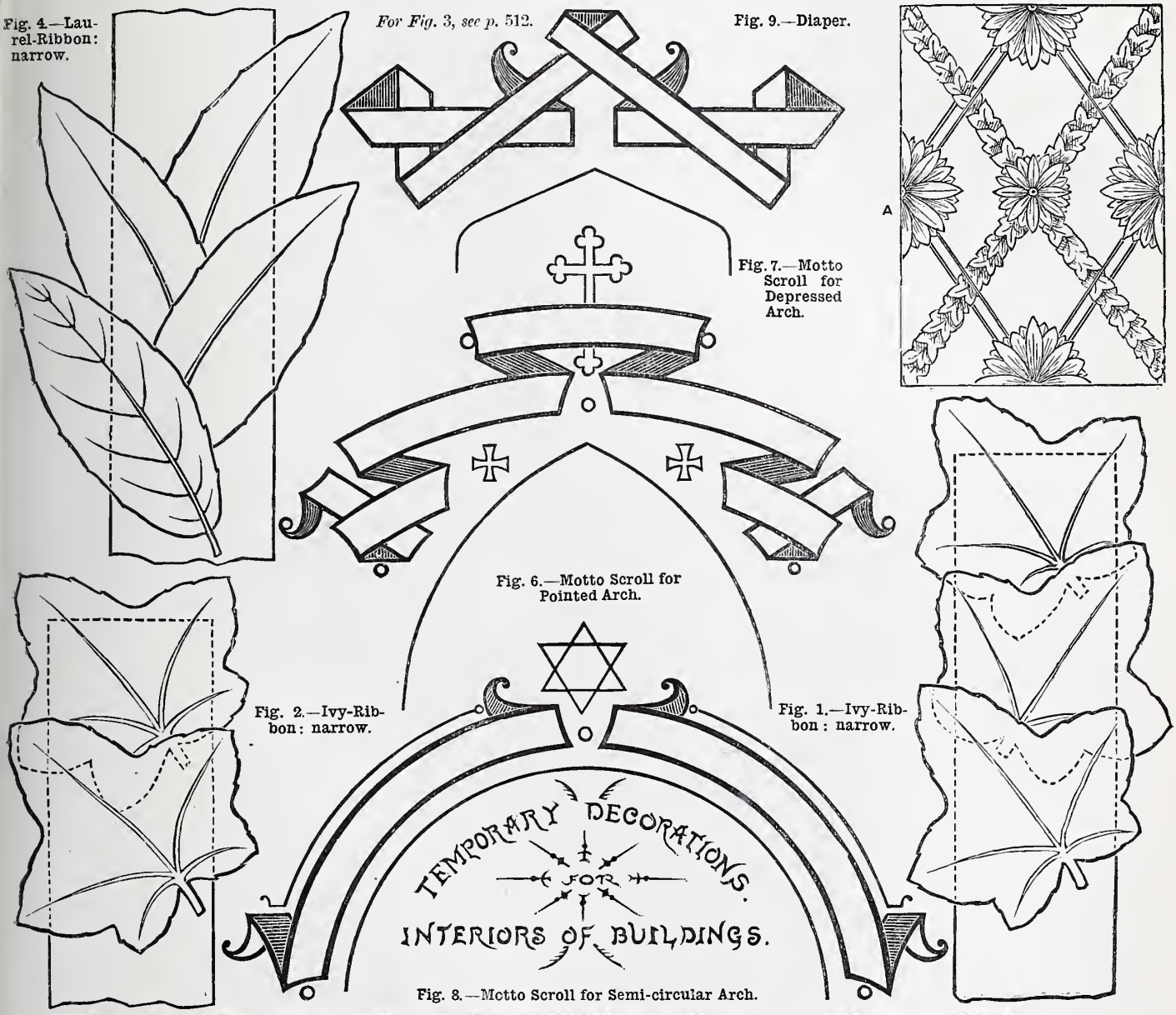


Fig. 4.—Laurel-Ribbon: narrow.

For Fig. 3, see p. 512.

Fig. 9.—Diaper.

A

Fig. 7.—Motto Scroll for Depressed Arch.

Fig. 6.—Motto Scroll for Pointed Arch.

Fig. 2.—Ivy-Ribbon: narrow.

Fig. 1.—Ivy-Ribbon: narrow.

Fig. 8.—Motto Scroll for Semi-circular Arch.

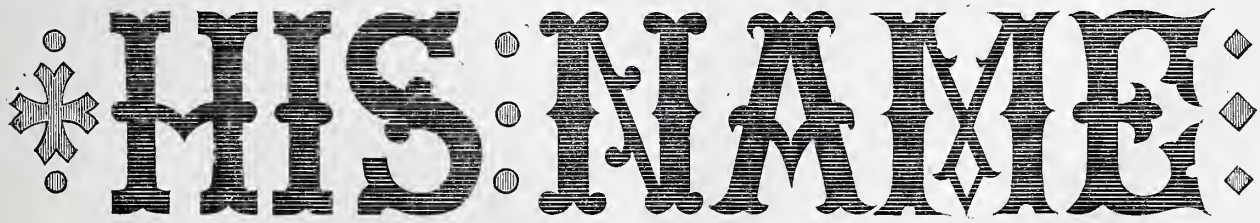


Fig. 5.—Letters for Texts or Mottoes.

TEMPORARY DECORATIONS FOR THE INTERIORS OF BUILDINGS.

BY ARTHUR YORKE.

ORGANISING THE WORK AND WORKERS—PREPARING MATERIALS—IVY-RIBBONS—FESTOONS—TEXTS AND MOTTOES—CHURCH DECORATION FOR CHRISTMAS—THE CHANCEL—WINDOW DRESSING—DIAPERING WALLS—DODGES FOR FIXING DECORATIONS WITHOUT DRIVING NAILS—DECORATING A ROOF—DIAPERING WINDOWS—NATURAL DECORATION—DECORATING CHURCHES OR CHAPELS FOR HARVEST FESTIVALS—SEASONABLE MATERIALS—THE "SEVEN YEARS OF PLENTY."

INTERIOR decorations of a temporary kind, whether for a religious or social occasion, are generally carried out by the united labours of a number of unpaid workers; and before entering upon practical details it will be well to say a word as to the way in which to organise such a band of volunteers. Its members will, as a rule, work with zeal, and among them will be more or less artistic talent; but if inexperienced, they may set about their task without sufficient system. It is too much the custom in decorating for one person to undertake one part and another a second part, independently of each other, and the effect of their work, however well it may be done, will not be harmonious.

The better way is first of all to choose the person best qualified for the office, and let him undertake the general direction. It will be his duty to arrange a scheme of decoration for the whole, to allot to the different members of his party such work as they are best qualified to do, and to see that his arrangements are properly carried out. By doing this, much waste of time and labour, and often much unpleasant feeling, may be avoided.

When the chief decorator begins to organise his staff of workers, he will find, if the building is a large one, that it will not be wise to dispense altogether with paid assistance. His staple material will always be evergreens, though in a smaller proportion in summer than in winter, and these will be contributed by a number of givers. It is found most satisfactory to employ a gardener to cut and collect these, for he will know how to cut the trees so as to benefit rather than to injure them. Evergreens do not quickly wither, and it is better to get the supply together before beginning work, as the amount of material must usually influence the plan to be adopted.

Supposing, then, that the building is large, and that there will be an amount of ladder as well as of hammer-work. On a ladder an amateur workman is rarely at home, so a couple of handy young carpenters should be engaged. Their trade knowledge will make them useful in more ways than one. Beside their neater methods of putting up the work, they will, if they are the right sort of men, be able almost at a glance to tell the approximate measurement of lengths and spaces, and be invaluable in setting out diapers and similar matters. Failing carpenters, house-painters are found the most useful men for the work.

A large proportion of "lady-power" will always be available, and this will be advantageously employed in preparing festoons, ivy-ribbons, and such-like stock forms of decoration; and it will be well that all should know distinctly what they have to do, and that "surprises" in the way of decorations will not be desired.

Something must be said about the stock forms just mentioned, and first of the *ivy-ribbon*, as it is a matter of first utility. Figs. 1 and 2 show narrow ribbons, the leaves being stitched on paper 2 in. wide. Either the more graceful wild tree ivy can be used or the garden ivy; the former looks best when the ribbon is to be placed near to the eye, but it is not always to be procured in quantity, like the common garden ivy, and with the larger leaves of the latter the ribbon is more quickly made. Fig. 1 is the more ordinary arrangement; Fig. 2 may be taken as a variety; and another variety is seen in Fig. 3, which makes a broader ribbon. Yet another form may be suggested as looking best for bordering the fronts of window-sills, in which the bases of the leaves are all to one (the lower) side, and the points all set to go straight upwards on the higher side. The leaves are sewn upon strips of brown paper, which can be pasted or sewn together to bring them to any length required; but in ordinary the ribbons are made in lengths of about a yard, which are fixed up with black tacks, and as the leaves overlap at the joinings, they form an (apparently) unbroken line. Laurel leaves are also made into ribbons; they are not so pretty as ivy, but suffice for some positions. If placed in single file, they are too monotonous, and are better arranged something in the manner shown in Fig. 4, or when made into a broader ribbon with a central leaf, like the ivy (Fig. 3). Laurel-ribbon is quickly made, and looks very well at some height above the eye. These ribbons may always be made in quantity: their uses are, as we shall see, many; they can be cut anywhere beneath the overlapping leaves. In common with other stock evergreen decorations, they should be kept in a cellar or other cool place till wanted. The illustrations of these ribbons are drawn to about half the actual size.

To make *festoons*, the approved way is to drive a hook into a wall at a convenient height, to make a loop in the end of your cord (which should be slightly thicker than ordinary clothes-line), and to hitch the loop to the hook, laying the cord out down the room. The binder employs a child or two to break off little sprigs of various evergreens for him, of which he makes up a little bunch, or besom, in his hand, and binds the ends of the stalks to the cord with binding wire. The leafy ends of the second besom hide the tying on of the first, and so on till the length is finished. For festoons near to the eye, evergreens with smaller leaves are to be preferred to laurels; yew is graceful and good for the purpose; but laurels look well when placed high up. If festoons can conveniently be made to the required length, it is well to make them so, as to make a good joining is troublesome. Wire is the best binding, but in default of it, twine must serve.

Texts or *Mottoes*—as the building to be decorated may happen to be sacred or secular—are tolerably sure to be wanted. In these the practice of forming the characters in leaves, rice, etc., is not to be commended; such characters are apt to be ill-formed as letters, and not ornamental as decorative matters. Nor are grounds for such characters in red flannel or calico altogether in good taste, as such things are apt to suggest mean associations. Paper will be found not only the most easily managed material for both letters and ground, but also the best in appearance. White cartridge is most suited for the ground, and for the characters nothing tells more effectively than that sold as "purple royal," which is familiar to most people in the wrappers of needles. For distinctness at a distance, neither gold nor red are to be compared to it. It is well to paste the sheets of cartridge together into such lengths as are convenient for the ladder-men to fix up; it will be found that lengths of more than 6 ft. are not easily managed. The letters are pasted or gummed to the ground before putting up. Letters tacked up separately are exposed to a certain danger, which it is well to avoid. The writer remembers a room decorated for amateur theatricals, where the dropping down of a final "e" gave the audience a new reading of Shakespeare—"All the World's a Stag!" If the wall is one into which nails may be driven, the lengths of motto are readily tacked up; if not, they have to be fixed on boards and hung. Just below the roof it is almost always possible to put in hooks from which to suspend.

The characters chosen should be so far ornamental as to be pleasing to the eye, but still so far simple as to be read with ease. Letters in which the decorative element is carried to excess, and which are thus rendered unintelligible, violate one of the first laws of beauty, which is fitness, and are offensive. No pleasure is derived from inscriptions such as those surrounding the Houses of Parliament, which convey no more meaning to the ordinary reader than do the hieroglyphics on Cleopatra's Needle. Fig. 5 shows two or three effective but perfectly readable forms of letters.

The letters used should also be large. In decoration designed by ladies this part of the work not unfrequently fails through the characters being too small and finikin, and the same fault is common in those printed and sold. For a room 50 ft. long 6 in. letters are none too high: they should be of a size to be read from every part. No capitals rising much above the general level are to be admitted; as there will always be a border, they make the margin look unequal in width. Nor are gold or red initials to be commended, for at a distance they will not stand out in equal strength with the purple; unless the following plan is adopted—as well as the red or gold letter, cut out another a trifle larger in purple, and stick the former on the latter so as to leave a half-inch border all round. This will not materially interfere with the margin, and will make the letter (or word, if a whole word is so distinguished) as legible as its fellows.

Punctuation, in its ordinary acceptation, is not attempted in mottoes, but space-marks of the nature of those in Fig. 5, in red or gilt paper, should separate all the words. They are valuable as giving colour; and, as there shown, a Maltese cross, quatrefoil, etc., should precede and finish each motto.

To avoid waste of time in shaping letters, it is found best first to draw carefully so much of the alphabet as will be needed on cardboard, and to cut it out. A whole alphabet will never be needed, as some of the letters will serve equally well for others; as, for instance, E, which by omitting the lower limb will serve equally well for F, and so on. A boy or girl can then lay these cardboard letters on the purple royal, and mark round them with a blacklead pencil, and a lady can cut out.

Figs. 6, 7, and 8 are intended to show how the (paper) scrolls for texts and mottoes may be manipulated so as to fill any desired space. Fig. 6 is made to surmount a pointed arch. The shaded portions—the back of the scroll—are supposed to be of coloured paper, the dark lines and the

border of ivy-ribbon; and the crosses and small devices are of paper, over which leaves are sewn in the same way as in ivy-ribbon. Fig. 7 is a scroll suited to a depressed arch. Fig. 8 is made to follow the lines of a semi-circular arch. The thin line above it represents a narrow line of ivy-ribbon, whilst the bordering of the scroll is a broad one.

Turning, as we can now do, to actual decoration, it may be observed that to lay down any cut-and-dried scheme would be of little good, since in practice so much must depend on the capabilities of the room to be decorated. The more useful course will be to indicate in a general way the ornaments that are most appropriate to certain situations, and to tell of the means at our command.

We will first consider church decoration at Christmas-tide. In a church the most important part—that to which all eyes naturally turn—is the chancel; it is therefore the part to be first thought of and most highly ornamented. In the chancel the most important part is the communion table, but as that will have its own proper ornaments, flowers, etc., it need not be considered here. Above it custom seems to have decided that a text is necessary, and this will be bordered with ivy-ribbon.

If the church possesses ecclesiastical banners, good of their kind, or if such are to be procured, they can be used effectively in dressing the east window; not by clustering them in a bunch in the middle, as is sometimes done, but by setting them, singly, each in the centre of a light. In small churches the lights are commonly three, and these may well be occupied by banners bearing the symbols of the three Christian graces, Faith, Hope, and Charity—the last, of course, taking the place of honour. If the lights are four, the symbols of the four Evangelists may well ornament them; or if five, the Agnus Dei may well come in the centre between those symbols.

A very rich effect is to be gained by diapering walls. This ornamentation is perhaps too elaborate to be carried out in all parts of a church, and may therefore well be reserved for the chancel. Diagonal lines of ivy-ribbon are fixed crossing each other at such angles as will result in a series of well-shaped lozenges (see Fig. 9). For these lines a narrow ivy-ribbon will be used, and at each intersection a boss will be added. Fig. 9 has really rather been designed as a diaper for the walls of secular buildings; in it the middle of each lozenge is filled with a larger boss, as at A, and these are connected by lines of red tape, so as to form a sort of double diaper. The ivy-ribbon also does not run, as we are now supposing, continuously from bottom to top. Nevertheless, this figure serves sufficiently well to illustrate what is being said.

During their season, which tallies with that of harvest festivals, dahlia blossoms are admirable as bosses. These, however, are not to be had at Christmas, but chrysanthemum flowers of the larger kinds often may be. Failing real flowers, paper ones must take their place, and these, though less pleasing in sentiment, will pass muster in practice. The way of making them will be explained in due course. The ivy-ribbon is best fixed up with tacks, and a needle-point through each boss will secure it. Wherever ivy-ribbons intersect or form angles, bosses are, it should be remembered, desirable.

Diapering requires a horizontal line of ribbon to finish it at top and bottom, also a perpendicular one at each corner angle; and wherever a break occurs in the walls, as at the sedilia, piscina, etc., a bordering of ribbon will likewise be required. If, however, arches with dripstones occur, or if, as is not unfrequently the case, a dripstone string-course runs round the walls, a festoon laid along the dripstone looks better. A wider ribbon will be necessary for all the borders, etc., than for the lines of the diaper.

The method of setting out a diaper is shown in Fig. 10. Along the horizontal lines which form the top and bottom of the space to be diapered, measure off and mark a series of dots (say with chalk), dividing it into equal spaces; then with a chalked string mark off the diagonal lines (as in Fig. 10), starting from the left-hand corner dot, and going to such a dot at bottom as will give the required slant. The object is to get such lozenges as are pleasing to the eye, not too square nor yet too pointed. In the diagram it will be seen that the above line is drawn to the eighth bottom dot. The same size of lozenge must be kept throughout, so that point may meet point and half meet half at the corners, or the effect will be ruined. Fig. 11 shows a more exact way of setting out the diaper with horizontal lines, which may be preferred by those who have abundance of time.

Mention was made just above of *needle points*. These broken needles, sold by the pound for such purposes, are most useful for fixing up the lighter decorations, as they do not, as do nails, make holes which disfigure the walls. As sold by the ironmonger, it will generally be found, however, that they are unmanageably long (except for fixing bosses). In woodwork it is usual to break off the superfluous length *after driving*, but this does not answer in plaster. It is better therefore to set a boy to shorten a quantity to ½ or ¾ in. with pliers. In many churches—and sometimes in other buildings—the driving of nails into the walls is strongly objected to, and there will always be some places where nails *cannot* be driven. As we go on, various dodges for fixing decorations without nails will be given.

Before absolutely leaving the chancel, we may find occasion for making use of one of these dodges. It frequently happens that the chancel arch is supported on pillars attached to the walls, with which we cannot deal as with ordinary *detached* pillars. Over the dripstone (if there is one) of the chancel arch on the nave side we shall fix a festoon, and over this will probably be a text (see Figs. 6 and 8). On the capital will be a wreath of evergreens, but this cannot be fixed by a wire surrounding it as if it were a detached cap, yet we shall probably have to fix it without using nails. To do this, we must get a wooden hoop of suitable size, cut an opening in it, and bind our wreath of evergreens upon the hoop. The spring of the hoop will hold it firmly, and other places will be found where this use of a cut hoop will come in handy. In the angle formed below the cap by the shaft of the pillar a "rat's tail" of festoon, say a quarter of the height of the shaft, might be made to hang down.

The caps of chancel arches are conspicuous places, and the wreaths that surround them are good for the display of colour. The

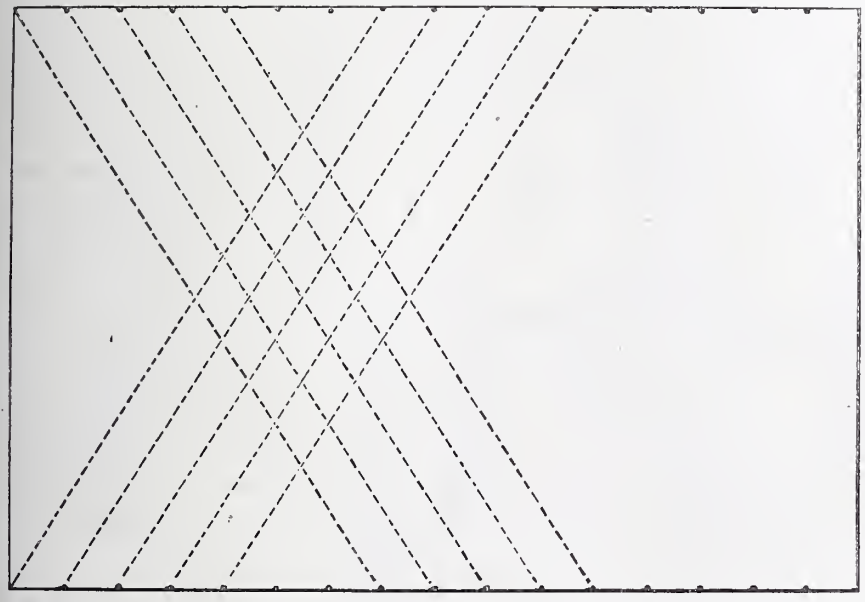


Fig. 10.

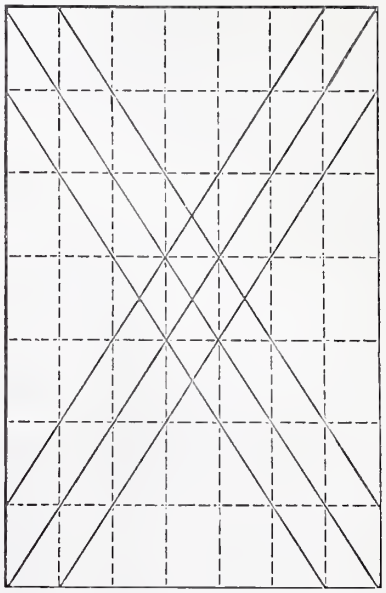


Fig. 11.

Figs. 10 and 11.—Methods of Setting Out Diapers.

berried holly, the red Christmas cherry, the iris pod showing its rows of bright scarlet seeds, will tell well among the evergreens crowning these caps.

The supply of fresh flowers will rarely be large at Christmas: it is therefore well to dry *immortelles* (everlasting flowers) of different kinds and colours for use in decoration. Fresh natural flowers need tucking into their places at the last moment, and renewing daily; faded flowers are the very reverse of decorative.

At this place may be mentioned a dodge useful when a carved stone pulpit, a font, or any similar matter, has to be decorated. Into anything of this kind nailing would be out of the question, but by wedging pieces of cork into the angles of the stonework or into the hollows of the carving, and driving tacks into them, the decorations may be kept in their places. Or another way (on carving) is by rolling up slips of paper and inserting the rolls into the hollows—their tendency to unrol themselves keeps them tight. The decorations are fastened to these by pins or needle points. If the rolls are so placed as to show, they should be of the same colour as the stone, etc.

Nor, in dealing with detached pillars, is there any need for nails. A wire tightened above the cap secures the wreath placed there. The shaft beneath will probably be ornamented with a festoon wound spirally round it. The top end of this can sometimes be suspended from the wire already fixed; when it cannot, a second wire, which will be practically invisible, can be tightened for that purpose round the bottom of the cap. Another wire surrounding the base may hold the lower end, and, unless the shaft be a tall one, any further support will scarcely be needed; but if it should be, it is easy to add a middle band of wire. In most churches there is, however, woodwork about the bases of the columns into which a small nail may be driven to secure the bottom of the festoon, and behind which its ends will be hidden.

In churches where the nave is very high or very short the roof will scarcely be considered as a subject for decoration; where it is otherwise, much may be done with festoons suspended from the timbers in the centre, and falling to the corbels, where will be a bunch of evergreens, below which the festoon will end, as shown in Fig. 12, in a "rat's tail." A succession of such festoons, as seen from either end of the church, has a bowery and pleasing effect. Fig. 12 may serve to give some idea of the manner of carrying out this kind of decoration, but, as will be seen from the arrangement of the timbers, this drawing is rather intended to illustrate the decoration of a schoolroom roof, which will be spoken of farther on.

In addition to its use in bordering texts on the walls of the nave or aisles, ivy-ribbon may be found

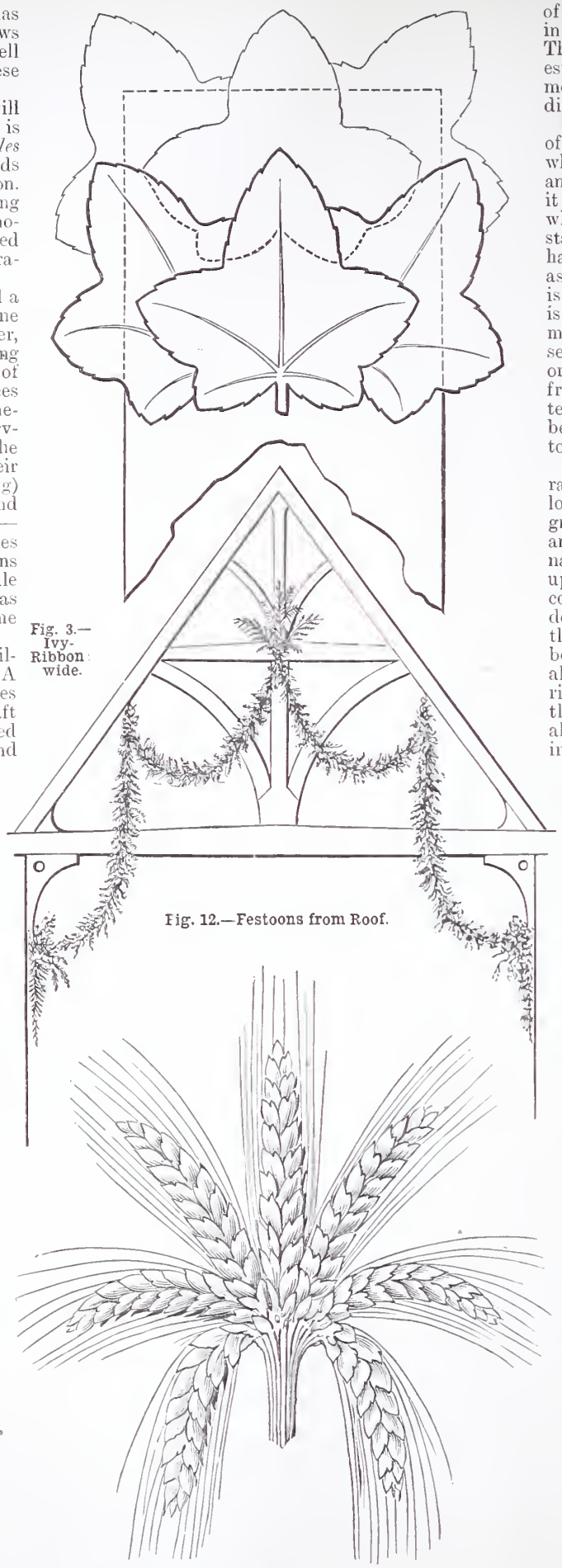


Fig. 3.—Ivy-Ribbon wide.

Fig. 12.—Festoons from Roof.

Fig. 13.—Emblematic Device: Seven Years of Plenty.

of value in the body of the church in forming symbols or monograms. They are readily made from it, and especially if they are composed of moderately straight lines and tacked direct on the walls.

Mention may also be made here of a method of diapering windows which will be novel to many readers, and may be used in churches, though it is really better adapted to chapels where the panes are larger and stained glass absent; it is also, perhaps, best suited for harvest festivals, as the most effective leaf to employ is the symbolic vine leaf. The plan is to gum or paste a leaf in the middle of each pane, the leaves being selected as to size, and arranged orderly. It should be noted that if freshly gathered, the leaves have a tendency to curl; it is therefore found better to press them flat and partly to dry them.

Among minor materials for decoration, moss should not be overlooked. Its chief use is to form a flat green ground, good for setting off any brightly coloured ornaments or natural objects which may be placed upon it. Sloping window-sills thus covered are good for the display of devices in flowers, berries, etc. If the sill slopes much, the moss may be kept from slipping by a lath along its front edge, covered with ivy-ribbon; if it only slopes slightly, the ivy-ribbon on stout paper tacked along will alone suffice. When speaking of the making of ivy-ribbon, mention was made of the most proper variety for this purpose.

Of what is called "Natural Decoration" nothing has yet been said, nor indeed is there much which can be said on that subject. In this, all must depend on the surface to be covered, the fitness of the material, and, most of all, on the individual taste of the decorator. The small and beautiful tree ivy is the thing to be used. The object is so to arrange it as to suggest the idea of its having grown where placed. It needs judicious joinings, and can then be made to twine round objects and spread itself over surfaces wherever its presence will be most pleasing to the eye. No other decoration equals it in beauty when well done. It may well be carried over the panels of a carved stone pulpit, and of course the cork or paper dodges above mentioned will then have to be called into requisition. Natural decoration is fixed in place with needle points and an occasional tack.

For the *Harvest Festival* many Nonconformist chapels as well as churches are decorated, and hints for this occasion will therefore be of wider use. Of the suggestions already made, the greater number will be as useful at this time as at Christmas. To be sure, at harvest we shall have to depend less on evergreens; in fact, we have then an overflowing abundance of decorative materials, the difficulty lying rather in selecting than procuring. We have the different kinds of grain, all beautiful and

appropriate: maize, less common, but highly decorative when it is to be had; the showy flowers of later summer, such as the dahlia and sunflower; and fruits, which have been so much over-used on these occasions that a word of caution seems to be needed with regard to them. Of grapes there is little danger of getting too many, but other fruits will be better used sparingly. Still less is it consistent with good taste to drag in such edibles as turnips and carrots, and the furniture generally of a costermonger's barrow, as we too often see done. Some of the smaller and more richly coloured gourds are really decorative, and may well be used, but not so the huge and colourless vegetable marrows which we sometimes see brought in, and which suggest only mean ideas. The feathery branches of the asparagus, with their tiny scarlet berries, are not to be despised; nor are the bunches of the hop, both of which are most graceful in decoration: hops, however, like flowers, need to be added at the eleventh hour, as their leaves quickly fade. Cut ferns, beautiful as they are, have for the same reason to be avoided, or stuck in at the last moment. Among other useful materials are the feather-like tufts of the gigantic Pampas-grass, and the scarcely less elegant heads of our common native reeds; the heads of the smaller grasses—graceful and ornamental as they are—should be reserved for home decorations; in large buildings they are apt to look small and weak.

In these decorations the propriety of giving to wheat the first and most important place is obvious. Wheat is highly symbolic, and stands as the type of man's food. Perhaps the most correct decking of the communion table is with a miniature sheaf in its centre—the sheaf being, however, big enough to show what it is throughout the whole church—and on each side of it a basket or vase-shaped dish of fruit, in which the grape, also highly symbolic, should be conspicuous. In Nonconformist chapels the wheat and fruit might in like manner be displayed on the small communion or "ordinances" table commonly set in front of the pulpit or rostrum.

In those decorations which come nearest to the eye, the corn, fruit, flowers, and suchlike seasonable matters, will doubtless chiefly be used; and at the same time more natural and less conventional ornament is properly looked for than at Christmas. Yet ivy-ribbons and festoons will still be wanted in considerable quantities if a really good effect is to be produced: to the former, however, dahlia bosses, and perhaps bunches of corn, will now be freely added, whilst in the festoons an occasional rosy-cheeked apple will not look amiss.

At this time there is also scope for displaying taste in flat devices in grain placed on moss for window-sills, panels, etc. The "Seven Years of Plenty" drawn at Fig. 13 is an example of such devices.

MODE OF FITTING GRINDSTONE AND CIRCULAR SAW TO LATHE.

BY GRADUATE.

The sketches and description here following may be useful to readers of Work who have a lathe, and who wish to fit thereto the two most important requisites for wood-workers—a grindstone and a circular saw. I have never seen any reference to the three plans described, and they may be useful to others, as they have been to me. The idea of the apparatus is a stout bar put in the lathe centres, a grindstone being mounted on the left hand and a circular saw on the right hand of it, a small and well-balanced carrier being placed on the extreme left for driving the whole appliance: the object in putting the stone and saw on the same shaft is to save delay in changing from one to the other.

The bar selected should be a good stout one, so that it will not "wobble" in the middle when running at a high speed, and must be truly centred. Each end should then be turned down to ½ or ⅝ in. diameter, the right end for about 2 in., and the left for about 3½ in.: these ends are then screwed, and nuts fitted to run easily upon them. The plan adopted for accurately centring the saw is shown in Fig. 2: the first nut is screwed well home, and then cut down in the lathe as shown, leaving on its right-hand side an edge about ¼ in. broad: the first washer and the saw then have their holes enlarged till they will just slip on to this edge, the saw particularly being a sound fit. The second washer, slightly hollowed in the centre (as shown), follows, and then the second nut: when the latter is screwed up the saw is bound to run true. If two or three saws are used—as they should be for different classes of work—each one should be mounted on a soft-wood chuck in the lathe, and have its centre hole enlarged *exactly* to the size of the nut where it is turned down, and then each one will be absolutely and immediately centred when put in position on the shaft.

All this work can be done by a jobbing mechanic for a few shillings: the grindstone can be fixed by the amateur himself, as follows:—Turn a peg of wood a trifle less than the diameter of the screwed end of the shaft; fix this by a screw to a board, being careful that it is truly vertical, as shown in Fig. 3; put an ordinary elastic rubber band on the board, concentrically with the peg; lay the stone down as shown, and adjust it till its edge is as nearly as possible an even distance all round from the peg: finally, put some weights on the stone, and fill up the hole with melted solder. When this is cold, unscrew the board, knock the peg out, and twist the screwed end of the shaft through the hole, as shown in Fig. 1, with a nut on each side to hold the stone fast; the screw will cut for itself a shallow thread in the solder, and the stone can at any time be removed, with the certainty that it can be properly centred when it is put back. If desired, more than one stone, or buffing wheel, can be thus prepared for use on the same shaft, one after the other. For running between the centres of an ordinary lathe, the stone should not be more than 4 or 5 in. in diameter, otherwise its peripheral speed will be too fast.

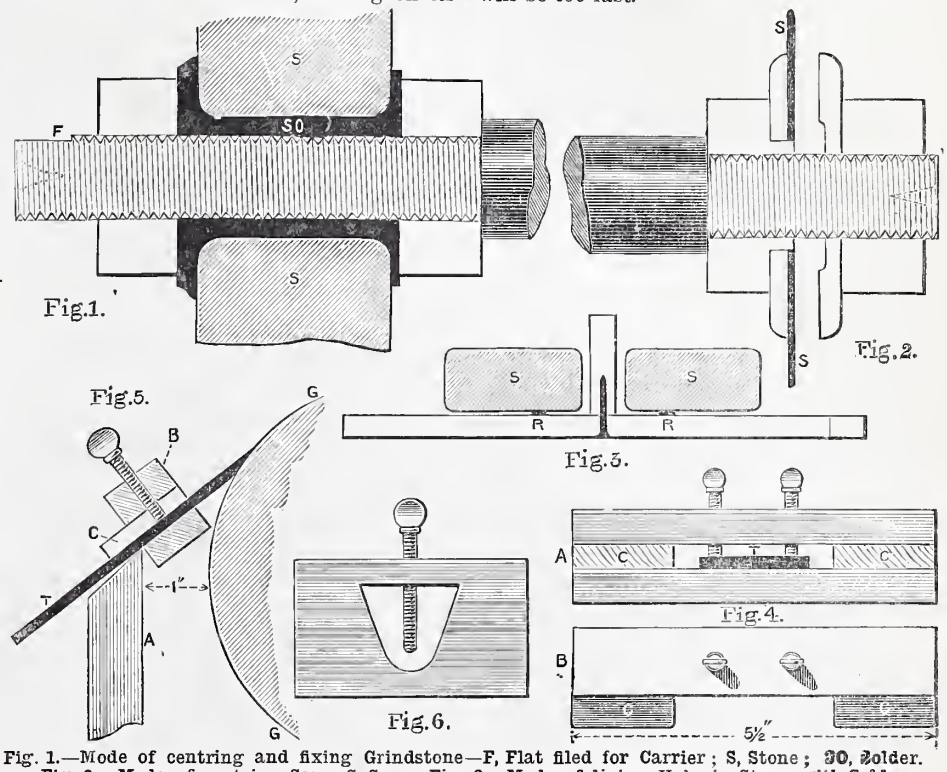


Fig. 1.—Mode of centring and fixing Grindstone—F, Flat filed for Carrier; S, Stone; SO, Solder. Fig. 2.—Mode of centring Saw—S, Saw. Fig. 3.—Mode of lining Hole in Stone with Solder—R, Indiarubber Ring; S, Stone. Fig. 4.—Tool-holder in Elevation (A) and Plan (B)—C, Slips between the two Strips of Wood that form Top and Bottom of Holder. Fig. 5.—Side View of Tool-holder (B), holding Tool (T), and resting on Slip of Hardwood (A) in front of Grindstone (G). Fig. 6.—Elevation of Tool-holder for Gouges.

Of course, a proper box must be fitted round the grindstone, and a can above, with a small tap, from which water drips on the stone. The front edge of the box should be about an inch from the stone, and a sharp edge of hardwood, about 8 or 9 in. long (A, Fig. 5), placed horizontally in front of it: upon this rides the tool-holder (B, Figs. 4 and 5), with which tools can be easily and expeditiously ground to the proper angle. The way of using this can be readily seen from Figs. 4, 5, and 6 (the latter shows the holder for gouges), some dimensions of which are shown in the drawings. The extent to which the tool should project beyond the holder can be found by actual trial, and when found, should be made a note of. I have never seen this appliance described, but for many years I have used it, and have found it invaluable in that important department of tool sharpening which amateurs so often neglect. I trust that these suggestions may be of use to some of the numerous readers of Work.

THE AUSTIN-LECLANCHÉ BATTERY.

BY H. E. AUSTIN.

About a year ago I fitted up a good 3 in. bell and battery from the information found in the articles in Work entitled "Burglar Alarms," but I found that the battery was not powerful enough to bring out the full tone of the bell; so I determined to fit up if possible a cell that should give a strong current, have a low internal resistance, and at the same time be more compact, portable, and less liable to damage than the ordinary Leclanché cell. My first thought was to do away with the usual porous earthenware jar, and substitute in its place something thinner and more unbreakable; and in so doing to bring the carbon plate nearer the zinc, thus decreasing the internal resistance of the cell.

I proposed also to employ two carbon plates instead of a single one as in the original, and to have one on each side of the zinc, which is in the form of a plate instead of a rod; thus there is clearly double the negative surface exposed, for in the old form only one side of the plate is practically brought into action; therefore, in the former case, there is a much larger current given out.

Taking all these considerations in mind, I proceeded to fit up a cell in the following manner:—

A stoneware jar is procured of the required size—about 5 in. × 3 in. will do for a small size; this will take about the same sized carbon as the small Leclanché, viz., about 6 in. × 1½ in., including the lead cap of the carbon.

The carbon plates can be bought with a lead cap and terminal ready for use, of the above-mentioned size, for about 8d. each; and the zinc plate for about 5d., ready amalgamated. But it is not advisable to rely upon the amalgamation of the zinc when purchased, so it is better to do it over again, for in keeping they get scratched and cut. We now come to the substitute for the porous jar. I have used for the present about ten or fifteen thicknesses of tissue paper. My manner of procedure is this:—The zinc plate is laid upon a sheet of white tissue paper (which has previously been folded into four), and wrapped round with this about three times and the remaining end fastened down with some waterproof cement or glue, (cobbler's wax does very well); but both of these must be used very sparingly, as they prevent the exciting liquid from gaining free access to the zinc.

The prepared plate with a wire soldered to the top is set upright in the middle of the jar, and a capped carbon plate on either side of it, each about half an inch from the zinc, and closely packed with a mixture of equal parts of peroxide of manganese and gas carbon (each broken to the size of peas and washed to free it from dust), to within half an inch of the top of the jar.

This charge will now want a seal of pitch run over the top of the carbon, and manganese to keep the contents in place; when this is cool, two holes will have to be made in the top of the seal to admit the exciting liquid, and also to allow the gases formed in the working of the cell to freely escape. The lead heads of the carbons and the zinc plate that projects through the seal should be coated with tar, enamel, or Chatterton's compound to prevent them being attacked and corroded away by the fumes. The solution used in this cell is the ordinary sal-ammoniac dissolved in warm water (rain water is the best) until it is saturated, and afterwards diluted with about one-fourth of its bulk of plain water. This should be poured into the cell through the holes that have been made in the seal until it is full, after which it is fit for use.

This cell gives a strong current for a much longer time than the ordinary Leclanché (I myself having rang a bell for one hour without any perceptible decrease in the tone); it is more portable and compact, and has a higher E.M.F. and a lower internal resistance than the above-mentioned cell. Added to these facts are the advantages that it is easily made up by anyone, and also that it is cheaper; the price of the cell described in this paper when completed is about 2s. 8d., an ordinary Leclanché of the same size costing 3s. 6d., the latter not giving such a powerful current as the former.

When recharging this form it is better to fill it with water two or three times to cleanse it of the old solution. The management, situation, and working are precisely similar to the description given in Work for the maintenance of burglar alarms.

I conclude by testifying that it works most satisfactorily, and hope that readers of Work may benefit by fitting up an Austin-Leclanché battery.

MORE HINTS ON ORDINARY ETCHING.

BY R. G. NAISH.

In a former paper I dwelt on a method of etching on steel or iron by a simple process, and I doubt not, ere these few lines are read, many have practised the craft to an advantage. I supplement a few more remarks, which doubtless will be found of service.

Probably a little difficulty was entertained at the idea of etching on anything presenting a convex surface. A glance at Fig. 1 will show how this may be achieved. After putting on your ground and marking the letters you wish to etch, put a border round them with some plastic acid-resisting substance. Tallow will answer the purpose very well. Let the border be of sufficient depth to hold enough acid to etch properly without running over the sides. Sometimes when the acid is poured on it will permeate through a little crevice which has escaped notice. When this occurs, plaster on some more tallow to stop the leakage. Here one might see the necessity of covering your article with "ground" freely, not confining it merely to the place where the etching is done, but spreading it where it may act as a protection in the event of any unpremeditated occurrence.

Fig. 1.—Mode of Etching on Convex Surface: Acid backed up with Tallow.

In very small round articles—some tools, for instance, where calibre is very diminutive—this method of "backing up" the acid with tallow is unnecessary. They should be coated with ground all round, and the acid applied when the characters are in an inverted position—facing the floor. The attraction of the metal will be found quite sufficient to retain enough acid to etch with. This mode requires a little attention during the process of biting in, when your characters are rather large in proportion to the circumference of the article, because you will only be able to etch part of them properly at one time, and the article have to be tilted occasionally for the other part to receive the benefit of the acid. This will entail a little patience on the part of the operative, though perhaps not altogether an uninteresting procedure. If considered a difficulty worthy of being avoided, your article may be fixed in the vice or placed

Fig. 2.—Etching in Relief: Letters marked ready for Biting.

on two supports, and just looked after occasionally.

Another method of treating your characters is leaving them in relief, with the surrounding parts corroded away to a limited distance, which should embody some kind of ornamentation or other. The design in this instance, when etched, stands out in bold relief, and presents a striking contrast to the corroded surrounding metal. This style may be preferable to some, especially those handy with the brush, the manipulation of which constitutes the principal agent.

The process will be readily understood by those who have attempted the other method; but to make all clear, I will briefly relate the main points. The letters, or whatever you wish to etch, must be painted on with a fine brush. Put the Japan black on as thick as you can, for the thicker it is the less chance of any detriment arising. Then enclose in the border, and when thoroughly dry, bite away the exposed metal with the nitric acid. For any kind of work where a little art is incorporated with the subject, I would advise only a weak bite with the acid. I mention this because one might applicate this method in various ways. Scrolls of other ornate work look very effective when treated in this manner, and plenty of material, such as cutlery, scissors, etc., may be always found to try your ability on. To the workmen who wish to etch of moderate depth, it may be worth noting that etching in this manner will necessitate ample use of acid, as the metal to corrode is considerably more than in the former method.

Fig. 2 represents some letters on part of a chisel; the dark part shows the Japan black laid on as it should be prior to putting on the acid. When the etching is completed and the ground washed off, a reversion of what you see shown will be the result, the light parts being dark, and the dark parts bright.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

Graining Maple and Pitch-pine.

In the preceding paper upon graining furniture, the imitations of maple and pitch-pine woods were particularly suggested as suitable for that purpose; and since both of these woods are also very popular for graining on woodwork of dwelling-houses, we shall now consider the best methods of imitating them.

The botanical aspect of this subject, the genus, tribe, and order to which the various woods imitated belong, is a matter I have intentionally avoided dwelling upon in these

papers, not from any disparaging notion of the usefulness of this beautiful branch of science, but with a view to keeping within the simple limits of the practical imitative work, and of best occupying my space to the learner's advantage. The maple tree, however, is far from being so familiar to most of us as the oak, hence it will be as well to indicate a few particulars of this wood.

The Varieties of Maple number considerably over fifty, and these are distributed throughout the temperate regions of both the eastern and western hemispheres. The only species which is a native of our own country is the *common maple;* this grows only as a small tree, and to some considerable extent as a hedge-shrub. The *sycamore maple*, or *great maple*, is, however, naturalised in Britain, and grows to much larger and more massive dimensions. This latter species, commonly termed the sycamore, is extensively used by turners and musical-instrument makers, and is probably familiar to many readers in the form of a violin back, or such like. Notwithstanding the foliage and flower of all varieties of maple are of a highly ornamental nature, and such as will provide the decorator with an admirable *motif* for decorative purposes, the *sugar maple* from the North American continent ranks far before those above mentioned for beauty of grain and serviceability for our modern civilised requirements. As its name implies, this species of maple is useful in a two-fold manner—as a source of obtaining sugar, and, particularly, under the designation of "Birds-eye maple," in providing the cabinet-maker with a fine grained and, beautifully marked wood, equally useful for both solid work or veneering.

Bird's-eye Maple—for under this name we will consider it—is therefore that particular variety which we purpose imitating, and the chief characteristics of which are a very delicate, irregular mottle upon a cream "ground," interspersed with clusters of, and "straggling," small knots, and, entwining and encircling these latter, a very fine and graceful overgrain. The general colour-effect of maple wood is of a decided cream, which, under the French-polishing process, usually develops into a rich and golden tone. Although the natural colour of the mottle is usually similar to that of the general fibre or "ground" colour, a slightly cooler tone of mottle is usually adopted in graining the imitation, instead of simply a darker glaze of the same golden ground. The little knots—or "bird's eyes," as they are suggestively termed, so much depth and transparency do they each present—and the fine overgrain are marked by a slight redness of colour, and this is a point further to our advantage in graining the imitation.

Maple is a wood we seldom find used for household furniture in this country, although in the United States and those parts of America to which this species is indigenous it is much more favoured; doubtless the higher cost of the maple over our equally serviceable but less beautiful native woods of birch, ash, etc., somewhat accounts for this. Its imitation, however, is almost as popular with us as oak, and, indeed, for many years it was the most favoured imitation for the drawing-room woodwork of middle-class houses. As it is my intention to consider the purely decorative aspect of grained imitations in a subsequent and separate paper, we may at once proceed to the imitative process.

The Tools required for Maple Graining by the distemper process are, generally, the same as those we previously used for imitating pollard oak, viz., thick hog-hair mottlers, a thin, stiff ditto, sable-pencil overgrainer, the badger, a sable pencil, and, besides these, the maple-eye "dotter" and "shader." The brushes are shown on page 40, Vol. II., at Figs. 5, 18, 8, 16, 21, 10, and 11 respectively. A clean piece of wash-leather and a piece of soft sponge are further indispensable items to this and all other water-grained imitations. When graining the woodwork of a room of any importance, several different sizes in width of thick mottlers and sable overgrainers are very necessary, the former for making mottle of varying size upon the various surfaces and the mouldings especially, and the latter to allow us to accommodate our overgrain more naturally to the different surfaces of the panels and stiles. A thick mottler of some 3 in. wide is the most useful, and this, with one an inch wide, will usually suffice; the best size for sable overgrainer is from 1½ in. to 2 in. wide, and the same width, or smaller, of thin, stiff mottlers is recommended.

The importance of cleanliness in working, and of purity of colour and materials, for every description of graining cannot be over-rated, and with imitations of so light and delicate a wood as maple or satinwood these conditions apply particularly. Brushes, vessels, pigments, and work should be free from any suspicion of grit, grease, or dust; otherwise, however excellent the imitation may be, no good finish and effect is possible.

The Ground and Graining Colours for Maple require care and judgment in preparing. The ground should be quite opaque, and of a clean, creamy white. The genuine white-lead, slightly stained with the best Oxford or Italian ochre (in oil), makes an excellent ground. Some experienced grainers prefer to give the ground a very faint pink tint with vermilion, and others prefer a ground slightly stained with the two pigments combined. These are points of personal election, for so long as the paint is kept from the two extremes of chalky-white, on the one hand, and decided red or yellow tints of ground on the other, the finished colour is not very materially affected. The *spreading* of the ground requires, however, the finest brush-work; for should the work be left for the grainer with coarse, streaky brush markings, the graining colour and varnish will bring them out very unnaturally and unpleasantly. The colours, or pigments, used for the graining vary considerably more with grainers than does the tint of grounds. Vandyke brown is the most convenient, and gives good results alone; combined with a little burnt sienna warmer tones are obtained, whilst we may occasionally see good executant skill displayed with very cool, black shades of mottling. In reviewing the general effect of these varying tones, the black-looking appears the least "happy" and natural, whilst decidedly warm mottling, on the other hand, detracts from the colour of the overgrain. The Vandyke is a good medium pigment, but, personally, I prefer a mixture of the *finest* burnt umber, ground in water, combined with a little *raw Terra-di-sienna.* This mixture, as also the finest raw umber, gives, to the writer's mind, the nearest natural colour of the mottle, as well as the most pleasing general colour. In graining all woods we usually aim at the colour of the real wood when French-polished, and observation will show that, as before mentioned, a decided golden tint characterises polished bird's-eye maple. For home or ordinary work, however, a Vandyke brown wash is admirable; and this having been prepared to the desired depth with weak beer, we rub it over the practice-board with the large mottler, and then proceed to imitate the wood in the following manner.

In Graining Bird's-eye Maple, the proper manipulation of and mastery over the mottler is a matter that will exercise the learner's patience for some little time, and he must not be discouraged at the probably unnatural results of first attempts. The action of this brush is to take out parts of the graining colour, and leave the remaining portion in the irregular, but not *erratic*-looking, form of soft shadows or mottle. Let us now assume that the panel has been evenly spread with the graining colour, using the mottler or a large tool, and that here and there a few slightly *darker* touches of the same colour have been put in towards the centre of the panel with the sponge. The badger is now taken up and the work "softened." By this "softening" the dark spots are blended into the general tone, and the colour is sometimes brushed from the centre towards the outer edges of the panel, thus getting away from the monotony of a perfectly "flat" looking mottle. On taking the large mottler in the right hand, it will be found that the fingers can grasp the hair —"dig into it," I might term it—at the base, and so break up the straight line of the bristle ends. When the mottler is held at nearly right angles to the panel, this action will cause the top of it to wipe out an irregular, undulating portion, instead of a straight, square shape. We therefore work a large panel by wiping successive pieces out of the softened colour with the top of the brush, leaving larger mottle at the sides, and working to smaller portions near the centre and "heart" of the plank. To get a natural mottle of maple, a double action of the brush is often used, the second one cutting across the first at a very obtuse angle; hence it is best to first mottle from top to bottom of a panel, across its entire width—in a slanting direction, and with due regard to the size of mottle, and then, after softening with the badger, to repeat the effect, but slanting the brush diagonally, as before mentioned, *across* the previous mottle.

Whenever mottling is done, we require a vessel of clean water at hand in which to rinse and dip the brush; the superfluous water, which would otherwise run down and spoil the "softened" colour, is then pressed out against the leather, and in maple graining this is of much importance.

Mottling a panel takes longer, and, indeed, is much more difficult, to describe than to execute, for quickness must be worked for and acquired not only to spread, soften, and properly mottle a panel before it dries, but to further add the following work, viz., the knots or bird's-eyes, and the bright lights thereto. Although interspersed somewhat irregularly all over a panel, the knots mostly occur near the top edge of the portions of mottle. A single knot will show us upon examination to be a nearly circular dark marking with a bright spot in the centre, and they occur in clusters and patches all over the panel, with "ones and twos" scattered between. To make the eyes there are several methods, the most convenient being the "dotter" before mentioned—a small camel-hair tool made hollow in the centre, and which, when pressed against the colour and then on to

the panel, prints the dark shape, or knot. This tool is a rather modern notion, for in the old days the worker would either twist a little piece of cloth or leather into the desired shape, and fix it to a wooden holder; use a sable pencil; or, for the commonest work, just dab the tips of his fingers on the panel, this latter getting results quite outrageous to look upon. The "eyes" should be put in with the "warm" colour, made with a little burnt sienna dissolved in beer and slightly softened in colour with Vandyke or black. Although by these methods we form the dark parts of the knot, we do not get the bright centre thereby, and when proper imitation is intended this light spot must be taken out with the leather covered over a pointed stick or the pencil handle. The small reflective lights must also be wiped out, and these will be found to spring from the eyes outwards across the mottle, coming to a point against the knots and softening off

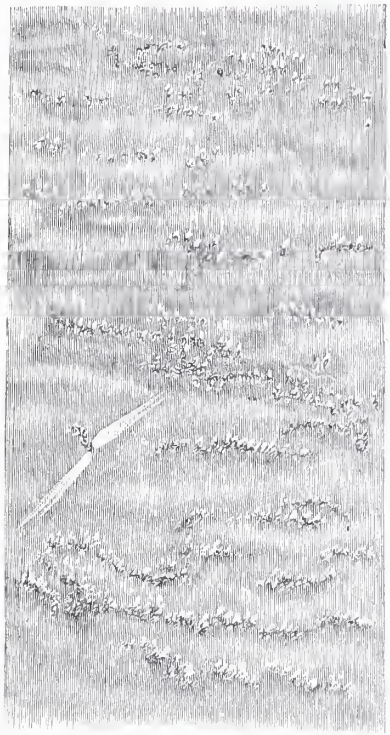


Fig. 1.—Bird's-eye Maple: First Stage.

like the overgrain of sap, only of a smaller size. All the imitative portion so far described should be done without stoppage and before the colour dries, when it is possible. For the best work, and in hot weather, we are often unable to get beyond the spreading, mottling, and softening ere the water evaporates. In such a case we leave the panel to get quite dry, proceeding with other portions, and then wash out the large mottler in clean water, and wet the panel by drawing the brush carefully down it. The use of beer is not necessary for binding, except with black, but it makes the colour safe for this wetting, and also keeps the work from drying so rapidly, therefore I advise using it. When the panel has been wetted over, the knots and reflective lights may be put in, and the work left as in Fig. 1. The final overgrain should also be put upon the panel in its wet condition, and this delicate work is "softened" outwards as it is executed. It is put in with the burnt sienna colour and the sable pencil, working from and around the knots in irregular, concentric lines from the heart and in the manner illustrated in

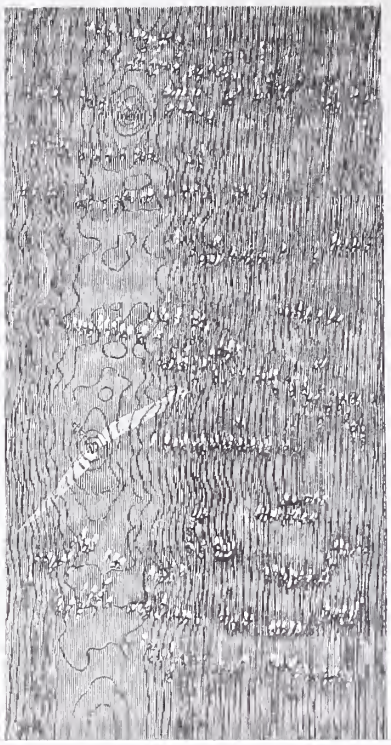


Fig. 2.—Bird's-eye Maple after Overgraining, etc.

Fig. 2. When the central heart-grain has been pencilled from top to bottom of the panel, the sable overgrainer completes the work on the sides, following the formation of the pencil-work, and gradually working into regular straight markings. A few delicate touches of red shading under the little knots are then put in with the "shader" or pencil, and softened downwards, both these and the overgrain being kept *unobtrusive* in tone and depth of colour. The work is then ready for varnishing, and for which the lightest copal varnish is necessary, otherwise the "ageing" of the latter will soon destroy the delicacy of the imitation.

Fig. 3.—Pitch-pine: First Stage.

Graining Maple in Oil is a process that has little to commend it, unless the imitation has to be worked on surfaces exposed to all weathers. The ground is prepared with the best brush-work, and the graining colour, made from the finest pigments ground in oil, requires the same working qualities as properly mixed graining colour. The usual methods of mottling in oil are either by working a damp wash-leather over the panel (as described in my previous paper for pollard oak), or by drawing down the face of the panel the hard edge of a strip of buff-leather, which takes out the colour in irregular patches, but hardly with a natural-looking result. Any worker who has followed me so far with success, and is able to execute maple in water, will scarcely need more than these few lines to put him in the right track; continuous practice and imitation of the genuine wood will then complete his training.

Graining Pitch-pine is a subject that will

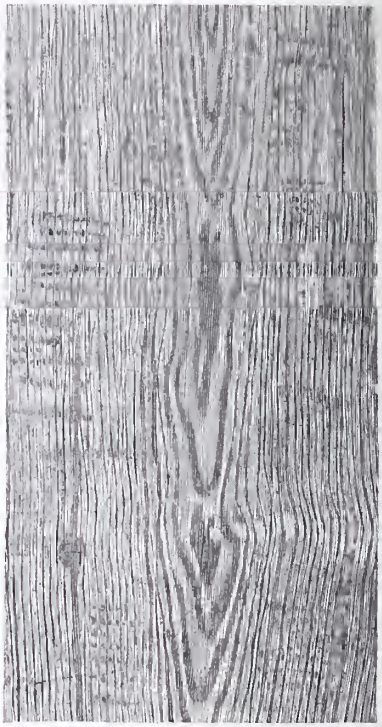


Fig. 4.—Pitch-pine after Overgraining, etc.

well repay study and practice. There are two good ways of imitating it, the first, according to my illustrations, Figs. 3 and 4, being executed in water-colour, and the other method that of graining the heart in oil, just as the sap of oak is wiped out with thumb-piece and rag, and then using open, leather or cork, combs for the plain outer grain. Although any good light oak ground will serve for pitch-pine, I prefer the finished effect which is obtained by working over a light buff colour, which shows a decided but soft *reddish* tint, instead of a *yellow* buff. For graining in water, take a little raw sienna ground in water, and slightly "warm" it with burnt sienna, diluting with weak beer as in maple-graining colour. Spread this wash evenly with a tool over the panel, and then with a goose sable pencil run in the heart-grain, using a slightly deeper shade of the sienna colour. After putting in the centre grain, take the pencil overgrainer, sable or fine hog-hair, and draw it down the sides to get the straight outer grain. A touch of Vandyke brown may be used to slightly darken the knot or heart, but the grain otherwise

uld be the same *tone* as the ground t. Before the work is dry the heart-n is softened and graduated with the ger as when overgraining oak (Fig. 3). get the best results the work must be ound down" with "*Japanner's*" or varnish, then rubbed over with the same grain-colour, and mottled after the style of rking maple (Fig. 4). This method es the worker good scope for his skill, l when varnished may often be mistaken the real thing, even by experienced nters.

Pitch-pine grained in Oil has one advan-e over the above—it requires no binding wn before the overgrain or mottle is put . To wipe quantities of sap-oak in oil, turally and without repetition, is a hard k to many a worker, who, however, will d the pencil work much easier, cleaner, d quicker. The mixing of a sienna oil-aining colour, the method of spreading it, d the manner of wiping such figure, are atters that have all been thoroughly ex-ored in their connection with oak grain-g; the only material difference between iping sap-oak and pine-heart is that a od "springy" badger, or a hog-hair ftener, has to be used to work up the iped figure in the centre and to soften the rd edges of the combed grain at the sides.

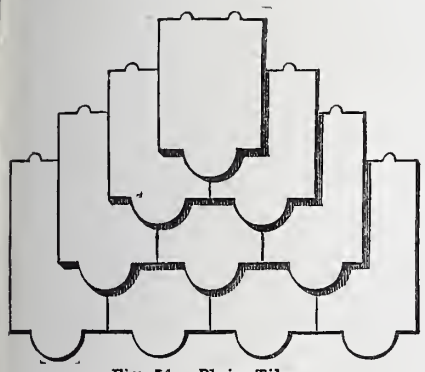


Fig. 54.—Plain Tiles.

In closing my directions for imitating maple and pitch-pine woods, I need scarcely point out the necessity of working from a good natural specimen, or, the next best thing for the time being, a properly grained imitation of the wood we are studying. When beyond this stage, and the learner applies his skill to graining furniture and the woodwork of buildings, the previous directions I have given—as to *contrast* and sharpness of rail with stile, the *simplicity* of figure and grain upon moulded surfaces, and the *due subservience* of the work on the framing or stile parts to that contained in the panels—must all be remembered and intelligently followed, to the end that the grained door presents that repose in its entirety which we find in the best woodwork.

BRICKLAYERS' WORK.

BY MUNIO.

Furnace Chimneys.

Furnace chimneys are built of various sizes and heights, according to the purposes for which they are required; the higher the chimney, the larger should be the size of the base, and it is advisable in all cases to lay a bed of concrete under the footings, as this forms a good uniform foundation. Fig. 51 is a section of a chimney, showing the manner in which they are usually built. A is the concrete; B is the base; C, stone base-course; D, shaft; E, stone top; F, fire-brick lining; G, flue. The concrete is brought up to a level surface, and the footings for the base built upon it; the centre portions of the footings should not be filled in solid, as the settlement of the chimney generally causes the concrete to rise in the centre. The base is generally built thicker than the lower portion of the shaft, and is lined with fire-bricks set in fire-clay; the flues are arched at the top, and an invert formed at the bottom; four strong iron cramps should be walled in the centre of the brickwork under the inverts, and above the arches; when the walls of the base are very thick, two rows of irons should be used: they are fixed by pins at the corners. The stone base-course is also cramped with iron cramps let in flush, and run with cement. The shaft is generally built from the inside, or "overhand," as it is termed. Two strong putlogs are laid across the inside of the chimney. On these the scaffold boards are laid, an opening being left in the centre, above which on a proper support a pulley is fixed, and the material is drawn up by means of a "gin," or steam engine.

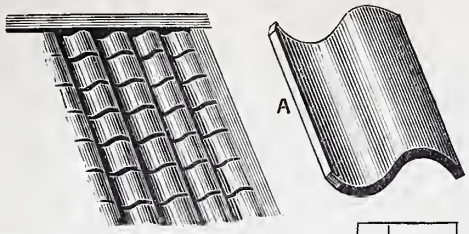


Fig. 52.—Pantiles—A, Single Pantile, showing Form.

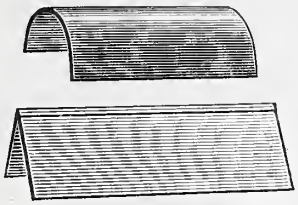


Fig. 53.—Ridge Tiles.

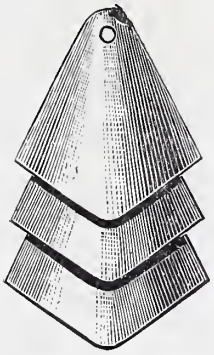


Fig. 55.—Hip Tiles.

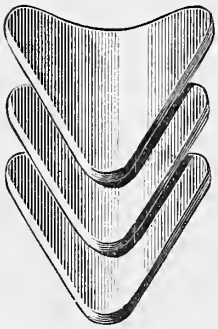


Fig. 56.—Valley Tiles.

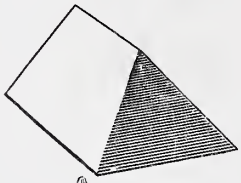


Fig. 57.—Ridge Tile for Hip End.

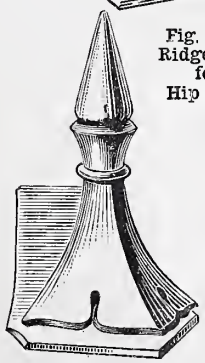


Fig. 58.—Finial for Hip End.

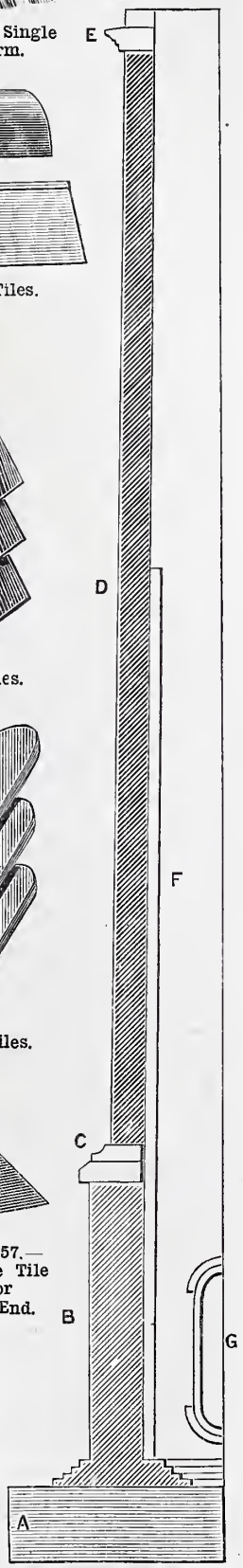


Fig. 51.—Section of Furnace Chimney.

The stalk is diminished, or set on, from the inside every 20 or 25 feet and the fire-brick lining is generally carried half-way up the stalk, except in cases where a very great amount of heat is brought into the chimney, when it is carried to the top. In such a case the work should be 1½ bricks thick at the top, 1 brick being the usual thickness. Sometimes the lining is carried up plumb instead of being set off, but the work is not so strong, the bricks having to be cut in nearly every course; sometimes a cavity is left between the lining and outside brick-work. In this case it is advisable to have gratings at the top and bottom to prevent gases accumulating in the cavity. The out-side of the stalk is built with a batter of from ½ in. to 1 in. to the yard. The top stones are cramped together with iron cramps, and iron straps or ties are walled into the brickwork of stalk every 3 feet in height. Cast-iron tops fixed together by bolts are sometimes used instead of stone: these are filled solid with brickwork, and cemented over.

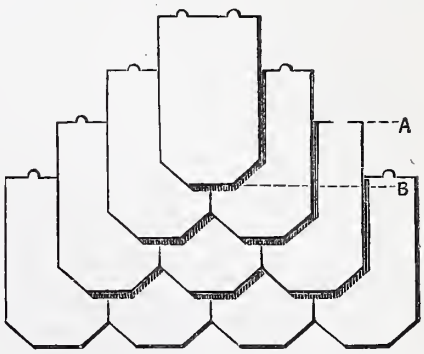


Fig. 54 A.—Plain Tiles.

A lightning conductor should be fixed on the chimney as soon as it is finished, and all the putlog holes should be walled up and made good.

TILING.

When roofs are to be covered with tiles, the timbers should be stronger than for slating, as tiles are much heavier than slates; the roof should also have a much steeper pitch than for slates. Tiles are of two kinds: pantiles and plain tiles.

PANTILES.

Pantiles are concave on the upper side; the right-hand edge, being turned over, is called the roll (see A, Fig. 52). They are hung on wood laths, nailed to the roof timbers, by means of a nib formed on the top end. The gauge of the laths is from 10 in. to 10½ in., depending on the length of the tile; if the gauge is too narrow, the roll of every tile will have to be cut at the top corner, and if too wide, the tiles will not turn the wet. In commencing to fix the laths, nails are driven about ½ in. into the two end rafters to the gauge; if the rafter does not divide equally to the ridge, the eaves tile can be given a little more lap. A line is then stretched between the nails, and the laths nailed to the line; if the roof does not project at the eaves, the feet of the rafters will be set back about 3 in. to form an eave; if the roof projects, a thicker lath, called a tilting fillet, is nailed at the eave. The eaves tile generally projects over 3 in.; the tiles are laid from the eaves to the ridge, the roll being kept straight to a line, hung from the ridge with a weight at the end. Any tiles that are crooked are set out to be used for cutting, etc.; the roof should also be gauged lengthways after a few courses are laid, so as to land with a whole tile at the end, by keeping the tiles closer together. The eaves tiles should be bedded in lime and hair mortar. The tiles for hips are cut to the rake of the hip at the top corner, and for valley gutters at the lower corner. The valley tiles should be bedded in lime and hair mortar. The hips and ridges are covered with ridge tiles, Fig. 53: they should be set to a line, bedded in lime and hair mortar, and pointed. In tiling round chimneys, lead flashing should be fixed, as collaring with cement or mortar soon cracks, and lets the wet in.

After the tiles are laid on, they are pointed on the inside, and it is best to do this after rain, as the pointing adheres better when the tiles are damp; sometimes the laths are boarded, or lathed between with plasterer's laths, and the tiles bedded in lime and hair mortar. The tiles are laid from the right-hand corner of the building.

PLAIN TILES.

Plain tiles are flat, and sometimes have the lower corners cut off (Fig. 54); they are hung on laths by two nibs at the top of the tile, and sometimes by pins put through holes in the tops of the tiles. They are of three kinds: ordinary tiles, eave tiles, which are shorter than ordinary tiles, and gable tiles, which are the width of one and a half tiles, and are used for commencing every second course, to get the proper bond. They are laid in parallel courses, commencing from right to left; they are generally laid with 3 in. lap. The lap is the distance the tail or lower end of the third tile covers the head of the first tile; the distance A B, Fig. 54, is the lap. The laths are nailed in a similar manner to pantiling, the gauge being half the length of the tile. After deducting the lap, the eaves are bedded in mortar, and are formed by setting the foot of the rafter back, or by a tilting fillet. The vertical joints should be exactly plumb over each other, and the horizontal joints perfectly parallel to each other: all hollow or twisted tiles should be set out, and used by themselves, as they cannot be laid properly with straight tiles. Zinc or lead steps turned up 1½ in. should be used round chimneys, with top flashing or cement collaring; where hips and valleys occur, the tiles must be cut to the rake of the hip or valley, and the ridges and hips covered with ridge tiles, in the same manner as pantiling. Sometimes the hips and valleys are laid with purpose-made tiles, (Figs. 55 and 56); when these are used, they should be very accurately formed to the angle of the hip or valley, as they look very bad if they stand up above the other tiles. When hip and valley tiles are used, the ridge is finished at the hip end, with a ridge tile similar to Fig. 57, or with a finial (Fig. 58). The tiles are pointed on the inside, or bedded in lime and hair mortar, on boards or plasterer's laths, nailed on the roof timbers between the tiling laths.

MEASURING.

Brickwork is measured by the cubic yard of 27 feet, by the standard rod of 272¼ superficial feet, one and a half brick thick, by the rod of 63 superficial feet without regard to thickness, and by the superficial yard of 9 feet, reduced to one brick thick.

Foundations, piers, and other heavy work are measured by the cubic yard, and ordinary walls by the rod, or superficial yard; the openings are deducted net size, but an allowance is made for extra labour in building the jambs or quoins of openings.

Rubbed and gauged arches, and cut and moulded work, are measured by the superficial foot, the whole of the face being girted.

Plinths, strings, cornices, etc., are measured by the lineal foot or yard, the girt being taken. Facing with bricks of a superior quality is measured by the superficial yard, extra on ordinary work. Pointing is measured by the superficial yard, large openings being deducted, and the jambs measured.

Chimney breasts are measured solid on account of the extra labour in forming the flues; the pargeting or plastering of the flues is measured by the superficial yard; chimney tops are usually measured by the superficial yard.

Paving and flooring are measured by the superficial yard. Digging and excavating and concreting are measured by the cubic yard. Drain pipes by the lineal yard; bends, junctions, and traps, at so much each.

Arching and circular work are measured by girting the inside of the arch and the outside, and adding the two together and dividing by two for the average girt; this, multiplied by the length, will give the area.

To reduce brickwork to the standard thickness of one and a half bricks, multiply the area of the wall by the number of half bricks it is in thickness, and divide this by three.

In all cases the cost of scaffolding should be included in the price, and when the work is executed in a street, or where traffic is carried on, an extra price must be put on.

Tiling is measured by the square of 100 ft. or by the superficial yard, large openings being deducted, but small openings are generally measured, in consequence of the extra work in cutting; cuttings to hips and valleys are measured by the lineal yard or foot, and ridge tiles by the lineal yard or foot. Zinc or lead steps are counted at so much each.

All cuttings to gables, and cutting and pointing of flashings, are measured by the lineal yard or foot.

With this I may bring my remarks on "Bricklayers' Work" to a close. I have touched briefly, but, I trust, sufficiently, on every point that bears on or is included in this most important branch of the building trade. Any special information that is required must be touched on in "Shop," which, as my readers are well aware, is always open to all inquirers.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

80.—"EXERCISES IN WOOD WORKING."

MESSRS. D. APPLETON & Co., New York, send me through their London agents, Messrs. William Allen & Co., Caxton House, Paternoster Square, a well-printed, well-illustrated volume entitled "Exercises in Wood Working: with a Short Treatise on Wood," written for manual training classes in schools and colleges by Ivin Sickels, M.S., M.D., a book of which space forbids me to say little more than that it is ably conceived and admirably carried out, dealing briefly but comprehensively with everything in connection with wood working on which it is necessary to touch. The introduction sets forth very clearly the beneficial effect of manual training on mental development, and the close connection that exists between drawing and wood working. The text itself deals with carpentry and joinery, and is divided into two parts, of which the first treats of the structure, properties, and kinds of wood; its manufactures and economic relations to other substances; the parasitic plants and insects that infest timber; and the means of preserving wood. The second part contains various exercises on the use of the tools used in wood working; sharpening tools; and the construction of the various joints made in carpentry, joinery, and cabinet making, and of many parts of the house, etc. Some hints are afforded on shaping a boat model, and the volume is aptly wound up with instructions in veneering, polishing, and painting. The price of the volume is 5s.

81.—"HANDRAILING AND STAIRCASING."

This is the second edition of an important and useful work by a practical handrailer, Mr. George Collings, author of "Circular Work in Carpentry and Joinery." It forms one of Weale's Rudimentary Series, and is published at 2s. 6d. by Messrs. Crosby Lockwood & Son, Stationers' Hall Court, Ludgate Hill, E.C. It is clearly written, plainly illustrated, and will be found valuable and helpful to all who are seeking information on this subject. Its aim and scope will be best recognised from its title, which runs thus:—A Practical Treatise on Handrailing, Showing New and Simple Methods for finding the Pitch of the Plank, Drawing the Moulds, Bevelling, Jointing Up, and Squaring the Wreath: to which is added a Treatise on Stair Building. Staircasing is a stumbling-block to many a young carpenter, who will find many things that he does not now understand made clear to him by the perusal and study of this volume.

82.—"SCREW THREADS."

This is a handy little book for the waistcoat pocket published by Messrs. Crosby Lockwood and Son, Stationers' Hall Court, Ludgate Hill, E.C., and written by Mr. Paul N. Hasluck, the well-known author of "Lathe Work," "The Metal-turner's Handy-book," and many other useful volumes on subjects involving manual labour of a high class. It is entitled "Screw Threads, and Methods of Producing Them, with Numerous Tables and Complete Directions for using Screw-cutting Lathes." It is freely illustrated, and having now reached the third edition, the author tells us that it has been entirely rewritten and increased by more than one half. It claims to contain more information on the subject than any treatise extant. THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

* *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

n answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Cheap Overhead.—J. L. writes:—"This overhead by H. A. Miles (see WORK, page 365, Vol. II.) has certain defects which prevent it from repaying the maker for his labour. In fact, it will give as much trouble in its construction as will suffice to make a better one. The only object of the swinging frame and hanging weight is to keep tight the cord from the fly-wheel to the end of roller; but this distance is constant, and the cord once fitted needs no arrangement for varying tension. But again, as the designer evidently foresees, this cord will prevent the action of the weight and swinging frame upon the second cord, necessitating the tension pulley and weight; and as this is a necessity, the swinging frame is useless, and the roller may as well be directly mounted on centres between its standards. But if a second roller is fitted to run upon the bar on which the frame swings (or two cone pulleys which are preferable), and if the main cord is taken to this axle with a short cord to the groove in the front rollers, then the swinging frame will act on the secondary cord which drives the cutters, and may be raised or lowered by the weight without affecting the two primary cords; and thus also the objectionable tension pulley is no longer needed."

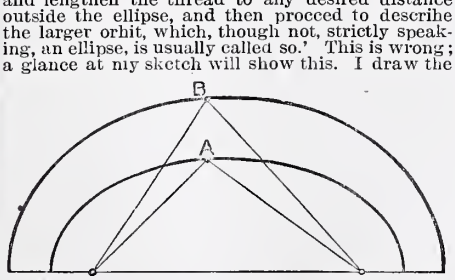
Gaiting Wheels.—See reply to A. P. (*Hardy's Gate*), WORK, p. 440, WORKER BEE (*Hertford*) writes:—"Allow me to point out to W. P. that his reply on the above subject is very vague, not to say misleading. W. P. makes no allowance whatever for the variations in length and taper found in the various kinds of axles and pipe boxes. Very recently I had to make a pair of wheels for an old axle, and one box was ¾ in. taper, while the other was barely ⅜ in. How would W. P.'s 'secret of allowing a small ¼-in. hook off every inch measurement in the dish of the wheel' apply in that case? as it is evident, if the wheels are to run alike, both arms of the axle must not have the same amount of 'hook.' If W. P. were to give either of my apprentices such a reply as he has given A. P., he would get derided for his pains. Here is a formula that will apply to all kinds of axles or arms and wheels of whatever dimensions. But to illustrate our point we will suppose we have to set a pair of arms, the boxes for which are 11 in. long, 2½ in. internal diameter at one end, and 1¾ in. at the other. The width of tyre is immaterial for our purpose, but the wheels are 4 ft. 8 in. high, and the spokes are 1 in. dish, measuring as W. P. has directed. We will proceed to find the amount of 'hook' required as follows:—With a straight-edge and pencil on a piece of clean board draw a straight line A B, at least 3 ft. 6 in. long. From A measure off 1 ft., and make a X at that point. From the X again measure off 2 ft. 4 in., which we will mark *b*: this represents half the height of the wheel. From the X again measure off 11 in. towards A: this we mark *a*, which represents the length of the box. At the point *b* we next measure off to the right a space of 1 in., which represents the dish of the wheel: this we mark D. We next, with our straight-edge, draw a line from the point D, crossing the line A B at the spot marked X, continuing it on to the point C. We next set a pair of compasses to 1¾ in., which represents one-half the internal diameter of the box at the largest end: this we prick off on the left of where the lines cross each other at the point marked X, and mark it *h*. Again set the compasses to ⅞ in., and prick that off on the left of the line C, parallel with the mark *a*: this represents the small end of the box, and we will mark it *f*. Now, the difference in measurement from the point *h* to the line A B, at the point where it is marked X, and the point marked *f* to that marked *a* on the line A B, represents the amount of 'hook' required to give the axle, to make the wheels run as they should. In this case it amounts to barely ⅛ in., as A. P. will find if he works it out full size."

Leather and Cotton Machine Belts.—A. R. (*Scorrier*) writes:—"I have often heard it asked—Which of the above belts do you prefer? and, as each have certain advantages, I pen the following. No doubt the leather belt will drive with less tension than most cotton belts, and is not so liable to wear at the edges in frequent throwing on and off the tight and slack pulleys; but where a belt drives direct, and even where it has not to be thrown on the tight and loose pulley, often the cotton belt answers well—that is, if the right kind of belt is selected. One reason the leather belt drives with less tension is, as a rule, it is more pliant, and adheres to the pulleys more so than cotton, which is a matter of some importance, as it requires less power to drive it, and will last much longer than a cotton belt that is hard and stiff. In buying a cotton belt, always see that it is pliant; if not, it will very soon crack in many places, and soon become useless. For instance: about six years ago we had a 10 in. cotton belt from a certain maker, and an 8 in. belt from another maker; at the end of two years the 10 in. belt had to be thrown on one side, and another from where we purchased the 8 in. belt put in its place. The 8 in. belt, that has been in constant work for six years, is still in good condition, and, by all appearance, will stand years longer. The last 10 in. belt is doing well, and is in good condition; so much for the choice of cotton belts. I might say that these two belts are driving direct. Again, although I prefer a leather belt in some cases, there is one thing I have against it—that is, its irregular running. As a rule, some lengths of the leather stretch more on one side than on the other; consequently, the belt sways, which is very annoying. The cotton belt, being in one length and texture even throughout, runs true if put together square. Perhaps a word on how to join a cotton belt will not be out of place. In the first place, take a square and mark the end the length you want to cut off—the ends being perfectly square—butt them, and take a piece of the same width belt and place over the joint and cross; lace, as in sketch: this will prevent a jump in the

Machine Belt Repairing.

belt, and it will not break as soon as if the ends were lapped. Another thing to be considered is the cost of the belt; a cotton belt can be had for less than one-half the cost of a leather belt, and there being so many joints in a leather belt, when they once commence to give out will waste a deal of time in repairing. Again, the question is often asked, How to prevent belts slipping? and very often very unsatisfactory answers are given. Some will say, the belt should be kept pliant, and at the same time recommend resin, etc., which will tend to make the belt hard and shorten the life of the belt. By all means I would say avoid resin, especially on leather belts; to keep belts pliant, and to prevent slipping to a great extent, a leather belt should be sponged over with warm water two or three times a year, and some dubbin rubbed into it; and, in case of slip, leak a little castor-oil on the side next the pulleys, not forgetting to brush off the dust by holding a brush or broom on the belt while running, before applying the oil. Should a cotton belt slip, brush and apply castor-oil as above. The oil will tend to keep the belt supple, as well as prevent slipping to some extent. But should this fail to keep the belt from slipping, take it up to driving tension; if the weather is very dry at the time of taking up, be sure not to take it up very tight, because as soon as the weather alters and the air becomes damp, the belt will contract, and, in consequence, the bearings become hot, when there will be further trouble. A cotton belt may slip to-day, and to-morrow drive without the least slip. Again, a frequent cause of belts slipping is by working too narrow a belt, and small pulleys, and short belts; the latter not only cause belts to slip, but shorten their life. I might add that castor-oil may be bought reasonable of the druggist for the above purpose. And if anyone wishes to make their own dubbin, the following will be the way to proceed:—Melt some good tallow over the fire, and add one-quarter its weight of cod-liver oil; let cool, and it will be ready for use."

Oval Drawing.—F. C. (*Leytonstone*) writes:—"In reply to J. W. H.'s comment on my letter in WORK, No. 78, I think it would be much better if J. W. H. would test his theories somewhat before publishing them in your valuable paper. For instance, he says (WORK, No. 78): 'Simpler than F. C.'s method of drawing an oval parallel to an ellipse is to keep the pins in my Fig. 3 (page 230, WORK, supplement to No. 66) at G and H as before, and lengthen the thread to any desired distance outside the ellipse, and then proceed to describe the larger orbit, which, though not, strictly speaking, an ellipse, is usually called so.' This is wrong; a glance at my sketch will show this. I draw the



Oval Drawing.

first curve G A H, then lengthen out the string to B, and describe the larger curve; the result is I get another *true ellipse* outside the first, but quite independent of it, and by no means parallel. It is impossible to draw a parallel to an ellipse, either by the string and pin method or by the trammel described by J. W. H. in a later paper, no matter what the proportion of major to minor diameter may be. There is so much difficulty experienced in setting out an elliptic arch, that the ellipse is often avoided altogether, and an arch made up of segments of circles, called an elliptic arch, used in its place. The method of setting out this arch is very ably described by your esteemed correspondent MUNIO, in WORK, No. 79. As to drawing the parallel by means of a working gauge being impracticable, I have seen it done, and have done it myself hundreds of times; of course I did not use a square-faced gauge: common sense will tell anyone that; but with a round-faced gauge the parallel may be drawn near enough for all practical purposes."

Life of an Omnibus Wheel.—F. C. (*Leytonstone*) writes:—"I should like to reply to a question asked me by J. W. H. in a former letter (WORK, No. 70), viz.: 'Does F. C. know that the life of a London omnibus wheel is *under ten weeks on an average?*' I was not aware of that; but I know, from actual experience, that a fairly well-made omnibus wheel lasted twelve months on one of the heaviest roads in London; some last longer, but twelve months may be taken as a fair average. A wheelwright working for one of the large omnibus companies assured me they had some wheels that had been running eighteen months. Perhaps J. W. H. means the tyre; but it is a well-known fact that a wheel will wear out several tyres. As to housing the spokes into the stock and fox-wedging, they may do it in America, but as yet, except in isolated cases, it has not been done in England, and from what I can gather in conversations with some of the oldest and most experienced wheel makers in the kingdom, is not likely to be; for my own part, I cannot see the good of it. I think the stock is quite weak enough already without housing the spokes in. Some years ago one of the large railway companies had their road wheels made with the spokes housed into the felloes ¼ in., the object being to prevent the spokes splitting; but I believe the practice is discontinued. As to the 'ounce of experiment and experience,' J. W. H. seems to forget that others may have had quite as good an opportunity of experimenting and acquiring experience as himself; therefore it is scarcely fair on his part to class their ideas as 'tons of precept and prejudice.' There may be some among the much-abused British workmen who are quite as capable of thinking as J. W. H., although they may not be able to express their thoughts so cleverly on paper."

Watch Repairing.—DEAN FOREST writes:—"In running my eye over the 'Shop' columns, I was somewhat pleased to read the complaints of ONE THAT PAYS, BUT WANTS STEADY TICK,' No. 79. Because of it, I feel I must write a few lines in answer thereto, to wish that our friend was with some of our watchmakers in England, for then should he know that there are still those in that trade who would put his watches and clocks in good working condition for him, and that for much smaller terms than are named by HERR SPRING. In answering a few of his remarks, I trust he will pardon me if I seem to take upon me (who am but a young man, and he, I should judge by his letter, an elderly one) the *rôle* of instructor. But I always find that those who boast a great deal are just the ones who lack the qualities and abilities boasted of; so that if a man 'blows his own trumpet,' it is because there is no one else to do it for him. And thus he would have done well to have steered clear of him he entrusted his carriage clock to; for although I am myself in the trade, yet I am confident of this: that there are multitudes of good watches spoiled by incapable or careless repairers, therefore, a great amount of care and discretion needs to be exercised by the possessors of watches. The best way, I think, to find out *the best* watchmakers is to inquire of people, for I find that the only way for my business to become extended is by the recommendations of those for whom I do work, and are pleased with it, and not by advertisements, etc. But, at the same time, I issue handbills occasionally, with a few useful directions for the use of my patrons printed with other matter thereon. I also have been pleased with the 'Hints to Watch Wearers,' by HERR SPRING; and, as a practical repairer, I heartily endorse the greater part of all he has, in his various articles, stated. But, so far as my experience has taught me, I always put the average time at about two and a half years between each time of cleaning. Nevertheless, as he implied, there are cases in which a watch cannot go safely any longer than the eighteen months. In regard to the method HERR SPRING stated of cleaning watches with soap and brush, I consider that immersing them for five or ten minutes in 'essence of lemoine,' and afterwards brushing them up, a superior one. This is the way adopted by me for some years now, and it is, in my estimation, the most thorough and safe way possible." [The handbill that accompanied your letter is well conceived and carried out, and ought to be useful to all watch-wearers.—ED.]

Winter Classes.—SELF-TAUGHT, ANXIOUS, and several other correspondents write, urging the necessity for, and advantage of, winter classes in all trades, with instruction and the use of tools, etc., at low rates. [These correspondents are referred to the Polytechnic Classes, Regent Street, W., and the classes, also, at the City and Guilds of London Technical College, Finsbury, E.C., etc.]

II.—Questions Answered by Editor and Staff.

Electrotyping.—Electro.—Machines for electrotyping are usually shunt wound, and made to furnish a definite volume of current. Whilst the resistance of the work exceeds that of the F.M. coils, a portion of the current traverses those coils and keeps up the magnetic intensity of their cores; but when too much work is placed in the vat, the resistance of this circuit is lowered and the current traverses it instead of passing around the coils to magnetise them. As a consequence the current falls in the outer circuit because the cores are not sufficiently magnetised. If the machine fails to give any current when the articles are all placed in the vat, then it must be wrongly wound, the resistance of the coils being too high. Sparking at the brushes is caused by wrong adjustment of the brushes. If the commutator is badly grooved, it must be removed and a new commutator put on in its place. To prevent burning by excessive sparking at one place, see that the brush pads press level on the commutator with equal pressure on all parts, and keep the edges trimmed evenly. Adjust the brushes to an angle found by experiment to be the best to prevent excessive sparking when the full load of work is on the machine. I do not know of a book which will tell you how to keep a dynamo in working order, but may tell you that one is in course of preparation which will embody the information desired by you. A good electrotyping solution is made by dissolving 1 lb. of copper sulphate in 1 gallon of rain water, and adding to this 1 lb. of sulphuric acid; then stir all well together. I shall be pleased to assist you with advice at any time; but you must state every detail of your difficulty when you write, so that I may see how you are situated. Correspondents cannot write letters too long, as the longest letter takes less time to read and understand than is consumed in guessing at the meaning of a short letter shorn of details.—G. E. B.

Gramme Dynamo.—R. F. (*Hamilton*).—You should have given the size of your armature as well as the size of the F.M.'s, and also stated how you have connected the coils. I infer that you have connected the F.M. coils in series with those of the armature. You won't get a very good effect on an incandescent lamp with the machine connected in this manner, unless the lamp has a low resistance. Machines for electric lights on a small scale should be wound so as to connect the F.M. coils in shunt with the armature coils. As you have 1 lb. of No. 22 on the armature, made up in twelve sections, you should have 4 lbs. of the same wire on each core of the fields, or 16 lbs. in all, and then connect the F.M. coil ends to the brushes of the machine in shunt. The machine must be driven the reverse way to work as a dynamo, and the brushes must also be adjusted in a different way to that adopted whilst working the machine as a motor. If you cannot get it to work after reading my articles on this subject, let me know, and I will try to make arrangements with you for seeing the machine.—G. E. B.

Electric Scarf Pin.—R. A. D. (*Forest Hill*).—First get your small pea incandescent lamp. Then get a cheap scarf pin with a large stone or glass in it, and note how the stone is set and how the setting is made. Make a claw setting in a similar manner out of very soft and thin sheet brass, to nicely fit and hold the lamp. You may make the setting in the form of a flower and cause the petals to clasp the lamp bulb. Before setting the lamp, make a hole in the bottom of the setting for the stem of the lamp to pass through, then fix this part to the top of the pin by soldering the parts together. Use a piece of silk braided double line wire, No. 24, as a connector; connect the ends of the wires to the platinum loops of the lamps by twisting the cleaned ends of the wires; bind some silk twist around the joint to hold the wires firmly in contact with the loops, and to insulate the ends of the wires from each other. Also bind the braided wire to the top part of the pin to prevent rupture ot the wire. The connecting line of double wire must be long enough to reach from the pin to the pocket in which the push or pressel will be located. Then a piece of the same wire must connect the pressel with the battery. Further directions for making these lamps will be given in the last article of the series on "Model Electric Lights."—G. E. B.

Magnesium Wire (Correction).—W. A. W. writes to correct a statement on page 387, respecting price of magnesium wire. The price of this wire has fallen during the last two years from 12s. 6d. an ounce "to 2s. 6d. an ounce, and can be obtained at that price from any photo stores."—G. E. B.

Electric Clock.—H. S. (*Byker-on-Tyne*).—Limited time and space preclude a full description of an electric clock. Referring to your sketch, the two bobbins on each side of the pendulum are left hollow to admit the ends of the cross-piece on the pendulum. This cross-piece may be ot soft iron or of magnetised steel. If of soft iron, which is most likely, the two coils are solenoids—that is, they are so contructed as to draw into themselves the ends of the iron bar, and in this case each coil is complete in itself, the ends of each going to a current interrupter placed near the top of the pendulum. As this swings to the left it causes the interrupter to break contact with the ends of the left-hand coil and make contact with the ends of the right-hand coil; the current then goes through the right-hand coil and draws the right-hand end of the cross-piece into itself; this causes the interrupter to make and break contact on the other side, and the current then passes through the left-hand coil. Thus the current is sent alternately through the coils by the motion of the pendulum, and its motion is maintained by the cross-bar being alternately attracted into the two coils. The size of this bar must be proportioned to the size of the clock; doubtless you have rightly guessed the size of the bar seen by you. You have also, I think, rightly guessed the size of the bobbins. They may be made of brass, coated with silk ribbon, and filed with very fine (36, 38, or 40) silk covered copper wire. Very fine wire is necessary to get a good magnetic effect with a small current of electricity. The battery in general use for electric clocks is the gravity Daniell, because this is the most constant battery when a continuous small current is required through a high resistance. If you know how to construct a clock with the pendulum so arranged as to beat seconds, you will have no difficulty in constructing an electric clock to beat time in a similar manner, as the current merely furnishes motive power to the clock. I should mention, however, that the two bobbins must be uniform, and be wound exactly alike with the same length of wire, each having the same resistance, so that the attractive power of one coil may be the same as that of its neighbour.—G. E. B.

Overmantel, etc.—Grupii Prawne.—For any, except the commonest, furniture varnishing is not a suitable method of finishing. Oiling it before varnishing would not improve the appearance or remove the faults incidental to varnished furniture. Oil brings out the colour and markings of the wood, but does not prevent the coarse look which varnish gives. If you do not care to French-polish, and, as you say, it requires experience to do it properly, nor to give the time required for oil-polishing, you might finish your furniture by wax-polishing. If the wood is not naturally dark enough to please you, oil it before polishing, or even stain it slightly. I do not think it likely you have seen oak furniture *varnished* and "deadened," or, as it is generally called, "dulled" afterwards. Furniture is often *polished* and dulled. If you wish to finish in this way, the work, after having been French-polished, must be brushed or rubbed down with some fine powder such as pumice powder. This destroys the gloss, and the work is said to be dull French-polished. Looking-glass would not be out of place in an overmantel such as you refer to; indeed, many people would consider it incomplete without some glass. As for mouldings of a different kind of wood from the bulk of the work, I hardly know how to advise you, as so much depends on the design, or rather on the taste of the designer. Without knowledge and experience it is, as a rule, injudicious to introduce various woods in the same piece of furniture in the way you suggest. The combination is very apt to destroy the harmony or breadth of the work, making it look fidgety and vulgar. There is, however, no definite rule to guide one, nor does the mere fact of several woods being used violate any recognised canon of art; the way in which it is done is everything.—D. A.

Air Compressing Pump.—Experiment.—To enable me to give you a dimensioned sketch of air-pump, I should require further particulars, such as, is the air to be used hot (it will rise considerably in temperature under compression), or will it be stored and allowed to cool? In the latter case the loss of power will be much increased. By what power do you propose to drive your air-pump? Grid-valves of brass or iron covered by vulcanised indiarubber discs will be suitable for the pump. You will find a variety of pump valves illustrated and described on page 513, Vol. I. of Work, and amongst others, those suitable for air-pumps. A double-acting piston-pump with metallic packings, and lined with or made of brass, should give satisfaction. A half-horse power is equal to 16,500 foot-pounds of work per minute. To obtain this effective power you must allow 15 per cent. for friction and loss, therefore the compressed air delivered must be capable of doing 18,975 foot-pounds of work per minute; therefore at 30 lbs. pressure per square inch, you must deliver 4·4 cubic feet of air per minute. You will find this method of transmitting power very wasteful. An electro-motor would be more efficient and less trouble, or, unless you get your power for nothing, you might use an oil engine with advantage.—F. C.

Magic Lantern.—J. G. B. (*Walthamstow*) is anxious to make a first-class biunial magic lantern, mahogany body, etc., for limelight, also capable of being converted into a triple lantern, and asks for the necessary instructions where he can get, and at what cost, brass fittings for the same. I have an article partly written in which I shall try to supply all the information needed, and which will be submitted to the Editor at an early date.—O. B.

Frame Quotations.—A Reader from No. 1.—If the moulding costs you 20s. per 100 ft., I should reckon the cost 2½d. per ft., and glass at 3d. per ft. super. Suppose you are asked the cost of a frame 36 in. by 24 in. (glass size), made of 2½d. per ft. moulding, and say your moulding is 3 in. wide, it would take 12 ft. .. .. 2s. 6d.

Glass, at 3d., 6 ft.	1s. 6d.
Backboard	0 4d.
Joining, brads, etc., glue ..	0 6d.
Net cost	4s. 10d.

Net cost per foot you might say 5d. It is impossible to give an accurate price per foot to embrace all sizes at one standard price, as the risk in breakage of a large glass must be covered, and in any case could not be done at the price of a small one; as, for instance, I make a 1½ in. solid oak frame, with ¾ in. best gilt flat glass and back, with rings for hanging rebate or glass size, 18 in. by 14 in., for 2s. to the trade at per dozen—which is equal to 4d. per ft. yet for 40 in. by 30 in. it is impossible to do under about 7d. or 8d. The custom of the trade is to get a sample board and mark it in a private manner per foot, suitable width for size, as a ¾ in. moulding is assumed for small frames, and 3 in. moulding for large ditto. Of course, frames without glass, for oil paintings, are the same; large or small, the price remains equal.—G. R.

Indiarubber Tubing for Hookahs.—Smoker.—You may get the tubing at a rubber merchant's, but it would not be encased in silk; and as this seems to be a *sine quâ non* with you, you should make application to a "tobacconist's sundryman." The sundrymen are men who supply the various trades they represent with any and every article that is wanted or can be asked for in their several lines. Thus Messrs. Maw & Co., Aldersgate Street, E.C., are "druggists' sundrymen." I do not know the name of any tobacconists' sundryman; but as you live in London you can consult Kelly's London Directory. Do not apologise for "badgering" me; I am glad to be "badgered" after your fashion.—Ed.

Magic Lantern.—S. R. (*Newry, Ireland*).—As far as I am aware no article has appeared on the construction of a magic lantern in Work. In reply to the question, "Say if there is an article on hand, and about when will it be printed?" I can only answer by saying there is an article on hand, which I hope at an early date to submit to the Editor, but when it will be printed is beyond the range of my knowledge; that is a secret known only to the Editor. He is the only one who can judge as to the fitness of the time. You should purchase the Index to Vol. I. of Work, and see what has appeared in "Shop" concerning the Lantern.—O. B.

Fishing-Rod.—Cooper (*Kentish Town*).—Such a rod as you require need differ only from an ordinary one by being stiffer. If you make it with standing rings, it will be all the better. A short article on home-made fishing rods is in the Editor's hands, and may possibly have appeared ere this meets your eye.—D. D.

Advertisements.—N. L. B. (*Grantham*).—This subject has already been referred to several times, and nothing more can be said on it in "Shop."

Stilts.—W. H. L. (*Southwark*).—Any good tough wood will do, but if you have a choice among the most commonly attainable kinds, perhaps ash will be most suitable. As you ask for hints, I may suggest that the height you propose making them is far too great for a novice, and if strapped to the knee will be dangerous and useless.—D. D.

Staining.—Mona.—The wood to which you refer has probably been stained first and then oiled; but of course without seeing it it is impossible to say definitely. Any way, you should have no difficulty in attaining your object by this means, and it is certainly the usual method of making a light wood darker. Try the effect on waste bits of wood of various stains, and select the one you like best before staining your fittings.—D. D.

Fretwork Stencils.—S. H. H. (*Brighton*).—I have never heard of white Bristol cardboard fretwork stencils, and do not think that any are prepared for sale. If you have seen them they were probably made by, or specially for, the user. They certainly are not part of the ordinary stock-in-trade of publishers of fretwork designs. If you want some, why not get the designs, mount them on white Bristol, or any other cardboard, and cut them out with a penknife?—D. A.

Books on Electrical Engineering.—Engineer.—When you ask for the best book on electrical engineering, your question covers a wide subject embracing all that pertains to the best engineering combined with a perfect knowledge of all that pertains to electrical science. It is clear, therefore, that no book outside an encyclopedia could contain all you ask for. If you have a knowledge of engineering, and wish to study its application to electrical work, get Sprague's "Electricity: Its Theory, Sources, and Application," price 15s., and Thompson's "Dynamo-Electric Machinery," price 16s. You may also learn something from Fiske's "Elements of Electrical Engineering," obtained from Spon & Co., at 10s. 6d. I have a very high opinion of Joshua Rose's book. His writings are all very good, because so clearly expressed in every detail.—G. E. B.

Casting in Plaster.—W. G. (*Stoke-on-Trent*).—I am much of the opinion of this correspondent as to experience giving a man the best right to be heard on practical matters; but I would remind him that possibly the sculptor who writes under the name of "Mark Mallett" may be a person of longer experience than his critic. W. G. claims fifteen years' practice; Mark Mallett has been a worker in plaster more than twice that time, and was exhibiting statuary of his own modelling and casting at the Royal Academy and elsewhere in the days, probably, when W. G. was mastering his A B C. He is therefore no novice in the particular kind of work under consideration. If W. G. prefers to use his hand for mixing and throwing on his plaster, no one need object to his so doing, neither need anyone object if he prefers to use his fingers in eating his food; but he need not therefore cavil at Mark Mallett, who elects to use a spoon for his plaster, and a fork for his pork. When two methods lead to the same end, the more cleanly one is to be

preferred. The point is merely one of taste and habit. The second question raised by him as to whether hoop-iron is not better than small bar-iron for strengthening moulds is not a matter of so much indifference; the irons are used to make the moulds rigid, and hoop-iron will not do this like bar-iron. But what he calls my "greatest error" is my statement that if a waste mould is thoroughly saturated with water, the cast will not adhere to it, and that any grease or other foreign substance applied to make the cast leave is superfluous. I can only repeat that such is the fact: that I have cast numberless models in this way, and that he or any other person can easily prove it who chooses to do so. I can only suppose that he must in some strange manner have misunderstood me. I would suggest to him that when in future he undertakes to criticise anyone who may possibly know more about the subject in question than himself, a little modesty may not be out of place.—M. M.

Heating Plant Case. — J. T. (*Hull*). —I am afraid that it will be a work of some difficulty for you to heat your little greenhouse in the way that you suggest; it is so very small that the expense of fitting up a constant supply boiler with piping would be much greater than the total cost of the whole concern. I can, however, suggest a plan that might answer, and that would cost little to try, at any rate. As I understand your letter, the case is in front of a window, looking into your yard; make, then, a small stand or table (a bracket shelf fixed to the wall would answer as well), place it at one end of your case, buy an ordinary small-sized oil stove, and set it on the table; on top of the oil stove place a tin boiler, to hold, say, about one gallon; into this boiler, about 1 in. from the boiler, make two holes, 1 in. diameter. Procure as much 1 in. tubing as will go round the sides of your case (inside, of course); insert the two ends into the holes in the boiler, and solder them firmly. You can now fill the boiler with water, light your stove, and the hot water which goes through the piping will heat the plants; of course, you must regulate the stove to obtain the proper amount of heat, and use a thermometer inside to denote the temperature. Cover in the boiler with either wood or sheet iron, and be sure, if you have a lid on it, to have an escape hole for the steam, otherwise you may have an explosion. The height of the boiler stand from the ground will be regulated by the size, or height, of the stove and the boiler, which you can easily find. As to the supply, you will have to add water from time to time to make up for the evaporation. By the use of a piece of wood in the boiler as a float, you can arrange, with a little ingenuity, to have an indicator inside the house to let you know when the boiler requires filling up, or you may cause it to ring a small bell. Perhaps from these few hints you will be able to fit up the kind of thing you require—at least, I hope so; and allow me to thank you for that sketch—it showed exactly what you wanted.—G. LE B.

Hinge. — G. W. B. (*Leyton*).—Hinge the cover with two brass butts in the usual way. Then get two curved springs, only slightly cambered, and screw one end of each on the top edges of the box ends, letting them in slightly, so that when the cover is down and fastened it will lie close in the joint, and the springs be pressed flat into their recesses. When the lock or the hooks are unfastened, the curve of the spring, being released, will cause the cover to fly upwards.—J.

Banjo and Dulcimer Making.—G. H. (*Camberwell*).—You can obtain the Index to Vol. I. of WORK from the publishers, Messrs. Cassell & Co., post free, for 1½d., or from your bookseller or newsagent for 1d., and you will then be able to see what has already appeared on the subjects named.—ED.

Answers in "Shop."—X. Y.—Replies to questions in "Shop" are given as quickly as space will allow. I agree with you entirely as to the desirability of giving an answer to each query in the shortest possible time, and I can assure you that in most cases this is done to the best of our ability.—ED.

Keying on Bicycle Crank.—J. M. E. (*Openshaw*).—File the flattened part on the axle *dead flat*. Then file out the *slot* in the crank with a square file, thus forming a fresh square slot, then make a new key from a bit of steel to fit exactly, so that when driven home it will fit very tightly. The key should be no longer than will just pass through the eye of the crank. I may mention that it requires practical experience in this kind of work to make a successful job, and without it J. M. E. is not likely to succeed. Even by practical makers the cranks have a trick of coming off when least wanted.—A. S. P.

Square Hole Drill. — BLACKSMITH. — I am obliged to you for the cutting you send with reference to the square hole drills recently introduced. One of them has been shown to me, but as I have not yet received a specimen drill for testing, I am unable to do more than testify the fact of their existence. As soon as I receive one from the makers, a full description both of the drill and its performance shall be given.—ED.

Wood Buying.—PRACTICAL.—Write to Messrs. D. Witt & Palmer, 168, Drummond Street, Euston Square, N.W., who are now supplying Hungarian oak boards at low prices. These oak boards are equal to any Odessa crown, and are square, and free from sap. They will also quote for walnut and mahogany; also try Snewin's, Back Hill, Hatton Garden, E.C.—A. J. H.

Repairing Old Sink.—G. H. (*Paddington*).—It is always a difficult job to solder an old zinc-lined sink, the grease, etc., seem to penetrate the very pores of the metal, therefore I am not surprised that you failed to make a good job, though I suspect that you did not persevere with the scraping long enough, for although difficult, it is not impossible, and with good clean surface and raw spirits you ought to have succeeded. I do not think that cement will answer, as it will crack away. I should take a piece of zinc about a foot square, cut a hole in the centre slightly smaller than the rim that the grating drops in, place it in position over the grating, mark round the square, and then well scrape the sink a ½ in. each side of the line; scrape clean the brass rim, replace the new piece, tack it in several places, and then solder it, first round the grating frame, and then the four sides of the square. This will make a good job, and I fail to see any other way except relining the sink.—R. A.

Asbestos Cloth.—BURNT ONE. — You can get asbestos cloth, that I think will serve your purpose very well, from Bell's Asbestos Company, Limited, 118, Southwark Street, London, S.E.; the price I cannot tell you, as it varies considerably in the different styles and thicknesses; but if you apply to the firm, they will, no doubt, inform you if you give full particulars of what you require. The Birmingham Agency is 7, John Bright Street.—R. A.

Various.—K. M. D. (*Harling*). — Surely you cannot seriously think that the "Shop" columns are too short, seeing that all questions coming within the scope of WORK are answered as fully as possible. I say as "possible" advisedly, for sometimes questions are so vague that even the wisdom of Solomon would hardly enable those of us whose duty it is to reply to understand what is asked. I answer your questions as follows in the hope that I understand them:—(1) The best thing you can do to restore (as far as it can be restored) faded morocco is to go over the surface very lightly with a little French polish. If you want to give it a little colour, put some appropriate colouring material in the polish. This answers your inquiry about green morocco, though it is possible you use the word "seating" to distinguish the covering from morocco. If so, say what kind of seating you refer to. (2) From any good dealer in cycling appliances, or from many oil-and-colourmen. Buy it in any quantity to suit yourself, and arrange with the dealer who supplies you about the price. Surely this compound question need not have been sent if you had chosen to consider. (3) Use any of the "enamel" paints. It would be absurd for you to think of making it yourself. (4) Use any ordinary "mahogany" stain. You can easily make one of Vandyke brown, Bismarck brown, and water. The more the latter brown is used the redder will be the stain. Mind, that is a very powerful pigment. (5) Any good, hard varnish is suitable for the purpose; but how on earth can you expect a varnish to "leave wood free from knots and unevenness?" If the wood has knots in it, no varnish will remove them, and to avoid unevenness, see that the work is properly finished "in the white." (6) I know of no works, illustrated or otherwise, bearing on "arionauts," and, as far as I am aware, no arrangements have been made or contemplated for any articles or sketches bearing on the subject to appear in WORK. Your "idea that there must be ultimate success in the science" of aërial locomotion is a very old one. Birds have managed to fly ever since they existed, but the *genus homo* has not been able to do so. If you can show us how to fly, by all means send the Editor an article, which, of course, must be based on your personal experience, on approval.—D. D.

Colonial Patents.—A DABBLER (*Pontypridd*). —The words referred to in No. 35 should have been—"If we require protection in Great Britain for inventions communicated from the colonies or abroad, it will be marked A¹." If our correspondent looks back he will find that the oversight was duly explained in subsequent numbers. As regards obtaining protection in the colonies, he will certainly find that additional outlay must be incurred. In the Official Circular of Information, published by the Patent Office (Sec. 21), he will read, "Applications for colonial or foreign patents must be made to the Government of the colony or foreign state in which protection is desired. Most of the colonial and foreign patent laws may be seen in the free library of the Patent Office," Southampton Buildings, Chancery Lane, London, W.C.—C. C. C.

Wood for Chip Carving. — DELPH. — Lime wood is the best wood to practice the chip carving on, as it has a nice surface and is easy to draw on; the only objection to it is its light colour. Best American walnut does very nicely; the white wood which is used for little articles made for painting on, and sold at many fancy shops, is also suitable—in fact, any wood with a close grain can be used, and even a smooth piece of oak, although it is not so easy to work on. The tools mentioned in my article (WORK, June 6th) are the only ones required, but, if you wish to do larger work, the sizes of the tools can be increased: thus, instead of a ¼ in. spade a ½ in. one may be used, and so on with all the tools.—M. E. R.

Patent — Provisional Protection. — T. H. (*Wandsworth*) should refer to the article, "Taking out a Patent," No. 35, page 545, Vol. I. of WORK. He will there find answers to all his questions except the last. If he wishes to see the Specifications *at length*, he should go to the British Museum, where they are open to the public, free of cost, daily. But if, as is most probable, the *Abridgments* of Specifications will serve his turn, he can find them at some thirty different libraries in London. Possibly the Free Public Library, Great Smith Street, Westminster, will be as convenient for him as any.—C. C. C.

Telephone.—X. Y.—I have read your letter very carefully, and can sympathise with you in your praiseworthy desire to make and erect telephone stations at your mill. But really I cannot advise you to begin to make these instruments for several reasons. The first one is simply that you cannot do so without infringing upon the United Telephone Company's rights. And in the face of that it is not worth while taking up space in "Shop" stating the others. However, I will tell you what I would be inclined to do were I in your circumstances. I would make and erect a pair of "mechanical telephones," which would meet your requirements most excellently; and, besides, they would not be so difficult to construct, nor, by using them, would you be liable to prosecution by any company. You might think over this, and if you care to write again I will give you drawings and sizes and instructions for erecting. If you decide upon this, you may fill up your ground where you are putting your gas pipes, as this wire must be overhead.—W. D.

Telephone.—M. H. P. (*Glasgow*).—The answer to this query will no doubt be found in "Shop," for I have already given two or three different connections for telephones; I am sorry I have not my back numbers beside me, so therefore cannot quote the pages. Your sketch is not sufficiently plain to enable me to give a sketch of connections. Just turn up WORK and see if anything given there will suit; you will learn a lot by experimenting.—W. D.

Yacht.—ENGINEER (*Huddersfield*).—After being so long in one line of business, commencing afresh in another is a course requiring the most serious consideration. No doubt the work you mention is very creditable, more especially the crane, for few boys of seven would be able to handle so large a work. One thing, however, I must impress upon you: amateur work, executed necessarily in a disconnected way, so far as occupation upon it is concerned, is no preparation for the duties of a workshop. Attendance at the technical school is without doubt a very great assistance; but if you wish to learn the trade of an engineer or shipwright you must pass through the shops; this means serving an apprenticeship, and I suppose you do not wish to work as an "odd man." Starting at your age you would be under many disadvantages. You would, as far as pay is concerned, practically give up several years of your life; you will not learn as quickly as you would have done seven years back, and you will find it difficult to acquire a tradesmanlike way of handling the tools; you would be practically several years behind those of your own age were you to make a start amongst workmen brought up to the trade. If you are of an inventive turn of mind, your technical studies will tend to keep you clear of absurdities such as "Keeley motors" and perpetual motion machines, and you may, without entering the shops, obtain some benefit from your mechanical aptitude; but my advice is, follow your business for your living, and keep mechanics for your hobby.—F. C.

Electrical Machine.—T. C. (*Hetton Downs*).—An article on the construction of an electrical machine will appear very shortly.—ED.

Stereoscopic Slides.—T. C. (*Hetton Downs*).—For stereoscopic slides, apply to the London Stereoscopic Co., Cheapside, E.C., or Mr. Walter Tyler, Waterloo Bridge Road, S.E.—ED.

Improved Drawing Table.—H. H. W. (*Blackheath, S.E.*).—I am sorry to say that I do not know whether or not the Cincinnati makers of this table have any agent for its sale in London. I am inclined to think they have not, and that the best thing you could do would be to write direct to the manufacturers, and have one sent over to you. They will give you information as to prices, which I do not know. Unfortunately, there are many things of which I am ignorant, and this is one of them.—ED.

Decorated and Coloured Tin.—H. L. (*Berks*). —I do not know the process of decorating tin plates, but I am quite certain it would not pay you to do it yourself, especially as you only want a limited quantity. You would most likely be able to get it from the Decorated Tin Plate Company, Neath.—R. A.

Coloured Metal.—J. S. (*Ilkeston*).—See reply to H. L. above.—R. A.

Papier-Mâché.—RAPIER.—Apart from soaking in water to loosen the fibres, the reduction of paper to a pulp is a purely mechanical process, the machine used being akin to the "devil" used in paper-making. All shoddy materials are probably produced in much the same way. I believe that the boot buttons of which RAPIER speaks are made from scrap leather torn up and mixed with some cohesive substance. The French "factum," or shoddy leather, is produced in much the same way, but the cohesive material then used is more elastic. Of varnishes, RAPIER can read in our articles on Papier-mâché. Linseed oil hardens the papier-mâché, and makes it better resist damp. Unless thus soaked, the papier-mâché would also tear up under the plane and rag under the saw.—S. W.

Wood Letters for Outdoor Signs. — J. C. (*Birmingham*).—The best job that can be made

of such work is to get ¾ in. yellow pine, or pitch pine, if you can get it very dry, 12 in. wide—13 ft. lengths—which should cost you under 4d. per foot super. It should be "*best*," not "best seconds," free from knots and shakes. Plane these over one side only; cut them into 12 in. lengths; then with a toothing plane, surface them as if for veneering. Prepare a flat surface, and, if possible, a press, to put them in; if you cannot get a press, obtain some heavy weights. Then with thin best Scotch glue, very hot, place two of these square pieces, previously warmed at a fire, face to face, but the *grain of one running the opposite way to the grain of the other*. Rub out all the glue you can, and put them under heavy pressure. Then warm two others in like manner, glue them quickly, and rub out, and so on. Let them remain twelve hours, then face them all on one side, square up one edge to work to, gauge them to your required thickness—viz., 1¼ in.—strap off the back with the jack-plane, smooth the face, but do not glass-paper it. Mix a small quantity of whiting—gilders' is the best—with warm water, say ½ lb. to the quart or three pints of water; rub it, smooth through your fingers so as to avoid all lumps, and then pour in about two spoonfuls of thin glue, and well mix by stirring. Prime the faces over with this wash, technically called "skeebo," let them dry thoroughly, and paper off with No. 1 and finish with No. 0, first across the grain and afterwards with it. You can then draw with a pencil as freely and as black as on paper. Having drawn your letters of any design you like, cut them out with a fret saw. Trim the soffits or edges up with a fine rasp, then with a file, and then with No. 1 glass-paper folded round your file. Then give the edges two coats of "skeebo," let each dry, and the faces a second coat, taking care that the "skeebo," is pretty warm whenever you use it. Now paper off again with No. 0 both edges and face, and, when quite smooth, give them all over edges and face a priming of gold size and boiled oil, thinned with turps or terebine, laid on as thinly as you can with a nicely half-worn sash-tool, and leave no brush marks. Let this set a day or two, if you can spare the time, but if you hang them up face to the wall, they will be hard enough in twelve hours for you to paint over with red lead priming at the back, so that you may give two coats at least to the backs whilst the faces and edges are getting thoroughly hard. Now proceed to gild the faces—and edges too, if you prefer it. I think myself, although it is a matter of taste, that they look far richer with the edges painted either vermilion or emerald green, and you gain an advantage by having paint instead of gilding on such parts of the edges, as water is likely to lie upon or lodge in after rain. If you decide to paint them, finish gilding the faces first, and then give the edges two coats of the colour you prefer. Then varnish the whole with colourless copal. These letters will never warp or break. You do not say whether you want to plant them on to a board or to hang them on strained wires. In the former case they should be screwed from the back of the board with screws that will not come through; two screws to a letter—one at top, the other at bottom. If to be hung on a wire, screw-eyes, to be had of any ironmonger, should be screwed into the backs, one at each side of the letter, 3 in. from the tops, and one at the same distance from the bottom, either in the centre, or as near it as you can. These eyes are about 2d. to 3d. per dozen, according to size, so if you prefer to use four instead of three, you can, but I think two at top and one at bottom would be sufficient for 12 in. letters. Having spaced your letters out on the wire, take some fine copper lapping wire, and pass it round the eye and the strained wire, and twist tight with the pliers, to prevent the letters sliding out of place.—J. W. H.

Rubber Shoes for Crutches.—J. M. (*Glasgow*).—Referring to my article on the above subject, Macintosh & Co.'s address is Cambridge Street, Manchester. They also have establishments in Glasgow: 176, Buchanan Street; Liverpool: 9, Chapel Street; and in London: 30, Fore Street, City. They state their price at 7s. 6d. per dozen, cash with order. See also my replies to A. S. (*Musselburgh*) and J. H. (*Redcar*).—J. W. H.

Glass Signs.—W. McC. (*Hull*) asks where he can best obtain the leaded glass signs such as one sees over the porticoes of London theatres. I recommend him to write to Mr. F. W. Sharp, Stained Glass Works, Windsor (a subscriber to WORK), or to Messrs. Jones & Firmin, 120, Blackfriars Road, S.E.—J. W. H.

Smudges in French Polishing.—E. L. T. (*Oporto*).—The fact that you are able to procure such excellent spirits ought, provided the gums are equally good, to be very much in your favour. The faults appear to be not in the materials, but in the finishing stages, for possibly you try to make the spirit rubber do what the polish rubber ought; in other words, if the polish rubber is used aright, no smudges or smears should be left for the spirit rubber to remove, only a semi-transparent film of oil. In removing this you may have used your spirit rubber too wet, so softening up the gums and, perchance, breaking up the surface. The fact that you get on all right with the filling and bodying-up proves this. When you take up the work again, and the grain appears full, with just a little over, gradually thin out your rubber with spirits, so using less polish and more spirits, till the rubber contains little else than spirit, using no more oil than is necessary to make the gums work easily, taking care that the rubber has a good flat face, and the rag covering is free from creases. Then try to finish without the aid of a spirit rubber (many an amateur fails at this point), but instead use a pad of clean soft rag, folded to resemble a polish rubber—*i.e.*, resembling a pear cut in half, not round as so often seen. Get this fairly damp with spirits, not merely a few drops on the surface, pass on to the work lightly at first, using pressure as it gets a little dried, rub away to your heart's content, and note the result. In re-polishing such as the wardrobe to which you refer, possibly you use the polish too thick; try the effect of using it thinner, and gradually thin out in the rubber as for new work. Many thanks for your kind appreciation of WORK. Am pleased to learn you turn its contents to such practical account, and shall be pleased to learn how you get on in this.—W. J. M.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

*** The Editor of WORK will be glad to see a greater spirit of co-operation shown by readers in replying to queries submitted in Section III. of "Shop." Many of these are somewhat difficult to answer, through lack of knowledge with regard to some, and lack of experience with regard to others. Editors, and those who work with them, are by no means omniscient, and are glad at times of a little outside help. Indeed, Section III. was started, that questions requiring special knowledge and experience might meet the eye of one or other of the thousands of readers of WORK who may possess either or both, and also to give readers something to do. So, readers, please hurry up with answers to all questions that are propounded in Section III.

Artificial Eyes.—F. T. (*London, N.*) writes:—"Would any reader kindly tell me if artificial eyes can be re-enamelled? If so, where can this be done?"

Graph that does not want Washing.—W. W. (*Chelsea*) wishes to hear of a graph of the kind indicated in the heading to this notice.

Artificial Water.—W. E. D. (*Hull*) writes:—"Will any reader say where I can obtain artificial water to put in a case with models of vessels? The price of same, and if it can be made? If so, how?"

Venetian Blinds.—ASPIRANT writes:—"There is an appliance used for rapidly painting these, called, I think, a 'boat.' I should be glad of instructions for making and using same."

Mandoline.—G. H. (*Walton-on-Thames*) is anxious to make a canoe-shaped bottom mandoline (Neapolitan is probably the name of it). He has seen the American inserted a few weeks back, and would be glad to have directions, etc., for making the kind of mandoline specified.

Canadian Toboggan.—W. F. (*Tunbridge Wells*) writes:—"I want to make a Canadian toboggan; can any reader supply a plan how to make it and what to make it of, or inform me where I can buy a plan?"

Plane Irons.—ONE IN DISTRESS writes:—"I am a joiner by trade, and in sharpening my plane irons, instead of getting an edge on them I rolled it off. I have lost the middle and third finger of my right hand, and I cannot put any strength on them. Can you tell me how to sharpen them? I have heard talk of irons that do not want sharpening or grinding; can any correspondent inform me of these?"

Harp.—H. W. P. (*Hull*) writes:—"I have a harp; will some kind reader give me the make of it? It has lost the right side plate that should have borne the maker's name; it has pedals, and the top is a basket of flowers instead of the round pattern at the top of the poll, the flowers partly covering the scroll. It has an Egyptian pattern running down each side of the belly. I should be pleased to know the make, and about the value of the instrument."

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Copying Apparatus.—A. A. (*Hawkesbury*) writes in reply to J. C. M. (*Bristol*) (see page 456, Vol. II.), and sends the following prices of a copying apparatus he uses:—Compo-lithograph, octavo size, 6s.; quarto, 11s. 6d.; foolscap, 14s.; folio, 20s.; brief, 25s. Cyclostyle, octavo, 21s.; quarto, 27s. 6d.; foolscap, 31s. 6d.; brief, 45s.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. G. (*Islington, N.*); W. W. H. (*Leyton*); M. T. (*Clapham, S.W.*); H. H. (*Finsbury, E.C.*); J. E. J. (*Huddersfield*); L. S. L. (*Kirkcaldy*); C. C. (*Rugby*); ÆON; G. E. B. (*Oswaldtwisle*); W. B. (*Derby*); F. E. F. (*London, W.*); W. P. (*Liverpool*); F. J. K. (*London, W.*); J. T. D. (*Nottingham*); W. G. (*Dudley*); H. C. (*Wednesbury*); J. J. O. (*Charlton*); J. P. (*Devonport*); A. F. (*London, S.E.*); W. E. G. (*Sutton*); J. W. (*Old Charlton*); EXPERIMENT; H. J. T. (*Cambridge*); A. W. W. (*Baltinglass*); NAD NEOGDUG; A HANDICRAFTSWOMAN; W. H. C. (*Ilkeston*); J. C. (*Ealing Dean*); E. A. P. (*Tullow*); J. C. E. (*Whitchurch*); H. M. (*Melsham*), SCRIBER; A. E. L. (*Congleton*); C. J. D. A. (*Eastbourne*); J. B. (*Dundee*), CYMRO DEWI; W. F. J. (*London, N.W.*); H. W. (*Strabane*); AMATEUR; H. C. (*Maidstone*); F. P. (*Dover*); J. C. (*Plymouth*); A. P. H. (*Bedminster*); J. G. B. (*Bearsden*); ONE IN TROUBLE; GLASGOW; E. A. (*Dublin*); M. D. C. (*Wavertree*); W. H. P. (*Hornsey*); BUSY BEE; HOBBY; A. E. S. (*London, S.E.*); W. J. M. (*West Cowes*); G. C. B. (*Sutton*).

Trade Notes and Memoranda.

IN the report for 1889 of the Massachusetts Bureau of Statistics of Labour, returns are given from 1,615 different manufacturing establishments in the State in answer to the question, "What relation does the cost of labour bear to the cost of the product as it lies in the manufacturer's hands?" The percentage of wages to total cost of production in the various industries varies considerably. For example, in the following industries the percentage of wages is high—viz., clocks and watches, 77·06 per cent.; concrete walks, paving, etc., 71·22 per cent.; earthen plaster and stoneware, 66·09 per cent.; glass, 61·76 per cent.; models and patterns, 61·51 per cent.; brick, tiles, and sewer pipe, 56·71 per cent.; stone, 56·47 per cent.; fancy articles, 56·65 per cent.; crayons, pencils, crucibles, etc., 54·71 per cent.; salt, 52·23 per cent.; toys and games, 51·74 per cent.; and cooking, lighting, and heating apparatus, 51·24 per cent. Industries with low percentages of labour cost are:—chemical preparations, compounded, 9·27 per cent.; cordage and twine, 13·97 per cent.; fertilisers, 8·57 per cent.; food preparations, 12·44 per cent.; glue, isinglass, and starch, 11·97 per cent.; hair work (animal and human), 12·19 per cent.; leather, 14·38 per cent.; liquors, malt, distilled and fermented, 13·46 per cent.; oils and illuminating fluids, 5·92 per cent.; polishes and dressing, 11·10 per cent.; tallow candles, soap, and grease, 9 per cent. These are industries in which the raw material is itself a manufactured article, involving labour in its production. The bulk of the industries come between these two extremes of percentage of labour cost.

THE following is from the official paper sent out by the Emigrants' Information Office, 31, Broadway, Westminster, S.W.:—The annual Penny Handbooks—one on each colony, with maps—and the Emigration Statutes and Professional Handbooks, price 3d. each; the whole being also bound together, price 2s., issued by this office, show the present prospects of emigration to the colonies. Male and female emigrants for Queensland, Western Australia, and the Cape and Natal, may, in certain cases, obtain through friends or employers of labour in those colonies passages at reduced rates. Queensland also offers free and assisted passages to unmarried female servants, seamstresses, miners, navvies, and farm labourers, but for male labour there is just now no demand in the colony; and Western Australia offers assisted passages to farmers with capital. Farmers and others with capital are wanted in all parts; female servants in Canada and Australia, agricultural labourers in Australasia, and miners in Tasmania and New Zealand. There is no special demand for mechanics, except in some few localities, as for carpenters and bricklayers in Natal. The demand for mechanics in Cape Colony, to which attention was drawn last April, has since slackened, owing to the depression of the Transvaal Goldfields, and consequent return of large numbers of workmen to Cape Colony and Natal. Emigration to the Transvaal under present circumstances is not advised. It should be noted that it is too late in the year for men to go to Canada, unless they go to friends or have money enough to keep them through the winter.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Waterproof Advertising Paper Letters and Figures in all colours and sizes. Best and cheapest. Liberal terms to agents. Sample sheets, gratis. Factory, 17, Arthur Street, London, W.C. [1 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [2 R

Glass Silverer and Beveller, Lead Glazing, &c.—EDWIN HAMMOND, Junction Road, Romford, Essex. Please state requirements. [5 R

Joiners' Tool List free.—BOOTH BROTHERS, Dublin. [6 R

Fretwork, Carving, Brass, Leather, and Poker Work.—Speciality in ornamented ivorine for painting. Illustrated Catalogues of tools, 800 Illustrations, 6d.—HARGER BROS., Settle, Yorks. [7 R

Picture Moulds, 9 ft., 2¼ in., gilt, 9d.; others equally cheap. Special Trade Terms.—DENTS, Importers, Tamworth. [8 R

Amateur Engineering.—FLEMING, 63, Stirling Street, Glasgow. [9 R

Fretwork.—Catalogue of Tools, etc., *free*. Book of Miniature Designs, 1d. stamp. BOLTON, 59, Burmantofts, Leeds. [10 R

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.

The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

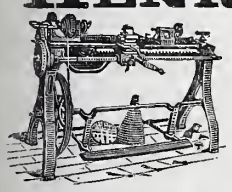
Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

NEW VOLUME just commenced. MONTHLY, price *7d.*

The World of Adventure.

"A fascinating collection of true tales of adventure by land and sea. In every respect it will prove a source of delight to boys, and to older people too."—*Scotsman.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

AMATEUR PHOTOGRAPHY.—J. H. SKINNER & CO.,

W Department, East Dereham, Norfolk.

J. H. S. & CO. have now a large Factory, with accommodation for upwards of 100 workmen, which is used exclusively for the manufacture of Photographic Apparatus of every description.

CHEAP SETS FOR BEGINNERS.

3/6 The Eclipse Camera Set. 3/6

Complete, consisting of a Polished Mahogany Sliding Bellows, ¼-plate Camera to photograph full-size carte-de-visites, with Focussing Screen, Dark Slide, Brass-mounted Lens, Brass Fittings, Developing and Fixing Solutions, Packet of Dry Plates, and full Instructions, enabling any amateur to take a good Photograph. Price 3s. 6d., or securely packed by Parcel Post, 4s.

7/6 Complete Photographic Outfit. 7/6

Comprising ECLIPSE CAMERA SET, as above; also PHOTOGRAPHIC PRINTING APPARATUS, consisting of Hardwood Printing Frame, with Brass Spring Back, Sensitised Albuminised Paper, Gold Toning Solution, Fixing Solution Glass Rods, Cards for Mounting, with complete Instructions. Also Hardwood Folding Tripod Stand and Focussing Cloth. Price 7s. 6d. Securely packed, post free, 8s. 6d. If packed in portable wood case, with hinged lid and leather strap, as in Illustration, 9d. extra.

10/6 Stanley Complete Outfit. 10/6

Including Polished Mahogany Camera with Folding Tail-board, Brass Side Bar, and Double Dark Slide in hardwood box, with leather strap, in all other respects the same as Eclipse Complete Outfit; by Parcel Post, 1s. extra. Better Outfits from 21s. up to £100. See Catalogue.

N.B.—If Apparatus does not give satisfaction, and is returned uninjured within three days of receipt, we guarantee to refund purchase-money. Catalogue of Photographic Apparatus, with over 100 Illustrations, price 2d., post free.

N.B.—Having DISSOLVED PARTNERSHIP we are offering better Cameras, Stands, Desks, &c., at 20 per cent. to 50 per cent. discount to clear. Send Post Card for Sale List.

FOO-CHOW ENAMEL.

Patented and Registered. **PRIZE MEDAL.** **REAL CHINESE.**

DRIES IN FIVE MINUTES.

For House Decoration, for renewing faded furniture, for *bric-à-brac* generally, there is nothing like it.

FOO-CHOW is the only Enamel suitable for Floors. Try the Oak and Mahogany. Can be used on any surface, oily or greasy.

The Gold, Silver, and Bronze are simply invaluable, the effect being equal to leaf gilding. For Baths it is made in White, Aqua Marine, and Cerulean Blue.

THE QUEEN states:—"The uses of Foo-Chow Enamel are practically limitless."

THE LADY states:—"In every way the most satisfactory."

THE BAZAAR states:—"Having tried other kinds of enamel, we feel quite justified in saying that it is quite the simplest and most pleasant in use."

GOLD, SILVER, BRONZE, AND ALL COLOURS.

☞ Write for Pattern Card, which will be sent POST FREE from the Manufacturers.

FOO-CHOW ENAMEL is sold everywhere in Sixpenny and One Shilling Tins; or from the Manufacturers, three stamps extra.

ADDRESS—

Donald Macpherson & Co.,
KNOT MILL, MANCHESTER,

CASSELL'S CLASSIFIED CATALOGUE, containing particulars of upwards of ONE THOUSAND VOLUMES published by Messrs. CASSELL & COMPANY, ranging in price from **THREEPENCE TO FIFTY GUINEAS,** will be sent on request *post free to any address.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

CHEAP EDITION now ready. Price *9s.*

Electricity in the Service of Man.

A Popular and Practical Treatise on the Applications of Electricity in Modern Life. With nearly 850 Illustrations.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

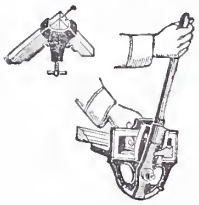
SALT REGAL.

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE**, and all other Stomachic Irregularities. **PURIFIES** the **BODY**, imparting **NEW LIFE** and **VIGOUR**. Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores; or by Post from the **MANAGER, SALT REGAL WORKS, LIVERPOOL.**

BRIGHTENS and **CLEARS** the **COMPLEXION**, and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET**, eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE**, and giving tone to the entire system.



PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine**, any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,
TOOL MAKERS, DUBLIN.

C. BRANDAUER & Co.'s
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6D. OR FOR 7 STAMPS
BIRMINGHAM.

London Warehouse: 124, NEWGATE STREET.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 85.] SATURDAY, NOVEMBER 1, 1890. [PRICE ONE PENNY.

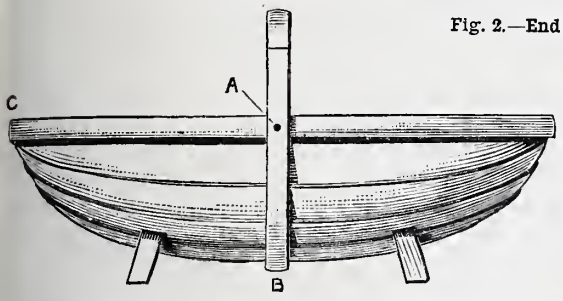


Fig. 1.—Sussex Trug Basket: side view.

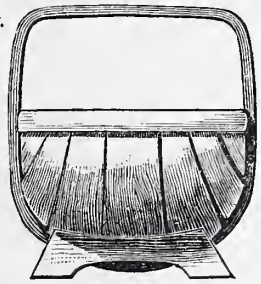


Fig. 2.—End View.

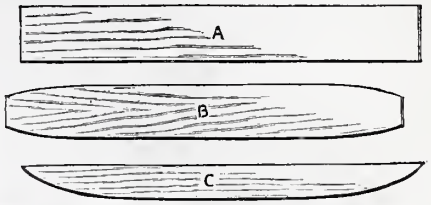


Fig. 6.—Boards—A, Middle; B, Side; C, Top Side.

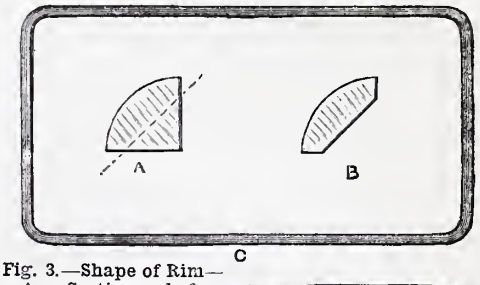


Fig. 3.—Shape of Rim—A, Section before Trimming; B, Ditto after Trimming.

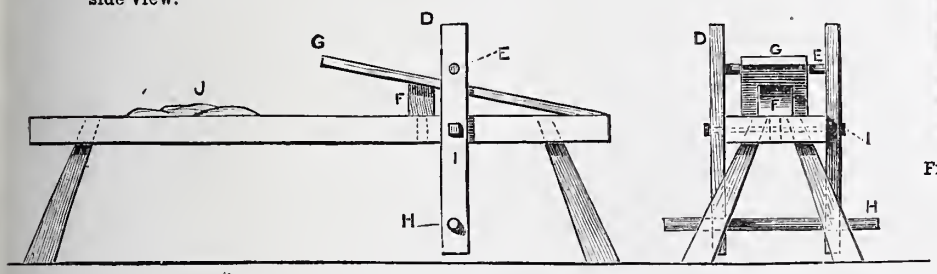


Fig. 7.—Shaving-Horse: side view.

Fig. 8.—Ditto: end view.

Fig. 4.—Shape of Handle.

Fig. 5.—Shape of Foot.

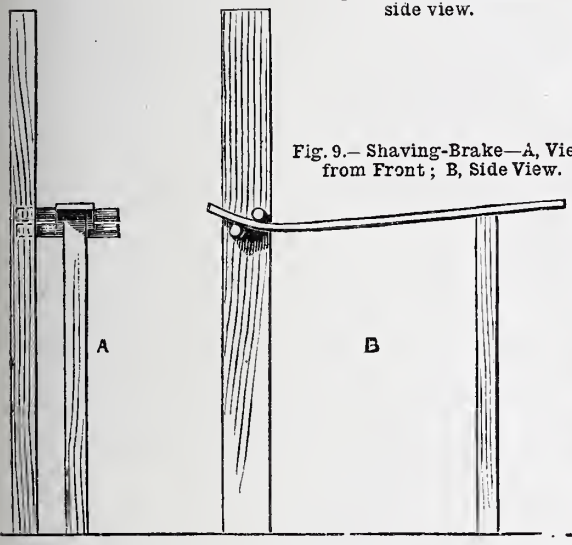


Fig. 9.—Shaving-Brake—A, View from Front; B, Side View.

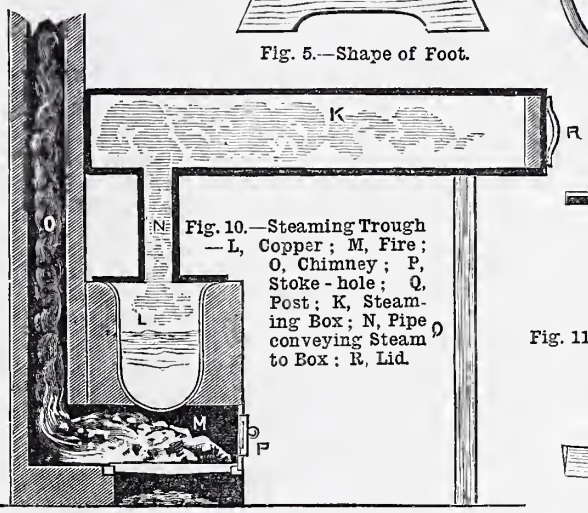


Fig. 10.—Steaming Trough—L, Copper; M, Fire; O, Chimney; P, Stoke-hole; Q, Post; K, Steaming Box; N, Pipe conveying Steam to Box; R, Lid.

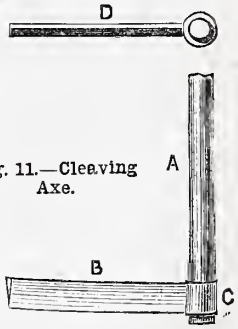


Fig. 11.—Cleaving Axe.

SUSSEX TRUG BASKETS: HOW TO MAKE THEM.

BY CHOPSTICK.

I HAVE no doubt that by far the greater majority of the readers of WORK, on seeing the above title, will exclaim, "And what are Sussex trugs?" If they will carefully follow my instructions, they will not remain in ignorance any longer. Before commencing the making proper, perhaps it will be advisable, by way of introduction, to describe what a Sussex "trug" is, and to what use it can be put. It is really a basket, but instead of being made of osiers, it is made of very thin wood. They were first invented in Sussex, and, I think, are not made anywhere in England except within a radius of ten miles of the original manufactory, which I must say is a matter for surprise, as to those who have always used them it is difficult to understand how anyone could manage without them. The uses to which they can be put are legion; the larger sizes are used in breweries, in coal-yards, in timber-yards, in gardens, and, in fact, everywhere; while the smaller sizes find a large sale at seaside towns for children; besides which some are made very ornamental, and are then used largely as ladies' work-baskets, flower-pots, etc. They are very durable; in fact, if not allowed to be continually wet, they will last a lifetime.

If there are any readers in search of something in which to make a start in business, this, I think, would be a good chance, as they would be certain to find plenty of customers, and the tools required are very

few, the timber cheap, and the trade easily learnt, which cannot be said of many things described.

I will first mention the tools required, which will have to be bought. The principal tool used is the drawing-knife, or, as it is called in some places, the draw-shave. We shall also want a hand-saw, a small axe, a cleaving axe, a hammer, and an old flat-iron; all the rest we can make ourselves. I will describe the most useful one first—that is, the shaving-horse (Fig. 7, side view, and Fig. 8, end view). To make this, we shall want a plank about six feet long and from ten to twelve inches wide—it is not particular to an inch. Into this plank, about six inches from each end, bore two one-and-a-quarter-inch holes, and drive a leg in each, so as to form a stool of the same height as a chair; be careful to bore the holes so that the legs spread well, so as to make it firm. Having got so far, the next thing will be two pieces of ash, or some other tough wood, two feet six inches long, about three inches by one and a half inches, bore two one-and-a-quarter-inch holes in each, six inches from each end, and a three-quarter-inch hole thirteen inches from the top end—these are the pieces marked D in the figures. We then want two round pieces to fit the largest holes, one three inches longer than the stool is wide, and the other nine inches longer still. These must be driven in tightly into the side pieces, so as to form a frame which will easily slip on the stool. Now bore a three-quarter-inch hole through the stool edgeways, one foot nine inches from one end, and, putting the frame on, pass a bolt through the sides of the frame and through the stool. We have now a stool with a frame swinging upon it. I should mention that the longest round piece should be at the bottom, and, if done as I intended, it will project four and a half inches each side, the reason for which I will explain in due course. The next proceeding is to get a piece of wood (any kind will do) ten inches long, and about four inches wide by three inches thick. This is the piece marked F in figures, and must be fixed in centre of stool, an inch or two nearer the long end than the bolt, before-mentioned, which the frame swings on. The best way to fix it is to tenon it through the top of stool and pin it; but any way will do so that it is firm. Having got the block fixed in position, it must be cut off on the bevel from five inches at the side towards the long part of stool, so that a board G, which should be six inches wide, will bed on top of block and fix to the short end. A glance at the side view in Fig. 7 will, I think, explain my meaning. Our shaving-horse is now complete, with the exception of the cushion to sit upon, J, which will require no explanation. Now to explain the method of using it. If we sit astride of our horse, and place the feet, one on each side, on the projecting pieces H, thrusting them forward, the frame swings on the bolt I, and clips the piece of wood we are shaving between the board G and the round piece E; and the more pressure we have to put on our work the harder our feet thrust forward, thus holding the work the tighter. I do not think anyone will fail to understand how to make and use the shaving-horse, and I may here mention that it is a very useful thing in any shop for many other things besides trug making.

The whole of the wood for the smaller trugs can be prepared on the shaving-horse; but those who go in for the larger sizes will require something else to shave the rims and handles on—this appliance is shown in Fig. 9, A being the end, and B the side view. It is simply a stump driven in the ground and two pegs driven into it, one a trifle higher than the other. The piece to be shaved is then put between the two and bent up to the top of a shorter stump, when the friction will hold it firmly. The whole affair, with a piece in position for work, is clearly shown in B (Fig. 9). The pegs and short stump should be about four feet from the ground.

The next piece of apparatus will only be required by those who go in for the largest sizes, or make in a large way to sell again. It is a steam trough for steaming the rims and handles, to make them bend easily, and also to keep their shape better. It is fitted up in connection with the common copper, or set-pan, which is found in nearly every house. In the figure (Fig. 10) L is the copper, M the fire, O the chimney, P the stoke-hole, Q, a stump to hold end of trough K, which is a water-tight box about six feet long and nine inches square, stopped at the end nearest the chimney, and fitted with a movable lid at R; a square tube N leads from the copper to the trough, and it will be plain to all that when the trough K is filled with the pieces of wood and the door R closed firmly, on the water being kept boiling for half an hour, they will get a good steaming, and will then bend as we want them. I do not think the steam trough will require any more explanation, especially as the smaller sizes can be boiled in the water, so no trough will be required.

Having now got all the tools we want, we will make a start at trug making proper. First as to the wood required. The trugs are formed of four parts, the rim (Fig. 3), the handle (Fig. 4), the feet (Fig. 5), and the boards (Fig. 6). We will take the rims and handles first: these are made from ash or chestnut poles about two inches in diameter—the straightest and most clear from knots are most suitable; these should be cut to lengths and quartered—that is, cleft through the middle—and then each piece cleft through the middle at right angles to the first cleaving; we have then four pieces in section like A (Fig. 3). We then shave off the sharp angle at the pith, and trim off any irregularities left from cleaving, and just take off all sharp edges; we have then four pieces something like B (Fig. 3) in section. The less we touch the outside the better, as that is where the strength is wanted in bending. The ends, for about six inches back, must be thinned down, so that the two will come together and form a neat joint, and look about the same size as the rest of the rim. The handles are made in exactly the same way. The shaving being done, the next thing is to steam them or boil them, as the case may be, which requires no instructions; so I will take that as done, and proceed to the putting together. This the young beginner will manage best by making a board of the same shape as a rim. We will make a trug about fifteen inches by eight inches, so all we want is a board half an inch less each way, with the corners rounded off; we can then bend the rim round edge of board and nail the splicing with about three or four nails, and it is done. The splicing should be in the middle of the long side, as at C (Fig. 3). The handle will be managed in the same way, only, of course, the board will have to be the shape of Fig. 4; and as the handle nails on outside the rim, the inside of it will have to be as wide as the outside of the latter, but it is not very particular to a quarter of an inch, as they will yield one to another. It may seem that an immense quantity of boards will be required for the different sizes, but after a little practice the workman will learn to dispense with them altogether, and bend both handles and rims by his eye alone, as they do in the trade. The handle and rim being ready, we must nail them together; to do so, slip the handle over the rim, holding it at right angles to same, and, laying the part where they intersect on a solid place, drive a nail right through as at A (Fig. 1); then turn the whole over and do the other side the same, clinch the nails inside, and the frame for our trug is done. We will now lay it on one side while preparing the boards (Fig. 6). These are made from sallow poles, which is a soft kind of willow; it is usually called "sally," so if you cannot get it by the name of "sallow" try "sally," when you will most likely succeed. The poles are cut off to the lengths required for the various sizes; the one we are about will require the boards twenty-one inches long; and it is then cleft out as thin as possible—the thinner the better—as there is then less shaving to do. After cleaving out with the cleaving axe, we lay them in a pile by the side of the shaving-horse, so that we can reach them without moving from our seat, and placing a piece in position on the board G (Fig. 7), we place our feet on the projecting pieces H, and then shave one side plain; then turn it over and do the other side the same, but a trifle round so as to make them thinnest at the edges; then turn ends and do it the same again, and our board is finished. They can be made to any of the shapes shown in Fig. 6, whichever will suit best, as it is a very accommodating trade, and they will all come in. Now, having finished shaving our stock of boards, we will put the bottom in our first trug. Select a board something like A (Fig. 6), and press it down in the framework and drive a nail into the handle at B (Fig. 1), then bend the board to the shape as shown in the figure, and nail again at C. Do the other end the same, and the first board is fixed, as one nail at each place is enough. Then take another board something like B (Fig. 6), and proceed in the same way, just allowing the board to lap over the edge of the first one, and so proceed on each side from the centre till the trug is finished. The last board on each side will have to be something like C (Fig. 6), and will most likely require fitting a little to the rim, which is best done with a sharp knife; the same tool is also used to trim off ends of boards after they are nailed in. It will be found that it takes about seven boards to complete the job, though, if they are of a good width, five will do it, and again, if very narrow, it will require more; but there should always be an odd number—that is, the same number on each side of the centre one.

All that we have to do now is to make and put on the feet (Fig. 5). These can be made from any odds and ends of either kind of wood, and are made about an inch thick to the shape shown, and nailed through from the inside, and our trug is complete; and, though it can hardly be expected that it will compare favourably with those made by the trade, there is no valuable timber spoiled, nor are there any insurmountable difficulties to encounter before we can make one that will both be a credit to the maker and also very useful in the household.

As there may be some of the readers of WORK who do not understand what I mean by a cleaving axe, I have given a rough

sketch of one in Fig. 11. A is the handle of wood, B is the blade, and C the eye of the blade in which the handle A is fixed; D is a plan of the blade looking at the bottom. To use it, the piece of wood to be cleft is stood on one end, and the edge laid on it where it is to be split, the handle being held upright in the left hand and the blade struck on the thick part with a billet of wood until it is well in, when the handle is used as a lever and at once splits the wood. I do not think anyone can fail to understand my instructions for trug making, but if there should be anything not quite clear, I will at once explain it in "Shop" on being requested to do so. I have not said anything about the price of the timber, as that will naturally vary with different parts of the country; but it is very cheap anywhere, as sufficient could be bought for two shillings to make a good start with. I omitted to say that the proper nails to use are the stout wire with large flat heads, and the flat-iron before mentioned is to clinch them on; they can be driven in fearlessly, as there is no fear of splitting the wood.

If any reader would like a specimen trug basket to work from—and I cannot deny that it would be of great assistance to him—I have made arrangements so that one will be forwarded on receipt of twelve penny stamps; but as I do not think it right to give anyone a free advertisement, I will not give any address, but the Editor will no doubt forward all letters to me, and I will send them to the makers, when the trugs will be sent direct from the works. I will now conclude this short but, I hope, useful paper, and I hope that every reader to whom it applies will find trug baskets as useful as the writer has, both in the north and south.

PRACTICAL DETAILS OF BOOKBINDING.

BY GILBERT CLARKSON.

Paper Ruling and Account-Book Binding.

In this, my last paper on this subject, I have to treat of paper ruling and account-book binding.

The mere mention of this subject reminds me of some rather amusing remarks which I read not long ago in a contemporary, about the mysterious nature of account-book binding (vellum binding, I think it was there called). I have yet to find out where the mystery lies. Account books are ruled and bound in the open shop; there are no trade secrets about either of them. The very boy that sweeps the floor and takes charge of the glue and paste knows all about them. Certainly, a thing *is* always mysterious if one has no knowledge of it.

Paper ruling will require very little description, it is such a simple matter. All that is needed is a machine (which may be of very simple construction), a few pen points, inks of different colours—the most general being red and blue, or, technically speaking, "faint and red"—a few strips of flannel, some person to turn the winch handle, and a boy or girl to feed the sheets, and the thing is almost done.

The essential parts of a ruling machine, are a pen frame, and an endless band of cloth revolving on rollers, to carry the sheets of paper underneath the pens.

Of late years great improvements have been made in these machines. Formerly they were almost as slow in their movements as Caxton's printing press. The ruler sat on a stool at the front of the machine (if I can use the term for four bed-posts and two rollers), turning the handle with his right hand, and with his left catching the sheets as they were ruled, and spreading them all over the table to dry; and as these had to be gathered together and knocked up twice in the course of ruling both sides of the paper, and taking also into consideration the stops and starts—such as striking from the head-line, double pens running "blind," single pens running light—incidental to paper ruling, it will readily be understood that this operation was a very slow one indeed. I suppose he would be considered a smart ruler who could manage to put through a ream of faints in an hour. As a set off against this output, a little girl—or, rather, a machine tended by a little girl—can now rule one hundred reams on both sides per day of nine and three-quarter hours. This machine is of French manufacture. It has an automatic feed, and delivers the sheets after they have been ruled as evenly as when they were taken from the cutting machine. I do not recommend this French machine for general use, as it has been designed and constructed for a special class of work. To the wholesale stationer, however, it is a *sine quâ non.*

The best machine that I know of for general work, and one which I can confidently recommend, is that manufactured by Mr. John Shaw, Honley, near Huddersfield, and described as the "Single Striker Machine" (Fig. 29). The maker is very modest in setting forth the capabilities of his machine. He says in his circular: "This machine (speaking of his No. 3) is specially adapted for stop at head work, striking the pens automatically with far greater accuracy than by hand, and ruling ledger and invoice patterns with any number of stops with nearly the same rapidity as ordinary 'faint only.' It can be worked either by hand or power." Had I written the above description myself, I would have omitted the word *nearly.* The machine is also self-delivering. The striking arrangement will be easily understood from Fig. 31. On the end of the cylinder is a movable metal plate, lettered C in the diagram, around which are a series of thumbscrews, D, D. Small pieces of metal, B, B, etc., are let in between the plate and the end of the cylinder, and held in position by the screws. As the cylinder revolves, these pieces of metal cause the pen frame A to rise and fall, and thus the pens rule or stop as required. The cylinder appears set for three stops. The pens which are used with this machine are a little different from ordinary ruling pens, and it will be better to buy them than to attempt to make them. Indeed, it is hardly worth while for the ruler to make pens now, they can be bought so cheaply. These striking pens cost about one penny per point. Of course, the ordinary pens will do for faint and run through work, as in other machines. Ruling pens are made of thin sheet brass. The shape and style of them can be seen from Fig. 30.

Account-book binding—or, more properly speaking, stationery binding—includes everything, from the penny memorandum book to the massive ledger.

I will pass over the cheaper kinds of stationery, and in my remarks under this heading I will endeavour to give a detailed description of what I consider to be the best and most workmanlike method of binding an account book. I have a large experience in this class of work. The books bound under my supervision were generally pronounced to be better bound and more lasting (a necessary feature in account books) than those sent out by a firm in the same town, which enjoyed a world-wide reputation. I mention this so that my remarks may be taken at their proper value.

After the paper has been ruled, it is handed over to the female operator, whose duty it is to fold it into sections and prepare it for sewing. If the paper is what is termed hand-made, there will be two shades on every sheet: one side will appear blue and the other white; so to prevent a blue and white appearing together when the book is opened, the paper is "faced"—*i.e.*, two blue sides are made to face each other, then two white sides, and so on through the entire book. The ruler will have left four sheets of the paper which is to form the book unruled. These are for the end papers, and should be given to the forwarder to be made.

The joints may be of cloth, linen, or leather. Black glazed linen makes a good joint for general purposes. The joint is glued, and two sheets of the four already mentioned are laid upon the joint, about ⅛ in. apart from each other. The other two sheets are treated in a similar manner. Four pieces of marble paper are cut to the size, glued all over, and laid on to the edge

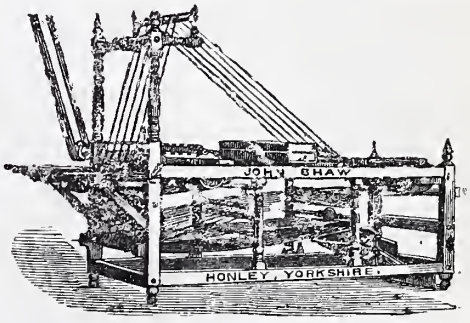


Fig. 29.—Single Striker Machine.

of the linen and rubbed down with the hand (nipping the papers in the press is superfluous), and hung up to dry. Meanwhile the folding of the paper has been going on, and it will be done up in three or four sheet sections, according to the make or thickness of the paper. The sections should not be too thick, for the leaves will start when the book is being rounded. Neither should they be too thin, for, in sewing, the back will swell, owing to the quantity of thread used. The first and last section should be lined on the outside with a strip of white calico. It is common with some binders to line the inside and outside of each section with calico. This may be necessary in special cases, but for general purposes it is not to be recommended, as a book thus treated will partake much of the guard-book appearance, and be very stiff to open. Given a good paper and a careful sewer, there need not be any fears of durability without the lining.

Account books are sewn on tapes, and there are no saw marks made in the back. For the class of work under notice a good strong twilled linen tape (called "binding" by us), of a grey colour, and sold in rounds, will be needed. Three or five bands, according to the size of the book, should be set up on the bench. Set up the bench by all means; I detest that slipshod method adopted by some binders of sewing on the table. This is done with the intention of saving time. It certainly does save the

time of setting up the bench, but the time lost in keeping the bands straight, and now and again unravelling them from the thread during the operation of sewing, will far outweigh the time saved. Whence the profit? Strips of vellum are sometimes used as bands in conjunction with the tape for heavy books. I fancy I now see a smile on someone's face, and turn to ask the reason, when I am asked the question, How can you set up strips of vellum on the bench? Ah, very easy, my friend.

Join a piece of waste tape to each end of the vellum with a few stitches, lap the one end round the rail at the bottom of the bench and the other round the cross-bar at the top, and put a pin or a broken needle through it. "Where there is the will there is the way."

The thread must be well selected. A good linen thread 3-cord No. 18 is a very serviceable size. Really reliable thread for bookbinding purposes is manufactured by Messrs. Wm. Barbour & Sons, Lisburn, Ireland. I have used their thread in various sizes for both letterpress and stationery sewing for many years, and have every confidence in recommending it to the trade.

The thread used must be waxed, no matter who is the maker. The wax preserves it, and consequently it will wear better. Each section of the book must be sewn all the way up, and the needle must be brought out at the far side of the band, and introduced again at the near side, thus bringing the thread round the bands. The end papers will also have to be sewn to the book, and treated in the same manner as a section of the book. The slips, when the book is sewn, should project about 1½ in. on each side of the back.

The forwarder takes the book from the sewer, and his first duty will be to glue it up. The glue, like the thread, should be well selected. It should be bought from a house which has a reputation for honesty, if not for cheapness. Avoid "French Medal" glue, that turns frothy in the glue-pot; it has its uses, but one of them is not stationery binding. The glue should be thin, and tolerably hot when applied. It must be rubbed well into the sections. If the brush does not accomplish this satisfactorily, the thumb will, and should be used.

When it is dry, the fore-edge should be cut, and if the edges are to be mottled instead of marbled, do the fore-edge at this point. For a red and black mottle, use ordinary red and black inks; put the red on first, a good even coat, and allow it to dry, then with an open-holed sponge, daub on the black neatly and carefully.

The book will now be ready for rounding. A greater degree of roundness should be given to it than to a letterpress book.

The inside sheet of the end papers will require to be glued to the first and last leaf of the book. This should be done after rounding the back, and the book put in the standing press between tins.

I like the practice of pressing books with tins. It should always be done, especially in the case of account books. A greater degree of solidity will thus be imparted to the book. If the book can be left in the press over-night, so much the better.

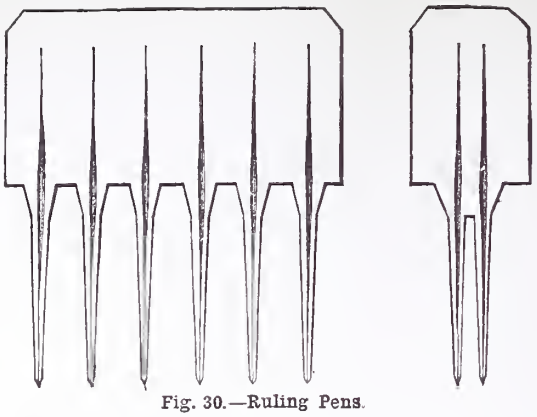


Fig. 30.—Ruling Pens.

In the morning, as soon as the glue is ready, get the book out of the press and line the back. Scraps of leather are kept for this purpose. The linings are cut to fit between the bands and the head and tail of the book. They should be long enough to extend about 2 in. on each side of the book. Glue the linings and the back of the book, and when attaching the lining, rub it well down with the folder to ensure it adhering well. The book should be screwed up in the lying press during this operation. In lining very heavy books, cover the entire back, the bands as well.

The next step in order will be to get the back made. This will have to be carefully measured for, so as to have it fit the book. Lay the book on its side with the back extending over the end of the lying press, and with a strip of paper measure the thickness of the back, allowing about ½ in. more on each side. Now cut two or three strips of thin hard millboard the breadth of the paper strip and a little longer than the book. Provide also a sheet of strong paper—"pressing" is the trade term for the stuff in general use. It is that greenish-grey paper used for the covers of memorandum books. Glue the paper and millboard strips and lap them up together, the millboard in the inside. According to the size and thickness of the book more or less paper and board will be required—in fact, the back should be almost as thick as the boards to be used for the sides. To allow time for the glue to set, cut the ends of the book, and mottle them as directed for the fore-edge.

It will be necessary to take great care in cutting the ends of an account book, as owing to the deep groove in the fore-edge, caused by the rounding of the back, the paper is apt to break at the corner. This can be avoided if the forwarder cares to take the trouble of padding up the fore-edge with waste paper.

A number of wooden rollers, with a sheet of stout paper or cloth tacked to them, are kept for the purpose of rolling the backs. Select one as near the thickness of the book as possible, take the back, which has been partially made and left while cutting the ends of the book, and heat it over the flame of the fire or a handful of burning paper shavings placed inside the fender at the fire-place for this purpose. It will turn quite soft with the heat and will be easy to roll. Place it lengthways against the roller, and roll it tight with the paper, which is attached to the roller lapped around it. Roll all backwards and forwards over the bench for a short time and leave it aside to harden.

When hardened sufficiently, it is pared at the edges and put upon the book. Be careful to have it close upon the back of the book and even at both sides: use the compasses, and gauge from the fore-edge. Glue the outside sheet of the end paper, and bring it over the back to the other side; repeat the operation with the other end paper, and rub it close into the back. Square the boards, which will have been made sometime previous, in the following manner. Two or three sheets of millboard are cut to the size and pasted together. The board intended for the inside should be thinner than the others, and only pasted about ⅔rds so as to leave a space for the slips and lining to go in, and thus attach them to the book; just before attaching them, make a cut in the lining with the scissors at each end on both sides of the book, and with the folder break the paper close into the back; this will admit the leather of the cover being turned in. Bend up the open piece of the board and glue it on both sides; put the slips into this space, leaving the piece which was cut with the scissors underneath. When both boards have been placed in position on the book, give it a nip in the lying press.

There is nothing special about the covering. Account books are covered in much the same manner as letterpress books, with the exception of knatching, which is done as soon as the cover is turned in. A pair of knatching boards—*i.e.*, boards with a projecting piece about the thickness of a small cane screwed along the top edge—is placed in the grooves made between the back and the boards on the sides of the book, and the whole screwed up in the lying press. After knatching, a cord is tied round from end to end and the heads are set. The setting of the heads should be carefully attended to, as when properly done, the book is much enhanced. It would be difficult to describe this process, so I will not attempt it. There should be, however, no hammer or folder marks on the edge of the book. When the cover

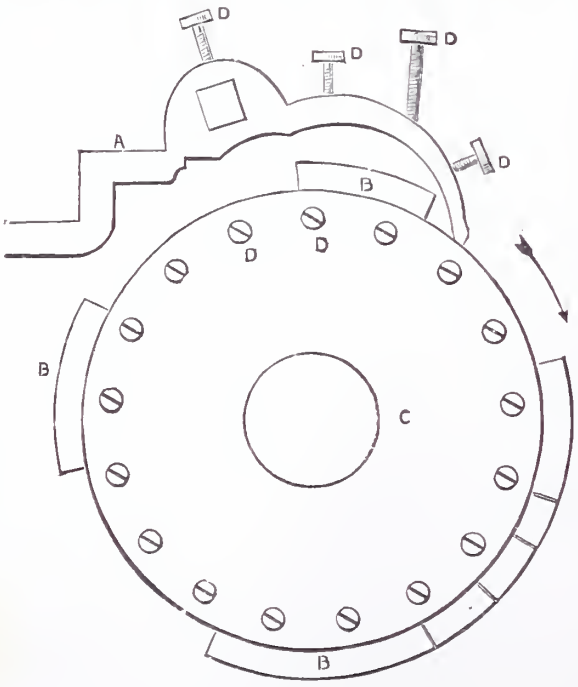


Fig. 31.—Striking Gear of Shaw's Ruling Machine.

has become dry, the cloth sides are put on if the book is half-bound, and the end papers are glued up; a strip of thin board is placed close up to the joint on both sides of the book during this process: this acts as a lever, and causes the book to spring when being opened. After gluing up, the book is put in the standing press, and left there all night if possible, and the forwarder's work is practically done.

Account books, like letterpress, are covered in various styles. They are half-bound in sheep, goat, calf, morocco, Persian, and full bound in the same materials.

When covered in goat or calf, it is generally the flesh side of the skin that is on the outside. Full calf with green vellum corners rounded, instead of being cut square, is a nice style. Full calf, with Russia bands laced with white vellum, is very commendable for large books, but I do not think it adds so much to the strength as is commonly supposed. Since I have mentioned this style, let me caution binders not to leave the lacing inside the board, as when glued up, it presents a horrible appearance. Instead of this, open the board and lay it down on an iron block, and beat it well with the hammer on the inside so as to close the holes well up, and after drawing the lacing as tight as can be done, cut the laces off and beat again and again, until not a trace of roughness is seen upon the board.

In finishing account books, the ordinary leathers are treated as already described. Rough calf and goat are cleaned by rubbing with bath-brick. The black lines are put on with iron liquor carried in a sponge tied to the end of a piece of whalebone or stick, and held upon the roll as it is being run upon the backs or sides of the book.

Alongside with bookbinding in the workshop at present will be found operations of a very different nature going on; for example, there will be found "relief stamping" in colour, and gold and silver, envelope making, map and plan mounting, varnishing and gumming, photograph mounting, etc. Questions on any of these or kindred subjects will have my best attention in "Shop."

A PLAIN CABINET BOOKCASE.

BY DAVID ADAMSON.

Cornice—Plinth—Doors—Hinges—Drawers—Nailing Parts together—Slips—Mouldings—Easing Drawers—Shelves—Finishing.

The backboard of the recess hardly requires mention after what has been said about it, the only direction being that it should be just long enough to fit comfortably within the ends. As it lies behind the two pieces to which it is nailed, its width is not of so much consequence, provided, of course, that it is wide enough. For the sake of neatness, however, it will be better not to have it projecting above the upper board of the two, any excess being allowed to be behind the drawers.

Before saying anything about these, it will be as well to finish with the carcase of the bookcase, of which the cornice and plinth have still to be made and fitted. They are, however, so simple that the drawings showing them are almost self-explanatory.

Let us take the top first. Two pieces widening the ends here will be wanted. Their shape and size are so clearly indicated in Figs. 2 and 3 (page 362) that it will suffice to say of them that they must be exactly the same thickness as the ends to which they are attached, the fastening medium being glue.

The cornice itself consists of three members, of which the bottom one is the top board of the case: it, like all the other front edges of transverse pieces, having bevelled edges. The second, or main, portion of the cornice is merely a piece of board three inches or so wide, with its lower edge bevelled so that when it rests on A it projects slightly forward. Its upper edge is also bevelled to correspond, so that a narrow piece of inch stuff lies flat on it, and forms the top member. These two latter pieces must be cut to fit exactly within the ends through which they are nailed, and glue is used along the edges of each member. A few blocks behind them would support the glue, or a screw or two through A into the piece above it, and the same through the top rail, will have the same effect. With accurate workmanship,

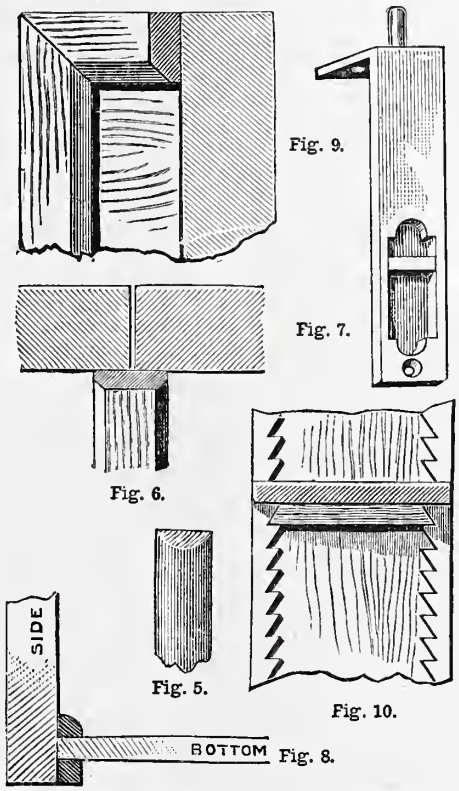


Fig. 5.—Moulding on Door. Fig. 6.—Alternative Moulding, showing Edges of Doors. Fig. 7.—Flush Bolt. Fig. 8.—Section of Side and Bottom with Slips. Fig. 9.—Corner of Drawer with Moulding. Fig. 10.—Rack for Movable Shelves.

glue alone ought to be enough—of course, in addition to the nails through the ends.

The plinth—if it may be so called—is constructed in a similar manner, but is even simpler, consisting only of one piece enclosing the space between the board E and the floor. The bevel which is shown on Fig. 3 at this part is, as will be seen, of considerable size, and gives relief to the front edge of the board E. Two short facing pieces are also used, as shown, and of course blocks may be used here as well as in other places, if they are considered necessary.

So far as the carcase is concerned, it merely remains to say that the front edges of the ends have plain beads run along them. As will be seen from Figs. 1 and 2 (pp. 361–2), the bead is stopped at the facing pieces, and also at the curved recess. The scratch will form the most convenient means to do the beading with, and as an article has recently appeared on the construction and use of this tool, the worker who may be unacquainted with it is referred to it for any particulars he may require. With regard to stopping the beads, it may be a useful suggestion to say that they should be formed before the facing pieces are attached, as these can easily be glued on afterwards, the bead running behind them.

The work is now ready for the doors and drawers. Enough has been said about the construction of doors when describing the overmantel to enable anyone to form these, but it may be said that the framing is $2\frac{1}{4}$ in. wide and the thickness 1 in. This, indeed, unless otherwise stated, is understood to be the thickness of which all this furniture is constructed. It will be noticed that the edges of the framing are stop-chamfered—*i.e.*, the bevel is stopped a couple of inches or so from the angle; but as all readers who are interested in carpentering work will see, in the articles entitled "Lessons from an Old Bureau," directions for this style of edging, nothing more need be said here. If preferred, the door framing may have a couple of beads corresponding with those on the ends "scratched" on them with perhaps less labour than is involved by chamfering. The panels of the lower door are quite plain, and are formed of $\frac{1}{2}$ in. stuff, beaded in behind.

The upper doors are transparent—that is to say, the panels are of glass. Good window glass will do very well for the purpose, and is much lighter than plate, unless this happens to be the thin "patent" kind, which is, however, so expensive that it may be left out of consideration for cheap furniture. The glass door may be fastened in either with putty, like ordinary window panes, or be beaded in. The latter is certainly the preferable way, and the other is only mentioned in case it should be more convenient, as it is sometimes used in furniture glazing. The glass, especially if it is fastened in with beads, should be cut to fit as accurately as possible; for there is no occasion, as there often is with bevelled silvered plates or mirrors, for any spare space in the rebate. It will be found a good plan to send the door-frames themselves, instead of measurements only, to the glass-cutter's from whom the glass is bought. An exact fit can then be ensured without loss—or, at any rate, without loss to the maker of the bookcase—through any error in measuring or cutting.

The right-hand door of both the upper and lower cupboards has a bead scratched along its edge, but perhaps a better way will be to plant a small moulding on so that one half overlaps the other door when both are shut. For a plain bookcase like this the moulding should be as unobtrusive as possible, and nothing will be more suitable than either a plain "half-round," as in Fig. 5, or simply a strip with the edges bevelled off, as in Fig. 6, where the overlap is clearly indicated. The principal objection to the moulding is that unless fastened on very securely with glue and brads, it is apt to be torn away. Still, with ordinary fair workmanship, this risk is very slight, and may be avoided by partially sinking the moulding within a rabbet. As, however, this involves more difficult work than is contemplated in connection with this furniture, nothing more need be said about it.

Each door is hung with a couple of 2 in. butt hinges of good quality, for it must be quite understood that in describing this

inexpensively constructed furniture there is no intention whatever of conveying the idea that anything will do. Though the construction is simple and departs in many ways from the recognised methods, there is no reason why, on that account, anything connected with it should be of inferior quality. In fact, I might almost say that because of its plainness everything about it should be good of its kind. On the left-hand doors a bolt of some kind is necessary to keep them closed when locked. The ordinary form of flush bolt will easily be recognised from Fig. 7. One for each cupboard will probably be enough, but if the door should have any spring, and not shut equally close at the bottom—a defect which, by the way, is sure to occur if the hingeing is not properly attended to—two bolts may be advisable. If only one be used—*i.e.*, one to each left-hand door—it will be better to place it at the top of the lower cupboard and at the bottom of the upper, so that the pins or bolts shoot into D and B (Figs. 2, 3, p. 362) respectively, where holes will be bored for them. The bolts are sunk in the edges of the doors, and should be of good width, as small ones are troublesome to work. The bolt holes in B and D may be protected by small brass plates, but with the ordinary precaution of always withdrawing the pin to its full extent no damage will occur to the woodwork. The exact position of the hole may be easily ascertained by smearing the end of the pin with gas-black or other material after the door is hung, and then forcing it against the wood above or below.

To prevent the hinges of the left-hand doors being strained by the doors being forced too far in, a small stop should be affixed inside the cupboards on D and A (Fig. 3).

On each right-hand door a lock, or some other catch, will be required. The proper kind is the cupboard lock, with "bolt shooting to left." They are let into the door frames and have a recess cut for the bolt to enter.

We now come to the drawers, which may be made in the usual way, but as this involves dovetailing and grooving—both of them processes which may not be practicable or convenient to those for whom these papers are intended—another plan may be suggested. Instead of dovetails, let nails be used to fasten the ends or side pieces of the drawers to the fronts and backs. True, the end grain of the sides will then be visible on the drawer fronts, but it may easily be covered, as we shall see.

The drawer fronts may be of 1 in. stuff, but the remaining parts will be better if considerably thinner—say $\frac{3}{8}$ in. or $\frac{1}{2}$ in. for the back and sides, while $\frac{1}{4}$ in. will be enough for the bottoms. In making a drawer in the usual manner, it does not much matter whether the sides or fronts are fitted first, but made as we are supposing these to be, it will be better to get the sides out first. They must be fitted exactly to the places which they are subsequently to occupy, rather tight than loose, so that they can just be forced in. When they have been properly planed up, and are in their places, the drawer fronts can be attended to; to have done so before, the length of these could not have been arrived at accurately. Now, with the sides it is simply a matter of cutting the fronts to fit tightly within them. The backs of the drawer should be of the same length as the fronts, but a little less in width—say $\frac{3}{4}$ in. It is by no means necessary that the drawers should extend quite to the back—indeed, it will be better if they do not—so that when cutting the sides this should be remembered.

The parts may now be nailed together, the nails being driven through the sides into the fronts and backs, and the heads punched in. The back, being narrower than the sides, may require a word of explanation about its fitting. As the bottom will be nailed under the back, but within the front and sides, it will be seen that space must be left. Let this space be $\frac{1}{2}$ in. or so; the reason for this excess, as it may be thought, will be apparent shortly. The top edge of the back will be below that of the sides a little. The precise distance is not of much consequence, as it is only necessary in order to facilitate easy action of the drawers by preventing the back coming in contact with C (Fig. 3). In the bottoms the grain of the wood must run from side to side, and not from back to front. They should be cut to fit closely within the sides, but in the other direction large enough to project about $\frac{1}{4}$ in. beyond the back. The bottoms might be nailed in, but it will be far better to support them on slips glued to the sides underneath them. These slips may be cut from the same stuff as the bottoms, and necessarily must not extend below the lower edges of the sides. With regard to cutting thin stuff like this, it may be a useful hint to the novice that it can be done very easily with a cutting gauge when the cut is with the grain.

These slips will form ledges for the bottoms to rest on, and by putting similar strips above these we come very close to the recognised way of fixing in drawer bottoms—that is to say, these are held within a groove. The slip may run along the front underneath the bottom, and will be advisable if this is only thin or intended to carry anything heavy. It will doubtless occur to the maker that the slips if used inside the drawer will look better if rounded off, as they are seen to be in Fig. 8, which represents, in section, part of a side and bottom fitted. The drawer bottom only requires gluing in front, as if not fixed elsewhere it has an opportunity of contracting without splitting. This it would be almost sure to do, unless the stuff is exceptionally dry, if it were bound at both back and front. After a time, if it shows no sign of shrinking further, a nail or two may be run through into the back. We have still to hide the end grain of the sides where they abut in front, and in covering them it may be satisfactory to know that the means used will be of advantage to the appearance.

Any kind of plain moulding will do for the purpose, but it should not be too large, and to harmonise with the general design it should be plain and simple. In fact, to call it a moulding is to give it a dignity to which it is hardly entitled, for it is merely a plain strip of wood, say $\frac{3}{4}$ in. wide—or at any rate a little wider than the thickness of the sides—and $\frac{1}{4}$ in. thick, with one edge bevelled off. It is planted on all round the drawer fronts, the corners being mitred. If the moulding is very little wider than the thickness of the sides—as end grain is not a very reliable foundation to attach anything to with glue—a few needle points may be used with advantage. Snapped short off, they will be scarcely, if at all, perceptible afterwards. To make this part of the work clear, Fig. 9, representing a corner of the drawer front showing the mitre and section of the moulding, is referred to. A stop must be fixed on the bearer or board on which the drawer rests, to prevent it being pushed too far in. A thin slip of wood, which allows the drawer bottom to pass over it, and with which the front comes in contact when the drawer is driven home, is not only the usual way, but the simplest.

The drawers will still require "easing" before they will run easily, but it will be better to let them stand a bit, and give them every chance of shrinking. They may shrink so much that no easing will be necessary. If it is, rubbing the sides or ends both on the outer surface and the upper and lower edges with glass-paper, or at most a shaving or two taken off with a plane, will probably be all that is required to make an easy fit. Nothing is more annoying than a tightly fitting drawer, unless it be one that is faulty in the opposite direction. A drawer that requires "humouring" before it can be closed or opened is so great a nuisance that no care which may be bestowed on this part of the work should be grudged. Although the drawers be made as described, there is no reason whatever why they should not run as easily as any of the best of the orthodox construction. With the remark that a brass handle will be required for each drawer, we have done with them, and may turn our attention to a very indispensable part of the work: viz., the shelves and their fittings.

It goes without saying that movable shelves are desirable in a bookcase, and whether strictly necessary or not, these pieces of furniture are generally provided with them. Those who do not require them will not need to be told that the shelves can easily be nailed, but directions could hardly be considered complete without showing how shelves may be movable and fixable at various heights. The arrangement is by no means a complicated one—or rather, I should say, arrangements, for there are several. It will, however, be unnecessary to do more than describe one of them, the common ordinary rack. By this method two pieces of wood—$\frac{1}{2}$ in. thick by 1 in. wide, will do very well—with serrated edges, are stuck from top to bottom on each end of the cupboard in which the shelves are to lie: one of them just behind the door and the other right against the back, each pair being quite parallel. For each shelf two bearers will also be required, the ends being bevelled off to fit within the notches on the uprights. On these bearers the shelves rest. The arrangement is shown in Fig. 10, where the section represents a shelf supported on a bearer fitting between two of the notched pieces. To make these, get out four pieces of wood of the required size and fasten them together with a screw, or by a nail or two, which can be removed, side to side, so that the edges form the top and bottom of what is practically a solid block. At regular intervals of, say, 1 in. to $1\frac{1}{2}$ in., draw a line across the edges on one surface, using the square as a guide, then on one or both of the outside surfaces, either with the gauge or otherwise, draw a line from end to end about $\frac{1}{2}$ in. from the marked face. With the saw cut down at each of the transverse lines to the other, and when this has been done it only remains to cut away the waste either with chisel or saw, and on separating the pieces we have four exactly corresponding with each other. A little trimming-up may be necessary, but it will not be much, as if the bearer fits within any two of the spaces, it will probably do so in all.

The shelves themselves must be good stout stuff, certainly not less than 1 in., or they will bend beneath the weight of large books; but of course a good deal depends on the length of the shelves. For those of 4 ft., however, or thereabouts,

intended for large books, they must not be thinner than stated. They are merely plain boards with notches cut in each corner to allow space for the racks, so that no directions can be necessary. In case some readers might wish to have leather edging, it may be said that this will be considered when dealing with an open-fronted dwarf bookcase. In the present one, as the books are protected behind glass doors, no edging is necessary, and superfluous ornamentation does not form part of the scheme. Three movable shelves are shown in the drawing, and they will probably be considered enough, but of course everything depends on the size of the books, and there is no reason why fewer or more should not be made if desired.

In the lower cupboard one shelf across will be most convenient if this part is to be used for general purposes; but here, again, each must decide for himself, not only about the number, but whether they are to be fixed or movable.

The cabinet-maker's part of the work is now completed, and however crude the construction appears, I may say, as some encouragement to those who hesitate on that account to make up a bookcase—or, indeed, any of this easily made furniture—that the one from which this description is written, and from which it differs only in very unimportant details, was made some ten years ago, long before this series of articles was contemplated, and that it now looks down on me as I write, sound and strong (but I am bound to say not quite so fresh-looking) as the day it was made. To the readers of Work I impart the secrets of its construction, and I do not think any, excepting those who are well accustomed to examining such things, would imagine the handsome, though plain, ebonised bookcase is formed as it is. One Art man went into raptures over it the first time he saw it, but then, like a great many of his kind, he was only a theorist, otherwise his opinion might have been of value. Still, it shows that even this easily made furniture need not be so badly put together that the casual observer is struck with its departure from ordinary constructive methods.

But perhaps someone may suggest that being made all in one carcase, the bookcase is rather unwieldy and awkward to get in and out of a room in the event of removal. Well, there is no denying that it might be inconvenient sometimes, but rather than describe it in an imaginary form, I have taken it as it stands, and for the benefit of those to whom its size may be an objection, I may give, as a closing suggestion, that it can easily be made in two carcases, the lower one ending at the top of the recess. The bookcase proper will then rest on a board covering this, the two parts being screwed together. If the joint on the ends be considered unsightly in itself, it can easily be covered with a thin piece of moulding or beading, such as that described for the drawer fronts.

A FEW HINTS ON CYCLE RIDING, PEDALLING, ETC.

BY P. B. H.

In a former paper I described by sketches and letterpress some of the important points necessary to recognise a good from a badly designed machine. In the present one I shall endeavour to give to learners a few useful hints on riding, pedalling, etc.

The first thing needful, after having bought a machine, is to learn to ride it. In mounting a tricycle no difficulty will be found, as no balancing is necessary, but such is not the case with a bicycle, in learning which the balancing is one of the greatest difficulties; and especially is this the case in an ordinary, where it is at first almost compulsory to have the assistance of some friend to help and steady the machine, as when gaining the seat, which in this style of machine is so high, the learner is so liable to be thrown over the handles into the road, until he has gained some knowledge of its peculiarities by repeated attempts at mounting. In this latter case the assistance is principally necessary to save the learner from falling forwards when mounting the seat, and not for teaching the balancing; the sooner this aid can be dispensed with, and the rider left to his own resources, the sooner he gains confidence, and therefore learns to ride. In a safety machine it is almost impossible to be thrown head-first over the handles; and as this eliminates one of the greatest dangers to learners, friendly assistance is not so much a necessity, and, as I have remarked, the sooner aid is dispensed with the sooner the learner becomes proficient; therefore to all learners of a safety I give this advice: "Commence and learn without any assistance whatever."

The method I employed was as follows: I found a quiet country lane with a very slight decline in the road, the decline being so slight that the machine needed scarcely any exertion to start it, and it was not so great that the machine would increase its velocity by gravity when once started. At the top of the decline I made a mark, to which I brought the front wheel of the machine. Then with one foot on the step, and holding the handles firmly, while making no attempt to gain the saddle, I pushed off, only endeavouring to keep my balance on the step as long and as far as I could, and when I could go no further I learnt to jump—or at first, I might say, tumble—off as easily as possible, which is a very important factor, and you will find it will well repay some trouble in learning. After every dismount I brought the machine back to the old mark, trying every time to get farther without a fall than on the preceding trial. In about ten minutes I accomplished the balancing so well that I could reach the seat of the machine. The next difficulty to a learner who has not even ridden a tricycle before is to find and catch the revolving pedals without looking, and to keep them when found, as most of the attention is necessary to keep the machine balanced and away from any obstacles in the road. Having once succeeded in gaining the seat and command of the pedals, all the difficulties are overcome, and practice is all that is necessary to ride with confidence. Any learner who will rely on his own powers, and will proceed as above, will learn far quicker than if he has anyone holding the machine for him.

On the supposition that the learner can mount and ride his machine successfully, I shall now give a few hints on pedalling, which, next after the position of the body on the machine, goes a great way towards making a graceful rider.

Most readers of this paper will know that in single cylinder engines there are two dead points in each revolution of the crank—that is, where the steam in the cylinder has no tendency to turn the crank round. There are a great many riders who assume this of the bicycle crank, but to a good pedaller, and using the ordinary crank, there are no dead points, as power can be applied by each foot to turn the crank for almost $\frac{3}{4}$ of a revolution—that is, some time before the pedal reaches the top of its stroke and some time after passing the bottom, as shown by darkened line in Fig. 1, though fifty per cent. of the riders only apply pressure to the pedals for the distance shown by darkened line in Fig. 2. In this case there is a dead space (if I may use the term), not a dead point—that is to say, in each revolution both the right and left pedals alternately pass through a space (A, Fig. 2) equal to about fifteen degrees without any power whatever being applied, the machine during these intervals being carried forward by its own previously acquired inertia.

This circumstance alone accounts for a great amount of the jerky riding seen on the roads, and especially noticeable when the rider is climbing a hill.

In the former of these two cases more use is made of the ankle, and this is the more elegant way of riding. It takes some amount of practice to pedal nicely in this manner, but the trouble is well repaid.

The correct position of the foot on the pedals is shown in Fig. 3. In Fig. 4 I have shown by a skeleton diagram eight different positions of the foot in making one complete revolution of the crank. The length of the foot in Fig. 4 is proportionate to the length A in Fig. 3. The sole of the boot resting on the pedal I have assumed, for simplicity, forms a circle. The eight positions taken by the crank I have marked 1, 2, 3, etc.; the corresponding positions of the point representing the heel I have marked *a*, *b*, *c*, etc. The point A represents the thigh, and the numbers at B represent the path and positions of the knee for the corresponding positions of the heel. When the rider is making the proper use of the ankle, the point representing the heel follows an elliptic path (Fig. 4); the ellipse, however, being slightly flattened below. It will thus be seen that by inclining the foot to the horizontal by making use of the ankle, and thus preventing the foot slipping while it travels from 4, the assumed dead point, to 5, and also when passing from 7 to 8, the other assumed dead point, a certain, though small, amount of work can be applied in a backward and forward direction respectively. This force, though slight, if applied regularly, adds greatly to the smooth running of the machine, and also diminishes breakages, as all irregular strains tend to increase these latter. I have also endeavoured to indicate graphically by arrows the direction, and also by the numbers of the feathers attached to the same the average amount of power which should be applied through certain spaces. The three feathers indicating full power, the two feathers $\frac{2}{3}$ full power, and the one feather $\frac{1}{3}$ full power: when I say $\frac{1}{3}$, $\frac{2}{3}$ full power, I mean to say that the average power should be $\frac{1}{3}$, $\frac{2}{3}$, etc., in the spaces so marked, as it will be easily seen the power is only just commencing to be applied at 7, gradually increasing to 8, and onwards to 3, when it gradually diminishes. From the diagram it will be seen that when the right foot is travelling from 1 to 3, full power is being applied just when needed, as the left foot would then be travelling from 5 to 7, when no power can be applied; again, when the right is travelling from 3 to 4, exerting $\frac{2}{3}$ full power, the left goes from 7 to 8, exerting $\frac{1}{3}$ full power; and

again, when the right travels from 4 to 5, exerting $\frac{1}{3}$ full power, the left goes from 8 to 7, exerting $\frac{2}{3}$ full power; and when passing from 5 to 7, exerting no power, the left passes from 1 to 3, exerting full power. In this manner the two combined pressures of the right and left feet together equal full power, and so an equal pressure is kept on the crank, chain, and driving wheels, thus keeping a very regular motion; any irregularities in the application of the power only tend to knock the machine to pieces. Pedalling, and at the same time making good use of the ankles, is difficult to a learner, but when once acquired it is the best and nicest method.

One of the greatest drawbacks to all cyclists, but especially to learners, are the hills to be encountered; and I have no doubt whatever that a great many beginners give up in disgust when they find them so hard to climb. The reason is that they never consider if it is worth the expenditure of power required to surmount it; but seeing some older riders doing it, they think they should go and do likewise, and ride blindly at it instead of dismounting when it gets too hard to ride without over-exertion. When a rider comes to a somewhat long hill, if he cannot increase his speed on it without extraordinary exertion, he should dismount and push the machine up it.

If you meet with a short sharp ascent of about twenty yards long, and if there is an incline down to it, then it is as convenient to ride sharply at it and surmount it on the machine, as the trouble of dismounting and remounting would equal the extra exertion required. But in general, if you cannot ride gently up to a hill and keep on at a uniform pace up it, then get off and push your machine up, as otherwise, if the road is hilly, you will soon be worn out and disgusted. Of course, climbing a hill becomes easier the more practice you have, so that if you persist for a short time the difficulties gradually become less, and the hills easier to ride.

The question is often asked by cyclists: "How is it that it is so much easier to dismount and push your machine than ride it up a hill?"

I will endeavour to explain it without any mathematics. From children we have been taught to walk, and we have grown so accustomed to this manner of progression that we do not really take into account the work we are doing. What child, after skipping, running, and jumping about all day, if told it had been working hard, would believe it? And yet such is the case.

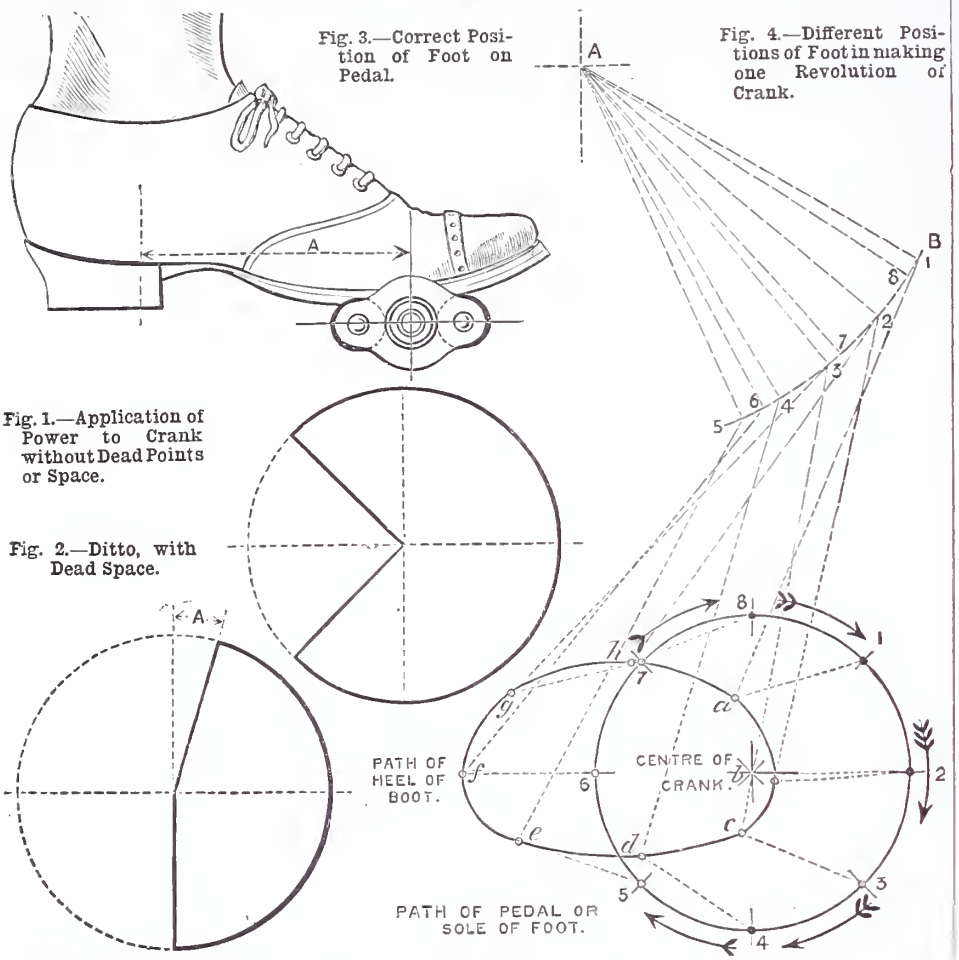


Fig. 3.—Correct Position of Foot on Pedal.

Fig. 4.—Different Positions of Foot in making one Revolution of Crank.

Fig. 1.—Application of Power to Crank without Dead Points or Space.

Fig. 2.—Ditto, with Dead Space.

You often, when out walking, on arriving at the top of some eminence, hear the remark: "That was rather a stiff hill," yet the speaker does not consider what work he has been doing; probably if he thought he had been working he would have remained at the bottom. Suppose a man riding a bicycle up a hill, and that it was geared so that the rider could go at the same pace as when walking with the machine, and that at that speed the machine could be balanced; then in these two cases the same amount of work is being done—that is, the man is lifting his own weight and the weight of his own machine to the same height—viz., the top of the hill—in the same time. The weights are, however, being lifted by two quite different methods. In the one case he is lifting the body by walking, which he has grown so accustomed to that he does not consider it work, so that really he only seems to be raising the weight of his machine. In the other case, in which he is seated on the machine, he is raising himself together with his machine in a manner and by muscles to which he has not grown so accustomed, and which are used in an unaccustomed manner. This is the reason the work seems to be so much greater, though the same amount is being performed.

In order to give the reader some idea of the amount of mechanical work which the various parts of the human body exert, it will not be out of place to give the result of some interesting calculations made by Dr. Buchheister on the work done by certain mountaineers during their ascensions. Suppose a man of 165 lbs. weight mounts to a height of 2,187 yards, the amount of physical work which the doctor calculates he does in the five hours duration of the ascent is $\frac{1}{6}$ of a horse power.

From this result it will be seen that climbing a hill without any impediments whatever, and in a way we have been so accustomed to from infancy that we do not consider it work at all, is by no means an easy task. Therefore, what must it be at first when we commence riding a bicycle up an incline by means of power applied by the legs in an altogether unaccustomed manner, and making use of muscles which up to this time have probably had very little on them at all, and the weight of the machine—40 lbs.—has also to be taken into consideration?

Never buy a machine on the recommendation that it is so light if it is your intention to use it on the roads, as most probably breakages will make you disgusted with your purchase.

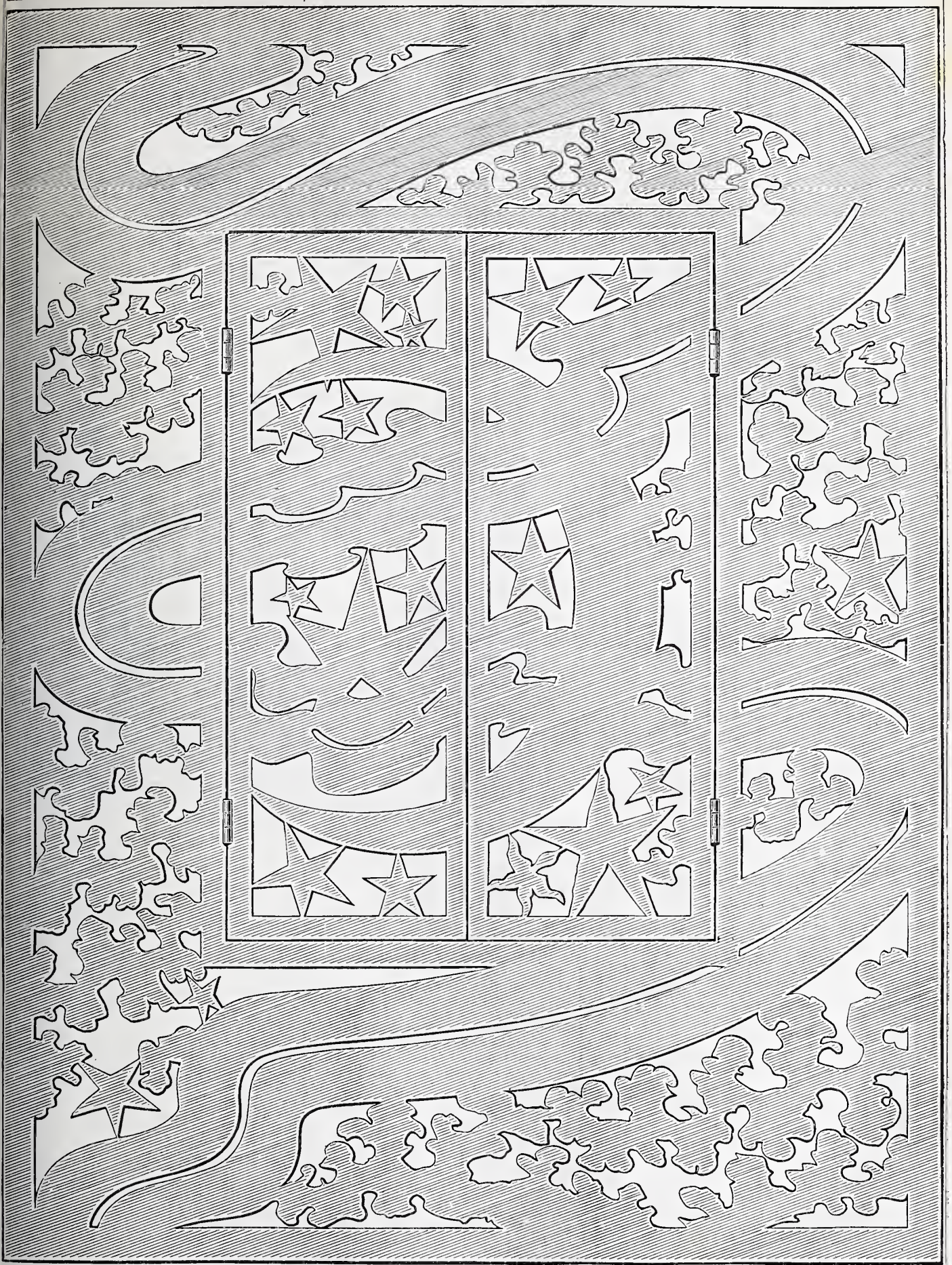
Never try to overtake riders who may be ahead or have ridden past you on the road. Keep up a regular pace, and vary this as little as possible, with the exception that after a meal you should always ride slowly to commence with, and walk up even the moderate hills for about twenty minutes, till your food has partly digested. On a journey, say of some seventy or eighty miles, you will see young fellows bent almost double rushing along as if their lives depended on the speed, and yet the slower rider will be the faster in the end, as the racing speed cannot be kept up without drink. This entails a stoppage: the drink invigorates you for about five or ten minutes after mounting, but you then become more languid than before the so-called refresher. I seldom drink in a journey of this length, except at a meal, which I should take when about half the distance was covered; and if the weather was very hot I should have an orange or some other seasonable fruit on the road. This will be quite sufficient to quench one's thirst.

A great deal could be written on the subject of cycling, but I hope that these few remarks will be acceptable, and afford some hints to the readers of this paper.

A FRAME WITH FOLDING DOORS FOR A CABINET PHOTOGRAPH.

BY J. W. GLEESON-WHITE.

To many owners of a cherished photograph there are reasons why it should not be always in evidence. It may be that the owner cares not to expose the similitude of one he loves to the gaze of every chance caller; it may be that it is a yet more sacred memory of a friend, who has joined



DESIGN IN FRETWORK FOR A FRAME WITH FOLDING DOORS TO TAKE A CABINET PHOTOGRAPH.

the majority, that he hesitates to allow all to see; or it may also be that he wishes the silver print to be screened from the ultimately fatal light, that sooner or later dims the fair beauty of even the most perfect photograph. But whatever his reasons, a cabinet photograph frame, with folding doors to cover the enshrined picture, is always a popular article for fret-cutters to construct, and offers no difficulty in its subsequent finish to anyone the least familiar with tools.

The design chosen is a conventional representation of the sky, with the emblematical Giver of Life sweeping across it, clouds, moon, and star forms also being employed. This symbol of life has been frequently used in Oriental art, and has no great unfitness for the purpose to which it is now adapted.

If cut in brass or metal, the hingeing of the doors would offer some little obstacle, and it would be easier to employ very thin metal mounted on plain polished wood. This yields a more satisfactory result than mere metal, which has rather a mean appearance unmounted and worked in thin sheets.

It matters little whether the star forms are exactly the size given, nor is it important that the rays of each should be of uniform thickness and at equal angles.

It is not needful to describe the fret-cutting, that has been repeated here often enough already, but a few details not shown may require comment. Such a frame would be more lasting if backed completely with a thin piece of wood. By this plan the rabbet for the glass would also be easily managed. Take a plain piece of $\frac{1}{4}$ in. stuff the size of the whole—or $\frac{1}{4}$ in. less each way—and cut a square hole $\frac{1}{8}$ in. larger each way than the size of the two doors. Plane down the piece cut out to about half its thickness; upon the backing panel above the opening fix a strut, with hinge, to support the frame.

If cut in wood, the doors should be lined with silk or thin films of wood. The whole may be gilded in various bronzes, or the design itself worked on solid wood in gesso and finished in various shades of lacquer.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

83.—Air Stuffed Collars.

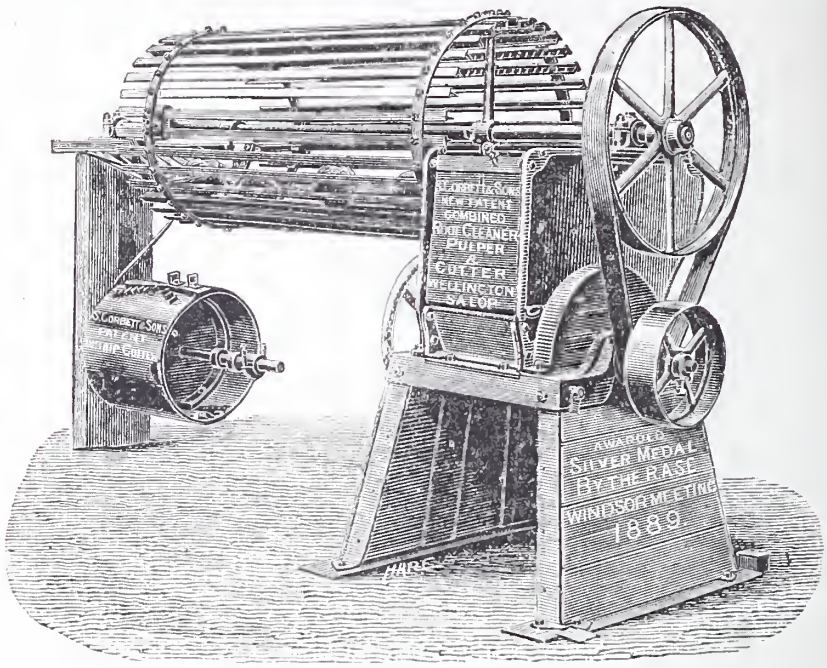
The omission of the aspirate to the word air is the only indication that the collars of horses are stuffed differently to the usual filling-in of the casing that takes the pressure of the "hames" for draft of horses. Air beds have long been known, cushions air filled are in common use, yet animal draft has been without that simple contrivance till recently.

The Alpha Air Horse-collar Company, Charing Cross Road, W.C., apply the same principle to pads for harness and saddle linings. The comfort of animals to have this yielding pressure on backs or shoulders must be great compared with the hard stuffing generally used in harness and saddlery. Trials under every variety of condition have proved the merit of this invention, and the economy must be coincident with it.

The utility of this invention is self-evident, and there will be no need to write more at length on the desirability of its general adoption.

84.—Corbett & Son's Patent Combined Root Cleaner, Slicer, Fingerer, and Pulper.

This handy agricultural machine, indispensable on large farms on which a large quantity of stock is kept and fed during the winter and early spring, is the patented invention of Messrs. S. Corbett & Son, makers of agricultural implements and machinery, Park Street Works, Wellington, Shropshire, and, now that autumn is already far advanced and winter pretty close upon us, cannot fail to be of interest to all readers of WORK who belong to the farm-keeping section of the community. The machine itself is shown in the accompanying illustration, which will afford a good idea of its appearance and purpose. It is driven by horse-power. The root-cleaning portion of the machine is the large horizontal cylindrical barrel, resembling a cage, to the left of the illustration, into which the roots are thrown from a hopper. The cylinder itself is about 5 feet 6 inches long and 2 feet 5 inches in diameter, and the bars are made of T iron, the shaft or vertical part of the T projecting inwards, and notched or toothed along part of its length. As the cylinder revolves, the roots are thrown against each other and against the upright flanges of the bars, and are completely cleansed from all dirt and small stones that may have adhered to them when taken from the ground—as thoroughly, indeed, as if they had been washed in a root-washing machine, and this without the slightest injury to the roots. From the cleaner the roots pass either into the pulper, or fingerer and slicer, as may be desired, for separate barrels are supplied to effect these operations, which are easily changed by the adjustment of four screws, or removable altogether as a matter of course, so that the machine may be used simply as a root cleaner. The pulper barrel is composed of sectional plates, which may be of fine or coarse cut as required, and have the quality of durability, and can be removed and replaced at any time in a few moments. The cleanness of the roots prevents any chance of injury to the pulping and slicing arrangements. The fingerer and slicer, which, as well as the pulper, is rotated more rapidly than the cleaner, is shown to the left immediately below the cleaner. As a slicer it can be adjusted, as the word implies, to cut mangold or turnips, as the case may be, into broad slices, and as a fingerer to cut the slices into fingers of the width of $1\frac{1}{4}$ inches for bullocks, and of half this width for sheep. The knives are double-edged and reversible, and a new set can be introduced by any ordinary farm labourer, when required, so simple are the means of fixing them. The machines may be had with the cleaner cylinder to the left hand, as in the illustration, or to the right hand, as may best suit the convenience of the purchaser, so this should be mentioned when ordering. The power required to set the machine in motion is not great, but I am not aware that it can be driven by hand. The price of the root cleaner and pulper is £17 10s.; an extra charge of £2 7s. 6d. is made for the fingerer and slicer.



Corbett & Son's Patent Combined Root Cleaner, Pulper, Fingerer, and Slicer.

85.—A Few Practical Hints on Repoussé.

Mr. John Harrison, Art Metal Worker, 30, Augusta Street, Birmingham, sends a handy little book on "Chasing and Repoussé Work," with seven original designs for trays, bellows, photo frames, finger plates, vases, etc., and illustrations of the tools used, but the drawings are on a reduced scale, and must be enlarged to form full-size working drawings. Mr. Harrison supplies some brief but clear instructions for beginners in his "Elementary Hints," and in the letter accompanying his pamphlet says that he "shall be very pleased to give any information on the art apart from this manual." He names no price for his book, but this may be easily ascertained on application to Mr. Harrison himself.

86.—Messrs. Harger Bros.' Price List and Designs for "Rizaline" Cards.

Messrs. Harger Bros., Settle, Yorkshire, the well-known north country dealers in fretwork tools, machines, materials, and patterns, send me the latest edition of their price list, which contains a great variety of items of use and importance to amateurs. I may call attention to what, as far as I remember, are new specialities, namely, furniture and mantel nails, and ornamental bookshelf leather, in page 35, and the mouldings for picture frames in gold, black and gold, oak, and walnut, in pages 36 and 37, shown in full-size sections. Some additions appear to have been made to their fretwork patterns. The price of the price list is sixpence. A separate book is devoted to patterns of Messrs. Harger Bros.' "Rizaline" cards, which, as the term implies, have a surface very much resembling Chinese rice paper. Cards in "porceline" and "ivorine" are also supplied—all at very moderate rates.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

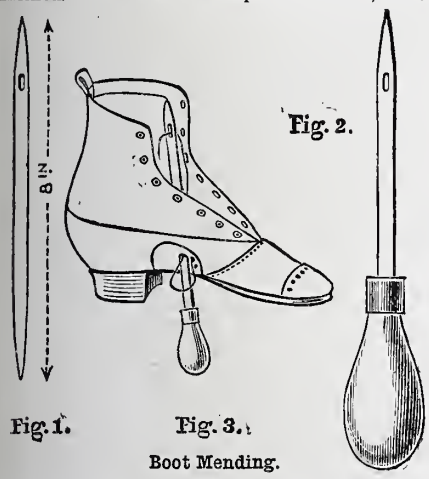
NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Boot Mending.—T. W. B. (*Ponder's End*) writes:—"One way of making an awkward job easy:—Get an upholsterer's needle, 8 in. (Fig. 1), put it in a handle (Fig. 2), fit your patch (Fig. 3), and make holes with awl if stout leather, such as kip—light leather will not want it, if you use the needle carefully. Pass needle with wax-end through, pull out needle, see that both ends are level, thread out side end, pass through second hole, pull out end inside boot, thread the inside end, pull out needle, draw both ends tight, and keep on till patch is finished. Work back a couple of stitches, cut off



Boot Mending.

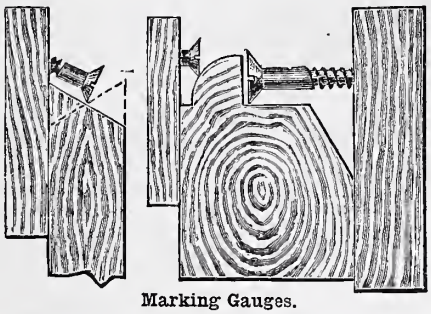
ends, and lightly tap with hammer to make it lay smooth. This, I think, will suit a good many people who cannot use the wax-end with bristles, as with the needle I can sew a patch on in a quarter the time I could with wax-ends. I hope this will be of use to some that mend their own boots, if you can find an odd corner for this. These needles are very little stouter than an ordinary stout awl."

Folding Chair.—J. D. (*Fairfield, near Manchester*) writes:—"*Re* W. C. W.'s comments (see Vol. II., page 455) upon folding chair, I for one shall be pleased if he will give sketch and dimensions of chair to fold flat, and to avoid the curved arms cut across the grain. I have already made a template of the chair; he questions the correctness of arm, and I will stop proceedings until his sketch and particulars appear."

A Coal Saver.—J. S. (*Oldham*) writes:—"Will J. W. B. (*Southport*) (see page 471, Vol. II.) give his address, and I will call and see his coal saver, as I don't fully understand the drawing? It seems to me a very good idea. I should be very much pleased to see it."

Carriage Cushions, etc.—An Old Trimmer writes, in reference to W. P.'s answer to Trimmer, (see page 436):—"The writer seems to have omitted a paragraph explaining how patterns, as diamonds, squares, etc., are formed in carriage trimmings, which is done as follows:—The size of the diamond, say, is decided upon. The cloth is folded in pleats and ironed on the back; this ensures the diamond forms being true and smooth in the crease; the button holes, where marked, are mostly strengthened by pasting on an inside patch of muslin at those parts, and the cloth is strengthened by a backing of glazed muslin; a layer of cotton wadding comes next, and the horse-hair on that; this is all done on a temporary frame at the bench independent of the main backing of buckram for squabs, etc. The rule for the quantity of horse-hair for a squab, is: for light stuffing, lay on the squab as much horse-hair as will stand up eight inches; for fuller stuffing, twelve inches in height; both give nice elastic squabs. For high raised diamonds they are each stuffed separately between the cloth and the 'backing;' but this is not usual in carriage work unless for very hard wear."

Makeshift Marking Gauges.—E. W. (*Peckham*) writes:—"In Work, Vol. I., page 540, a simple bead router was shown by J. M. E. It may interest many readers to know that marking gauges may also be made the same way. With two screws a very serviceable makeshift mortice gauge can be made, whilst an extension of the principle gives us multiply tooth gauges. In multiply tooth gauges so made, it is best not to have the screws in line, but ranged in a curve, so that not more than two



Marking Gauges.

screws can mark at one time. These screw gauges are often preferable to those of orthodox pattern, and may frequently be applied where the others could not be used. A few suggestive positions are shown in the accompanying illustrations; no explanation is needed."

II.—Questions Answered by Editor and Staff.

Work on Marbling.—T. R. (*Paisley*).—If you will apply to the publishers of Van der Burg's work on marbling, namely, Messrs. Crosby Lockwood & Co., Stationers' Hall Court, Ludgate Hill, London, E.C., they will give you all necessary information as to price, etc.

Painting Brasswork.—F. T. C. (*Bristol*).—Macpherson's Foochow Enamel, which, I daresay, will answer your purpose. A special kind is made for metal work.

Taking out a Patent.—W. D. (*Collyhurst*).—An article appeared in Work, No. 35, which would be of use to you.

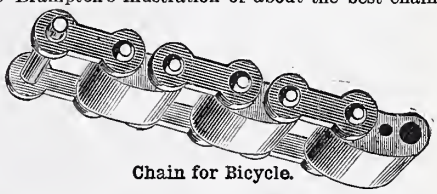
Warn's Book on Tin-plate Working.—A. T. S. (*New Swindon*) writes to ask if Tinker will tell him where he may be able to get this work (see Work, Vol. II., page 355).

Cutting Spirals in Wood.—Carino.—The spirals often seen in wood turning are seldom done by turning—properly so called. There are two ways of making a spiral cut round a cylinder, or a screw thread, which may be regarded as an inclined line wound round a cylinder. These two ways are (1) to cause the work to move to and fro in the line of centres: this is done in a lathe with a traversing mandrel; (2) to cause the tool to move from right to left (generally, but not always) as the work revolves between fixed centres. In the first case the screw or spiral is limited to the pitch (or distance of threads) of the model screws fitted to the lathe mandrel; in the second case, the pitch of screw or spiral depends on the relative speed of the traverse of the tool and rotation of the work: for instance, if we ensure 1 in. travel of tool from right to left to each rotation of the work in the lathe, then we have 1 in. from centre of each cut to centre of next, or 1 in. pitch; the relative speed of movement is determined by change wheels, having cogs, which, though interchangeable, are various in number of teeth and in diameter. The work done by these two methods and other expedients of similar nature are usually of too fine a pitch to be useful in wood turning, and in such articles as pillars for whatnots, balusters, candlesticks, and stands. A process of hand-cutting is adopted which, though it is not turning, is yet done on the lathe—that is, while the work which has been turned remains on the lathe. If a band of paper the width of the desired strand is wound round the work in a spiral direction, leaving the wood uncovered between each turn of the paper as much as the width of groove is intended to be, a little gum or glue will fix the paper temporarily, and the band being removed from the driving wheel, the left hand can govern the mandrel while the right cuts to the desired depth in the uncovered space between the coils of paper: first with a saw, then with gouges, and lastly with rasps and glass-paper. This is easier to do than would appear from the description, though necessary brevity forbids a fuller explanation. If a double twist is desired, let Carino—at all events, at first—use two bands of paper, both the same width but of different colours, being careful to leave a space for the cut-out portion and to begin exactly opposite each other; but practise a single twist first. The obstacle to doing this work by ordinary lathe appliances is the rapidity of traverse required, and the necessity of swift motion in wood-turning, though the writer has seen an appliance which he was informed was for twist pillars of bedsteads only.—B. A. B.

Acids for Electro-plating.—F. W. (*Kensington*).—I think I understand what you want, although you have not clearly expressed your wishes. You cannot make the *acids* used in electro-plating and gilding, nor do you wish to know how to make them, although this is the gist of your question. You evidently want to know how to make up the liquids used by electro-platers and gilders, when they dip, say, a copper coin into a silvering bath and it comes out looking like silver, and then dip it into the gilding bath and it comes out coated with gold. Ah! my friend, there is a little conjuring done behind the scenes, of which you know little or nothing. If I were to tell you here how to make up the liquids for silvering and gilding you would not be able to silver or gild them because you would not know how to work them. I should have to explain the whole art of electro-plating to you, and this could not be done in the limited space at my disposal. I hope to be able to tell you and other readers of Work, very soon, how to silver and gild a few trinkets.—G. E. B.

Solution for Silver-plating.—J. C. R. (*London, S.W.*).—To make up one gallon of silver-plating solution, suitable for plating a few small brass articles, procure 5 ounces of silver nitrate, costing about 3s. 6d. an ounce; ¼ lb. of potassium cyanide, costing about 1s.; and 2 or 3 gallons of rain water. Dissolve the silver nitrate in ½ gallon of the water, and 2 ounces of the cyanide in 1 quart of water. Add the cyanide solution to the nitrate solution in small quantities at a time, and stir well with a glass rod each time. White curds of silver cyanide will form and sink to the bottom of the vessel with each addition of cyanide, whilst any silver nitrate remains in the solution. When these become scanty, add the cyanide still more carefully and stir up the curds well after each addition of cyanide. Cease adding cyanide when this ceases to cause a white cloud in the solution and appears to pass clear through it. Allow the white precipitate to settle well down; then carefully decant off all the liquid above, and again fill up with rain water. Allow this to settle; then pour off as before, and give the precipitate of silver cyanide a third washing in a similar manner. To this wet silver cyanide add the remainder of the potassium cyanide dissolved in 1 quart of water, and stir all well together. If the cyanide employed is pure, the quantity given will throw down the silver as silver cyanide, and dissolve this to form the double cyanide of silver and potassium solution. But as this is not easily obtained, it will be advisable to have a few extra ounces of the cyanide, and add some of this in small quantities at a time until all the silver cyanide has been dissolved. This done, filter out any dirt there may be by passing the solution through a calico filter, and dilute the whole to form 1 gallon of plating solution. Now add 1 ounce of potassium cyanide, and work the solution with two cells of a Smee or a Daniell battery, employing a sheet of pure silver as an anode. I presume, from your letter, that you know how to prepare the articles for plating, to manage the process, and to finish the articles when plated. Should you meet with any difficulties, write again, and I will try to help you over them.—G. E. B.

Chain for Bicycle.—Cyclist.—The sketch given is Brampton's illustration of about the best chain



Chain for Bicycle.

going of 1 in. pitch to fit same wheel as Appleby's chain, new hard steel block chain No. 4. Address—F. Brampton & Co., Oliver Street, Birmingham.—A. S. P.

Frosted Glass: How to Imitate.—D. S. (*Aberdeen*).—The kind of glass frosting which I expect you wish to imitate can only be executed at the glass manufactories, the principal and most successful processes being a part of the manufacture of the glass itself. However, here are some:—Roll up tolerably tight a piece of tin 8 in. long and 2 in. broad, or use a small flat piece of marble. Dip either of these in Croydon or glass-cutter's sand, moistened with water; rub over the glass, whether flat or round, dipping it frequently in a pail or pan of clear water. This is the method employed for frosting jugs, etc. For lamp glasses a wire brush is used, and they are chucked in a lathe. Large pieces of glass should be laid on a bed of baize or other soft material. If the frosting is to be very fine, finish with washed emery and water. As a temporary frosting for windows, mix together a strong hot solution of sulphate of magnesia (Epsom salts) and a clear solution of gum arabic, and apply warm. Or use a strong solution of sulphate of sodium (Glauber's salts) warm; when cool, wash with gum water to protect the surface from being scratched.—H. L. B.

Parkinson's Gas Burner.—A Reader of "Work."—The address, Messrs. G. J. Parkinson and Co., Birmingham, is full enough, and, indeed, the fullest address I can give you. Correspondents must kindly note that I invariably give addresses as far as I know them in "Our Guide to Good Things," and that they should always write to the address given.

"Electricity in the Service of Man."—Oswaldstree.—A new edition of "Electricity in the Service of Man," in one vol., price 9s., will be published in a few days by Messrs. Cassell & Co.; it can then be had by order of any bookseller.

Incubator.—J. M. J. (*Belfast*).—In answer to this subscriber I wish to say—(1) the drawer containing the eggs is under the tank, or source of

heat. In the older incubators this was not always secured, but glue-pots or similar vessels having water in the outer pot, and the eggs laid in sand in the inner pot, have been used, but as the animal heat of the hen is applied above the eggs, we ought to imitate the natural process as closely as possible. (2) A paraffin lamp is better than most other lamps, as its heating power is greater than many others; moreover, paraffin is cheap, and in a three weeks' consumption spirit of wine or other liquid fuels of a costly character would be rather expensive. (3) The lamp must be outside the incubator in order to obtain air and to allow the fumes to escape; the effects of combustion are, obviously, bad for the eggs from which you expect the chicks. (4) This is difficult to answer, as you do not give full particulars of your partially made incubator. If the pipe is a flue for the lamp, then make it of tin plate, about 1 in. in diameter, say 3⅛ in. in circumference, well soldered; if the pipe mentioned is for the hot water to pass through, ½ in. gas compo tubing will answer well. (5) It will be well to have the top of the case movable, but as it cannot often need to be removed, you can fasten it with wood screws. You would do well to get the Index to Vol. I., and obtain each number that contains any information on the subject. Always, in asking information on any work in progress, tell our Editor where you are, how you have hitherto proceeded, and where the difficulty has arisen. Much better information could then be given than is possible when the querist gives so scanty information. This exhortation may be universally applied. —B. A. B.

Safety Machines.—T. W. (*Birmingham*).—There will in all probability be a series of papers on making a safety machine of the "Diamond" type in Vol. III., but Vol. II. is already too far advanced, and so much has to be completed therein that I cannot undertake to commence and finish any new series of nine or ten papers within its limits.

Sea Diving.—T. W. (*Birmingham*).—As far as I can see, you can only become a sea-diver by associating yourself with a man who is already a diver by calling, and going through a regular course of instruction and practice under his directions.

Address.—J. H. (*Redcar*) asks for the address of Messrs Macintosh & Co., Limited, of Cambridge Street, Manchester (see also my reply in "Shop" to A. S. (*Musselburgh*), No. 83, page 504. At the time of writing on the subject of shoes for crutches, I was not at all sure that this firm, after a lapse of many years, still made these useful articles. I therefore wrote, and received a reply stating that they will be happy to supply WORK readers with them at the price of 7s. 6d. per dozen—cash with order, of course.—J. W. H.

Telephone.—W. B. (*London, W.*).—The article on the Telephone appeared in WORK, No. 28, page 439. There is also a book published at 5s. by Trübner & Co., Ludgate Hill, on the same subject, by Du Moncel.

Powdered Glass.—FISHPONDS.—The powdered glass for frosting Christmas cards must be very fine; you could get it of nearly any glass blower, and a small quantity would go a long way. Do you not know of any glass-blowing works in your neighbourhood? This would save the cost of carriage; if not, write to London to Messrs. J. Powell & Sons, Whitefriars Glass Works, Temple Street, and say what you require it for.—W. E. D., JUN.

Glass Bottles.—H. G. (*Oxon*).—I do not think an address has been given for glass bottles; I cannot find it; one was asked for, but I do not see any reply; however, here are the addresses of two glass manufacturers, either of which I think will suit you:—Mr. G. Fletcher, Bottle Manufacturer, Walmgate, York; Messrs. J. Powell & Sons, Whitefriars Glass Works, Temple Street, London. —W. E. D., JUN.

Patenting Inventions.—E. C. M. (*Ipswich*).—Advice has been already given to inventors who seek to become patentees in various parts of WORK, for which see Index to Vol. I., published at 1d., for reference to papers in the body of WORK, and comments, etc., in "Shop." I cannot lend assistance in forming clubs of would-be patentees. If you have a sufficient number of friends to join you, why not follow the directions given in the newspaper cutting of which you speak?

Silk Winder.—W. P. (*Dartford*).—I regret that I cannot see my way to making a model of the silk winder I described in No. 76 of WORK, for your benefit: it would open up too large a field of possibilities. It is not very hard, however, to make one for yourself. The lower wheel drives a smaller one by means of a band, and the silk is wound on a little frame attached to the top. This frame may be a simple card or the form I described. If you begin at the beginning, following carefully each direction, there ought not to be much difficulty in the matter. I hope you will succeed.—APIS.

Tyre Indiarubber.—S. B. E. (*No address*).—Your correspondent wishes to do an impracticable thing. There is no simple method of making a tyre out of a lump of rubber, the simplest process involving expensive plant, as well as practical knowledge. In other words, it can only be done in a rubber manufactory. It would be about as practicable for S. B. E., out of a solid nugget of steel, to make a hollow backbone for his bicycle. S. B. E.'s plan is to give the lump of rubber to a rubber manufacturer and get value for it in tyres.—A. S. P.

Camber of Girder.—J. M. E. (*Openshaw*).—J. M. E. does not state what kind of girder he means, whether a wooden turned girder or an iron lattice girder, such as is used in bridge work. From the dimensions given I should presume it is the latter. A girder 60 in. by 7 in. by 7 in. is a largish job for one who does know how to give it the requisite camber; but it may be he only wishes to possess the theoretical knowledge of how it is done. A practical builder would draw with chalk on a drawing loft floor (precisely as is done with the frame of an iron ship) half the length, namely, 30 ft. of the girder of the full height; he would draw the main bottom beam, showing the camber by a curved line rising from a horizontal line, showing the 4 in. at the end of the 30 ft., then he would show the top beam parallel with the lower, then he would connect the two by as many uprights as he thought necessary, after which he would fill in the panels (thus formed) by the lattice work, then he would mark every rivet hole, showing how the whole was to be riveted together. After this the carpenter or joiner would come and make templates of thin wood to fit this full-size drawing. These templates would be in two or three pieces, as a frame 30 ft. by 7 ft. would be unwieldy to handle. In any case the frames, when put together, would cover the drawing exactly, and on these frames every rivet hole on the drawing would be marked. The iron workers would now use these frames in cutting the various plates and bars, and in punching or boring them for the rivets. It will be obvious that the same templates or frames, by turning them over, will serve for the other half of the girder, and the whole 60 ft. when riveted up will show whatever amount of camber has been given to it in the preliminary drawing. If the girder was a wooden one the operation would be entirely different. The lower beam would be pulled upwards in the centre, and at other necessary points by tie rods. The uprights are called king or queen posts; all the angular pieces, going from corner in the panels, are struts; all the pulling parts, which must be of iron, are ties. —A. S. P.

Silvering Glass.—B. J. (*Port Talbot*).—I am glad you were not too much discouraged to write, we are always glad to help. The only reason why readers are sometimes referred back is that it seems unfair, when so many are waiting for answers, to take up the space with replies exactly the same as what appeared a short time before; however, as it happens, I do not think your question has been answered before, for in the postscript you casually remark that you are in the glass trade and want information professionally; most of the letters did not say anything, and so I concluded they were written by amateurs, and of course what would do for the former would not be suitable for the latter. To silver plate glass you will require tinfoil, mercury (quicksilver), roller for smoothing the foil, and a silvering stone—this is a large slab of slate or marble, very carefully prepared, perfectly level and smooth, and mounted upon a swivel. Take a piece of plate glass, clean it very carefully, or you will have your work all to do over again, as the slightest speck or mark shows perfectly plain when laid upon the tinfoil and mercury; even with the greatest care you may have to take the glass off once or twice before it is successful. Unroll a piece of tinfoil, which is sold in lengths of about 6 ft., and from about 1 ft. to 3 ft. in width, to allow of it being cut to the best advantage (I believe larger sizes can be had to order), and cut about ½ in. or 1 in. larger all round than the glass; smooth out all the creases, and pour on the mercury; put plenty on, as the greater part is recovered; now slide the glass along the prepared foil, pushing out all the air bubbles and dirt, etc.; this will require a little practice to do well. You will now see if the glass is clean; if not, it must be removed at once before the foil has adhered; if perfect, weight down so as to squeeze as much of the mercury out as possible, and leave for a few hours, according to the size of your piece, tilting up your stone at the same time slightly. When the weights are removed, block one end up with wood, placing a piece of foil at the lower end, and let it remain as long, or even longer, than before; then stand upon a shelf or on the floor, and leave until the foil has adhered perfectly. For small glasses, crown glass is sometimes employed; if this is used you will see you cannot weight down like plate glass; you can use a board for this instead of a stone, and it is usual to do several at one time, and as each piece of glass is slightly curved, silver on the hollow side, and place one on top of the other, so as to squeeze out the mercury. Proceed in the same way as for plate glass, only when the foil is ready do not slide the glass on, but lay a clean piece of white paper on and the glass on the paper, then, with a quick motion, draw the latter away, leaving the glass resting on the foil and mercury. I hope I have made everything clear, but if not, or if there is anything else you want to know, write again, and you may feel assured we will do our best for you.—W. E. D., JUN.

Spood China.—A. B. (*Yoxford*).—It is impossible to give you a correct idea of the value of an old "spood" china service without seeing it, especially as you do not say the colour of the pattern (I suppose it would be blue?). So many things must be considered in valuing old china—the pattern, the colour, the condition, etc.—so that if a price was named simply from a description it would only mislead you most likely; if only a single piece was seen, an expert would soon tell you the value. Have you no one close by you could show it to? I may say "spood" does not rank very high in value the market. If you do not succeed write again, a I may be able to recommend you to someone your neighbourhood, or in some way to help you you were willing to incur a little expense in sendi a plate.—W. E. D., JUN.

Fretwork.—FRET CUTTER.—Try the local iro mongers. You might get what you require fro either of the following places in Glasgow:—M Kellar, 468, Gallogate; J. F. Fergusson, Maxwe Road, Lamb & Crawford, 295, Shields Road; or J. and A. Stewart, Kelvinhaag Street. If y cannot get what you require at any of these, wri to L. Marshall, 14 and 15, St. James's Street, O Street, E.C., who can forward you one per parce post.—A. J. H.

Wood Drying.—E. H. G. (*London, S.E.*).—If y mean by your inquiry, "How can you dry fi wood?" there is only one method—*i.e.*, by stacki it so that the air can pass through the pile. course you are aware that white deal does not bu so readily as yellow, and if rotten will char. A. J. H.

Electrical Engineering.—A WOULD-BE-ELE TRICIAN.—The only course open to yourself, a those like you who are already in some emplo ment but have limited means, is to continue your present employment and devote your leisu to a study of the subject, with a view to the practic application of the theories committed to memo from text books. It would have been better h you brought the youthful vigour of the young bra to bear on the subject, but at the age of twen three you are not too old to begin. Many me occupying prominent positions in the professio commenced later in life than yourself. If you a in the vicinity of science classes, held in t evenings, attend them and get a good elementa grounding in magnetism and electricity. At t same time, put the theoretical knowledge thus o tained into practice by making electrical apparat and experiments at home. Whilst studying t elementary part of the subject decide which branc you will take up as a means to obtaining a livel hood in the future, and give this your closest atte tion. The lower rungs of the ladder are occupie by electric bell fitters, telephone and telegrap linesmen, engine and machine minders, men i charge of electric light installations, and electr platers. You will probably have to enter the rank of one of these branches when the opportunit occurs, and work your way up to an official pos tion by sheer force of brain and muscular powe Your path would have been easier could you ha afforded the fee charged for tuition at one of th schools of electrical engineering, as there yo would at once be placed in a position to obtain a insight into the construction and working of ele trical instruments and machines, and you coul from these have testimonials as to your ability But much can be done by you if you will study th best books on the subject, and go to work with th full determination to overcome all obstacles place across your path. I shall always be willing t advise you should you get in a tight corner; bu my advice now is to *work* yourself out of any fi you may get into, if possible.—G. E. B.

Gold Plating.—SULPHO-CYANIDE.—The full an correct details of the art of electro-depositio cannot be compressed into the columns of "Shop There are several good books published on th subject, and some of these have been repeatedl mentioned in WORK. It is my intention to writ out a few papers on the subject for publication i this journal, when I can spare time enough for th purpose. If you cannot wait for these, get Mr Watt's book on "Electro-deposition," or the boo by Mr. Gore on "Electro-metallurgy." Either o these will tell you all you wish to know of the art —G. E. B.

Cure of Disease by Electricity.—D. McG (*Renton*).—Questions relating to the cure of disease by means of electricity should be addressed to th Medical Editor of *Cassell's Saturday Journal*. I WORK we will gladly advise you respecting th construction or repair of any electrical apparatus whether used for curative or other purposes; bu we cannot advise you in the application of such apparatus to the cure of diseases. This, we ar assured, can only be effectively done by a qualifie surgeon. Amateur attempts at curing diseases b such means as these may result in serious injur instead of cure.—G. E. B.

Circular Saw.—J. McD. (*Glasgow*).—I migh put you in the way of fixing up a small circula saw bench, but am afraid after it is fixed and se to work that in a short time you would be lik many I know who have started to work a smal circular saw by hand power—wished they had never fixed it, and resort to the old way of ripping with the hand saw. It must be understood tha to despatch work with a circular saw, it has to be driven at a high speed, and unless there is some power different from hand power, there cannot be a great amount of work turned out. A man may commence to turn at a fair speed, but he soon becomes tired, when the speed decreases, and the saw becomes a mere drag. To drive a circular saw is not work for man or ass—at least, that is my opinion, and I have had no little experience; and I am of opinion—in fact, I am almost sure—that for the work you have to do, if you go to work the right way, you may turn out more work with the hand rip saw than with a small circular saw driven by hand. You may say, "What do you mean?" I mean that many a man will take a hand saw

ıd commence to cross-cut his stuff the length quired, then he will take the same saw and y to rip his stuff with it, hut he finds he makes ow progress and very bad work; then he will) and, after a fashion, sharpen the saw, thinking ıe mistake is in the sharpening, at the same time ot knowing where the fault is. After he has nished the so-called sharpening, he commences) rip again, but the saw, if anything, runs worse ıan before, and there is an amount of trouble to ut a straight cut in the hoard. As you have to ross-cut and rip your boards, you should, in the rst place, get two good hand saws—one for cross-utting, the other for ripping—and if you are not cquainted with or do not understand saw sharpen-ıg, put your saws into the hands of a practical man, elling him at the same time the kind of work you hiefly have to do with them; then if he knows is work he will know how to proceed. When your aws are ready, line one board the width you want it nd place it square on another hoard, as your stuff s not very thick, and rip away the two at one time; hen mark them for cross-cutting, placing one oard on the other as before, and cross-cut the two, r even three if you wish, at once, which the saw hould cut easily if in good condition. And when he saws get dull, if you do not understand the harpening, give them to the saw sharpener; do not egrudge a sixpence; it will more than pay you n the long run. If after reading the above you till would like to fix up a small circular saw bench, I would refer you to Vol. I., No. 28, page 446 of WORK, where you will see how to make a circular aw bench, also instructions how to drive off a mall circular saw. I might add that for some ime past a small circular saw hench has heen dvertised in this paper by Lewis & Lewis; how it answers I cannot say, as I have not seen it at work. I have no doubt, should you write to the above makers, that they would send you full information in reference to it.—A. R.

Monogram on Desk Nameplate.—SECOND-HAND.—With regard to the monogram you wish to remove from the hrass nameplate on your desk, you may erase it. Procure a 6 or 8 in. flat smooth-cut file; heat it te a dullish red; place in the viec with lead or copper clams, and bend the end to a gentle curve, to give clearance to the handle while using. Re-heat to a cherry red, and quench in *clean* cold water, say half a gallon, into which put a handful of common salt; this will make the file very hard, but if you handle carefully it will last your job well, and the probability is that you may never want it for a similar purpose. Now with your bent file (or riffler, as it is termed by the users) proceed to file the surface of the nameplate equally all over, until the last deepest cut is taken out; afterwards ruh with pumice stone and water, next with Tam-o'Shanter hone, and lastly with putty powder (oxide of tin), applied dry, with a piece of leather. Now all this seems very simple, if you can avoid rubbing the plate into holes, as the natural tendency is to erase the objectionable letters first. Try to avoid this, and rub well outside the monogram first, and then smooth over equally. The best plan (for desk nameplates are very thin) is to get a piece of sheet hrass $\frac{1}{16}$ in. thick, and file it out to the shape of the original nameplate, but $\frac{1}{8}$ in. larger; have the new plate engraved, and take it to a cahinet maker to be inlaid, who will finish up the surface equal to new.—N. M.

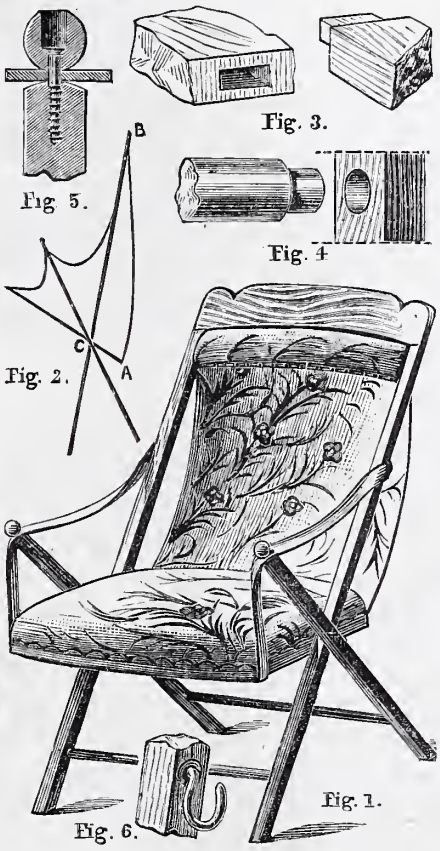
Cycle Enamel.—BIKER wishes to know how to make an enamel for cycles for haking on. I would strongly advise you not to attempt anything of the kind, as, unless you make very large quantities, it will not pay you. If you only want a gallon or so, why not buy it of some first-class maker, and save all chances of failure, as well as trouhle? You can get an excellent stoving enamel from Palmer, of Old Street, E.C., at 2s. per pint. Why don't you enamel your cycles in the same manner as a lot in the market? The following is the way, and about half the cost of the stoving process:—Thoroughly clean all parts to be enamelled, and see that they are perfectly free from oil or grease. Pass all parts through smoke of fire or forge, until they become thoroughly dull. Ruh all loose soot off with a piece of dry rag. Next procure some good spirit enamel and carefully paint cycle with same. On no account go over the same part twice, and always in the same direction. Always paint a machine in a well-lighted room, as darkness causes the enamel to dry clouded and dull. Harris & Son, Becch Street, Barbican, sell an enamel at 9d. per pint, well suited for this process. You will find this an excellent substitute for baking, and the cost and trouble cannot he compared with the stoving process. Write and let me know how you get on, and I will help you over any difficulty, should any occur.—F. C. P.

Self-acting Fountain.—READER.—A complete design for a self-acting fountain appeared in WORK a few weeks ago; you could adapt the features to any size.—C. M. W.

Fountain.—T. B. (*Dover*).—It is evident beyond doubt that you have not carried out the instructions as to self-acting fountain correctly, either in making or using, I cannot, of course, say which; look them over again carefully; it cannot help playing if correct. I may add that another correspondent writes, "Have just finisbed my fountain, and it looks so well and works so satisfactorily that I and all who see it are quite delighted with it."—C. M. W.

A Child's Cot.—MRS. G. H. (*Walton-on-Thames*).—Mr. E. Bonney Steyne has left this country for a short sojourn in the States; but when WORK reaches him and he sees that you wish for a child's cot, "the top, hottom, and sides to be made something the same as the first tier in the 'Overmantel in Arahian Style,' the arches to be made of a different kind of wood to that which would take the place of glass, or one with some inlaying in the panels, to he French polished," I am sure he will use his hest endeavours to meet your wishes.

Folding Chair.—A. A. (*Richmond*).—On account of its associations, there is very good reason for you to prize the wood you possess, which you say was brought from Cabul by a partaker in the last Afghan war. My only regret is that every soldier in that war (and in any other, for the matter of that) did not bring home some trophy or another, for then it would have heen evidence that none had lost their lives. War is a dreadful slaughterer, but talking of it will not, alas! prevent it, so let us return to a peaceful subject. I think that concerning chairs (either folding or otherwise), or anything for bodily accommodation, given dimensions are almost useless, although I have sometimes given them. It is true that such articles sold in shops are always all of one size, hut in our "Shop" we must study comfort. You can buy ready-made clothes, or you can have clothes made to order—which is the best course? Proceed upon the plan mentioned by Mr. G. Le Brun lately. It is a curious fact that I have used the same method



Folding Chair and Parts.

for two or three years, when designing any new folding chairs, showing that the same ideas occur to several persons as being most preferahle. Get some wooden laths a few feet in length, and place two of them crosswise. By shifting them along each other you will find the most convenient spot to pivot them together, and the hest width to have the rails; and when this is done you will be in a position to decide the most preferable lengths for the back and front legs. I am well acquainted with the chair of which you speak, and I have drawn it here with an improvement or two. In order not to entail too much labour, I have intended that the seat shall be merely a rather thin board with rounded corners. It could, of course, be a mortised and tenoned framing, strengthened by corner triangular blocks screwed and glued inside, and upholstered (of which latter operation I cannot speak here). The top would he morticed and tenoned (Fig. 3), the mortice being in the top; and if you take my advice you will have a head-rest, as I show. Under the top join a rather wide rail, on to whieh tack a cushion. To fasten the leather arm straps, drive a long screw partly through a turned knob, then through a hole in the strap, and into the top of the front leg (Fig. 5), afterwards filling up the hole in the knob with a piece of wood. The strap should be twisted and the lower end of it screwed or pivoted to the under side of the seat, while the top portion of it should he treated similarly in connection with the back leg. If you have a hook (Fig. 6) in the back legs, and holes in that part of each strap, you could adjust the chair to various inclinations. Fix the seat so that an inch or so projects at the back, and on to it tack the lower end of a piece of stair carpet, or other material; tack the other end of the latter in the same manner to the top rail. Have a cushion for the seat, and either tack it to the latter or stitch it to the back carpet. You must have the back long enough to allow the chair to fold, for the longer the distance between A and C (Fig. 2), the greater the distance between A and B increases during the folding. Connect cross spindles as in Fig. 4. For material you might use a cretonne cushion for seat, and cretonne stitched to canvas for the back.—J. S.

Horizontal Coupled Engine.—J. D. (*Glasgow*).—Your engine is evidently altogether wrong. I want further particulars to determine the horse-power. I suppose the cylinder which is not working is disconnected from the shaft, but you do not say so. Tho cut-off should he the same at hoth ends. The valve gear must be wrongly set to give different cut-offs at opposite ends, and, unless you have a very heavy fly-wheel, I should expect the machine to be shaken to pieces very shortly. In one, say, outward stroke you cut off at $\frac{3}{4}$ and on the rcturn stroke at $\frac{1}{2}$. You must set the valves to cut off equally in bold strokes. Then take an indicator diagram to give you the mean pressure. Multiply the mean pressure in pounds per square inch by the area of piston, 154 square inches, by the stroke and twice the number of revolutions per minute, thus—

$$154 \times 2{\cdot}5(\text{feet}) \times 2 \times 58 = 44{,}660 \text{ ft. lbs.}$$

of work per lh. pressure per square inch on piston. One horse-power is 33,000 lbs. per minute. Therefore for each mean lb. pressure per square inch the horse-power will be $\frac{44{,}660}{33{,}000} = 1{\cdot}353$. This multiplied by the mean pressure will give the horse-power in the cylinder—the deductions for friction will depend upon the connections. I shall he glad to answer further questions on this subject. There is a second edition of "Details of Machinery," published by Messrs. Lockwood & Sons, London.—F. C.

Repolishing Plates of Gas Engine.—ONE IN TROUBLE.—If your slide valve, cover, or plate is cut, through working without oil, take them off of engine and clean them of oil; then rub a fine flat file over the surfaces so as to remove any parts that may be standing above the surface, but he careful not to scratch the face; wipe them clean of dust, and oil them all over, and replaeo them. Should the slide leak after this so that the gases in the cylinder do not fire, the best thing you can do is to send them to the makers to have them refaced, as special tools are required, and experience to do this properly.—S.

Telephone.—MAC.—The back number of WORK—*i.e.*, No. 28—containing article on "The Speaking Telephone and the Microphone," can be had for 1d. through any bookseller or newsagent, or from Cassell & Co., Limited, post free, for 1½d.

Phonograph Screw.—MECHANIC.—Your question is rather a strange one. You say, "Please tell me, per 'Shop,' the smallest diameter a piece of steel could be 20 in. long to be turned from end to end without vibrating." Well, I am not a turner, so I cannot tell you; but suppose I could and did, what benefit would the information he to you? The information which you really want, I think, is of what diameter should you make the shaft for a phonograph. Haven't I guessed aright? If so, my answer is, get $\frac{3}{8}$ steel rod, and you will find that will answer your requirements, and you need not make the screw so fine, it is not necessary. I hope this will help you.—W. D.

Photos on Wood.—PHOTO.—The plan most usually adopted is the transfer of a carbon print to the surface—this is the most satisfactory method; every precaution has to be taken to prevent the hlock warping by only moistening the surface just enough to perform the operation. Another plan, preferred hy some, is to coat the surface with salted gelatine (very little gelatine) and sensitise in an ammonia nitrate hath 60 gr. to the ounce; dry and print by contact; tone and fix. The wood should be prepared firstly hy a coating of fine zinc white or a weak solution of gelatine, to which a little chrome alum has heen added, and dry in the light. The principal thing to be borne in mind is to leave as *little substance* on the surface of the wood as possible, and only allow the *surface* to come in contact with moisture. The hlocks must be set edgeways to dry, and as much moisture removed by smooth blotting-paper as possible. Whatever process is adopted, a certain amount of practice is required to perform the operation neatly; the beginner had hetter experiment on some worthless blocks to begin with.—D.

Plaster Mould from an Engraved Spoon.—E. M. (*Barnstaple*).—I am sorry that E. M. does not tell more fully the purpese for which he requires the plaster moulds from his spoons; whether for electrotyping or otherwise. If he were more explicit, I could give him fuller information. Possibly some other moulding material might be better than plaster; though there is no reason why, with care, he should not get a good impression from it. Let him first have his metal spoon quite clean and dry, and then give it a thin hut uniform coat of olive oil. The plaster used should be superfine, it should be mixed as thick as cream, and first brushed over the metal with a camel-hair brush, so as to ensure every delicate marking of the engraving being filled; the remaining plaster can then be poured

on, and the mould brought to the required thickness. Of course, only one-half of the thickness of the spoon will be moulded at once. When the first half has set, say in ten minutes, trim the mould with a knife; brush it over with clay-water to prevent sticking, and mould the second half upon it. If carefully done, there will be no difficulty either in separating the two halves of the mould or the spoon from the plaster.—M. M.

Varnishing Leather Work.—J. G. (*Kirkdale*).—The shops at which the materials for fancy leather work are sold also supply varnish, either pale or coloured, with more or less umber, so as to give imitations of dark wood; they also supply a stiffening composition to brush over the leaves, etc., before varnishing. This last may be made with orange shellac 6 oz., Australian red gum 2 oz., and spirits of wine ½ pint; put in a bottle together and shake occasionally. This is applied with a camel-hair brush. If J. G. wants a varnish which will colour his leather less than those ordinarily sold, let him put 3 oz. of gum dammer in a bottle with ¼ pint of turpentine; and when the gum is dissolved strain to free the solution of possible impurities. If too thick, more turps can be added; if too thin, more gum. Absorption must first be stopped by sizing over the leather with isinglass dissolved in water, and the varnish afterwards put on with a hog-hair brush.—S. W.

Painting Portland Cement.—J. K. (*Durham*).—The cause of the paint coming off is most probably owing to the cement not having been thoroughly dry when the first coat was laid on, although it might appear dry; this will have partially stopped the pores, and prevented all the moisture from coming out; or the paint may not have had a sufficient quantity of driers mixed with it; or the cement or the sand with which it is mixed may contain some ingredient that prevents the paint drying properly. If the cement is hard and clear of cracks or blisters, you may conclude it is right. If soft or cracked you will have to take it off, and replaster it, using clean, sharp sand, and the best cement. If the cement is good I should advise you to let it stand till next summer, in order to give it time to dry, then after two or three weeks of hot dry weather, give it two or three coats of good oil paint. You had better get a painter to mix it for you, telling him the purpose you want it for, so that he can make it quick drying paint. It should not have had less than four months to dry in before the first painting, and more if the weather was wet. In first coating cement work with paint, if the cement is properly dry, the paint sinks in nearly as fast as it is laid on.—M.

Eminent Electricians.—F. W. (*Hinckley*).—The Institution of Electrical Engineers, whose office is at 4, The Sanctuary, Westminster, S.W., has on its list 3 honorary members, 175 foreign members, 429 members, 880 associates, and 109 students, making in all a membership of 1,596. As it is probable that all the 429 English members are eminent in some one branch or other of this wide-reaching profession, and scarcely any can claim the eminence of being masters of it, I think it would be an invidious task to single out four of them and mark their names as most eminent. You will find the full list in Berly's "Electrical Directory for 1890," price 6s. Respecting the religious opinions of scientific men, I do not greatly concern myself. Good men are found professing belief in a variety of creeds. I do not think it is within the province of WORK to inquire into and publish the religious opinions of electricians.—G. E. B.

Wood for Packing-cases.—TINNER (*Hebden Bridge*).—The best wood for cases is spruce or white deal, not because no other wood will do so well—as, of course, yellow deal or pine will do—but it is impossible to obtain high prices for packing-cases, and white deal or spruce answers every purpose at a much lower rate. Where it is possible, have the width of the case and the depth (if advisable), so that a certain number of boards join up to the required breadth. Much may be done in this way by a judicious selection of deals and battens, which should both be always kept in stock by the packing-case maker. TINNER, no doubt, knows that deals are 9 in. in width and battens usually 7 in.; but the item may be news to some younger reader. The ends of cases may, with advantage, be made of stouter stuff than the sides, and it is usual and judicious to make any joints that are in the sides and ends *not* coincident—in other words, to borrow a bricklayer's term, "to break joint." Management will usually effect this without extra work; but in any case it is wise to give attention to the point. In a case I made yesterday two 9 in. boards formed each side. I cut each end out of two 9 in. boards, one of which was cut down the centre and joined—thus, 4½ in., 9 in., 4½ in.; by this means an effective "break joint" is afforded at the cost of a little sawing and two shot joints; sometimes the same effect can be produced without any extra work. Some shippers—perhaps all—will not receive cases without iron hooping round ends—that is, they will not sign receipt, "in good condition," consequently I always put iron bands round all cases to go by sea. As to lining, I, a woodworker, cannot hope to give advice to a tinner, though I always line my cases myself with zinc, and find no difficulty in turning up the lining. The best plan I know is a tinman's bench with its iron straightedge along the front; but I am obliged to do without even that, and use a wooden mallet and a straight-edged piece of wood. If I wanted any other appliance I think I should consult Mr. Alexander, of WORK; but for the few I do I find very simple tools sufficient. This is the only reply I can make when asked to give "*any information on packing-case making.*" The word "any" is very indefinite, and I expect that I have told TINNER what he knows, and missed the difficulty which he has found. Many regrets.—B. A. B.

Pepper's Ghost.—GHOST.—The necessary instruction, with diagrams for rigging up a "fit up" for the optical illusion known as "Pepper's Ghost," would take up at least two pages of "Shop," so I will not attempt it here. I will, however, write a special article on the subject should the Editor wish it; and as a nephew of Professor Pepper—who is now in England—I may say I know a little about the subject. The magic lantern is of no use in this particular case, but the limelight is used, worked with a theatrical limelight box. I could include, however, in such article, instructions "How to raise a Ghost by the aid of a Magic Lantern." Domestic bereavement has prevented me contributing any articles for some time, but I hope soon to be at work again. Cassell & Co. also publish a book on Pepper's Ghost, price 1s.

Glass Tube.—S. R. (*Newry*).—To fuse and close a glass tube such as you describe, you will require a blowpipe flame of some sort; but with this the job is a simple one. Apply the flame to the part of the tube you wish to bend or close, and when at a white heat you will find little difficulty in hoisting the tube so as to close it effectually. Referring to your second question, the spirit lamp of which you send sketch is one of the most ordinary kind; you may burn spirits of wine or methylated spirit in it.—OPIFEX.

Gravestone Letters.—R. F. S. (*Sunderland*).—Fill the letters with molten lead, which will last for years.—C.

Work on Steam Engine.—JUNIOR DRAUGHTSMAN.—Thank you for your suggestion. I will look into it.—ED.

Organ Building.—CONSTANT READER.—The following books deal with this subject:—Dickson's "Practical Organ Building," 2s. 6d., Lockwood and Co.; Wicks' "Organ Building," 3s. 6d., Ward, Lock and Co.—C.

Materials for Polishing Brasswork.—JACKO (*Tottenham*) can obtain all materials for brass polishing, including Trent sand and Sheffield lime, from Messrs. E. Gray & Son, 47, Clerkenwell Green, London, E.C. Either of the above can be had in small quantities of 7 lb. for 1s., or 10s. per cwt.—C. A. P.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Weighing Machine.—M. N. W. (*Wells*) writes: "I have a weighing machine for weighing coals, etc., registered to weigh six tons, made in 1832 by John Hutchison, Sheffield. The platform seems to have been bolted to a wooden frame. The frame is gone; would some of your correspondents tell me how to make a frame and set the machine up? I have no doubt some of them have seen this class of machine in working order. A rough sketch would oblige."

Collieries.—W. G. (*Dudley*) writes:—"I should be glad if any readers would tell me the names of some of the principal collieries in South Wales, and also which is a good newspaper circulating in South Wales for advertising."

Wood Carving.—A BEGINNER asks:—"Can anyone tell me the best and most reasonable place near London to get the wood, tools, and patterns for wood carving?"

Ointment Boxes (Wood Pulp, Wood, or Metal).—ÆON writes:—"I should like to know manufacturers of above—particularly wood pulp—or particulars of how made."

Sound Conductors or Reflectors.—J. H. E. (*West Kensington*) writes:—"Will readers kindly mention a few of the best materials both for conducting and throwing back sound-waves, and in the order of their conductivity or otherwise, both metals and woods of different kinds, and plastic materials? The information is desired with regard to aids for the deaf mainly."

Bell-shaped Vessels.—EXPERIMENT writes:—"Will any of your readers inform me what is the cheapest and most rapid way of making a quantity of bell-shaped vessels, about three or four inches deep, of mild Bessemer steel or brass sheet of 18 or 19 gauge, what sort of tools are required, and where they may be obtained?"

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—B. B. S. (*Portadown*); A. G. (*Rathgar*); P. H. (*Pendlebury*); AQUA; T. S. C. (*Birmingham*); E. T. (*Bolton*); C. H. (*Old Charlton*); E. D. (*Liverpool*); A. J. E. (*Edenbridge*); W. J. W. (*Whitehouse*); B. L. S. (*Richmond Hill*); G. and M. M. (*Glasgow*); W. P. B. (*Southport*); G. E. (*Oswestry*); H. A. (*Birmingham*); J. W. T. (*Birmingham*); T. E. D. (*Northampton*); J. B. (*Westminster*); AMATEUR BELL FITTER; E. R. (*Crouch End*); FISHER; NERO; A. W. G. (*London, W.*); J. T. V. (*Durham*); AMATEUR; E. J. B. (*Chesterfield*); W. S.; NO NAME (*Kidderminster*); R. L. (*Glasgow*); J. C. (*Aberdeen*); CONWAY; ELECTRIC; F. T. (*Plymouth*); E. C. (*London, W.*); C. H. (*Gateshead*); STEEL WORKER; F. S. C. (*Birmingham*); E. T. (*Lancashire*); CRISPIN; A. G. (*Dublin*); DITTON STUDENT; C.A.B.; J. J. M. (*Ashton-under-Lyne*); AN AMATEUR; W. B. (*Birmingham*); C. M. (*Gloucester*); A. E. S. (*Maidstone*); E. W. (*Colchester*); J. N. (*London, E.*); E. B. (*Liverpool*); W. E. W. (*Brixton*); E. R. (*Crouch End*); W. R. (*Wood Green*); TELEPHONIST; H. B. (*Brixton*); AN OLD SUBSCRIBER; GYPSUM; E. E. (*London, S.E.*); FOGOED; JOUST; H. O. B. (*Peckham*); AMATEUR (*Halifax*); F. L.; AMATEUR CARVER; D. B. D. (*Glasgow*); E. H. (*Manchester*); LITTLE JOE; IMPROVER.

IMPORTANT TO INVENTORS AND DESIGNERS.

"WORK" EXHIBITION.

THE Proprietors of WORK are gratified to be able to announce that under the PATENTS, DESIGNS, AND TRADE MARKS ACT, 1883, they have applied to, and been granted by, the Board of Trade, a CERTIFICATE, as required by the Act cited, that the WORK Exhibition is an Industrial Exhibition, as defined by the Act, and that therefore any exhibitor, on giving notice to the Registrar of Patents, Southampton Buildings, shall be entitled to protection for any design or invention which is not the subject, as yet, of any application for Provisional Protection or of any Registration of Design.

Notice is therefore now given that the time specified for the receipt of applications for space, previously fixed for October 30th, will now be extended to November 15th, in order to enable inventors and designers to take advantage fully of this privilege.

JOHN WHITFIELD HARLAND, Secretary.

La Belle Sauvage,
Ludgate Hill, E.C. October 31, 1890.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [2 R

Glass Silverer and Beveller, Lead Glazing, &c.—EDWIN HAMMOND, Junction Road, Romford, Essex. Please state requirements. [5 R

Joiners' Tool List free. — BOOTH BROTHERS, Dublin. [6 R

Fretwork, Carving, Brass, Leather, and Poker Work.—Speciality in ornamented ivorine for painting. Illustrated Catalogues of tools, 800 Illustrations, 6d.—HARGER BROS., Settle, Yorks. [7 R

Amateur Engineering.—FLEMING, 63, Stirling Street, Glasgow. [9 R

Fretwork.—Catalogue of Tools, etc., *free*. Book of Miniature Designs, 1d. stamp. BOLTON, 59, Burmantofts, Leeds. [10 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [2 S

Castings for Microscopes; parts, finished instruments, etc. Illustrated list, 3d.—BUTLER BROS., Bentham Road, South Hackney, London. [3 S

S. Bottone, Electrician, Carshalton, Wallington, supplies batteries, lamps, carbons, zincs, chromic acid, etc., very cheaply. A neat box battery, with lamp, £1 1s. Lists, 1½d. [1 S

Walking-stick Gun, breechloader; horn and malacca; self-ejector. Cash, 25s.; exchange, 42s.—HAMILTON, 275, Liverpool Road, Islington, London. [5 S

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [4 S

Elliptical Chuck, as page 468, WORK.—If sufficient demand exists, BRITANNIA CO., Colchester, will supply parts, either rough or machined, at a moderate price. [11 R

All Amateurs should send stamp for catalogue of electrical goods.—G. OLSSON, 125, Everton Road, Manchester. [6 S

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

Bovril. **Invaluable as a Strengthening and Invigorating Beverage.**

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

STERN'S PUMILINE LINIMENT

NEVER FAILS to give immediate Relief and finally to Cure all cases of *Muscular* and *Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,* etc. Also most efficacious in *Bronchitis* and *Throat* and *Chest Affections.*

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes: "Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

From all Chemists, 1s. 1½d. *and* 2s. 9d. *per Bottle, or* 3*d. extra for postage, from*

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A Work on the "Home Use of Pumiline" sent free on application.

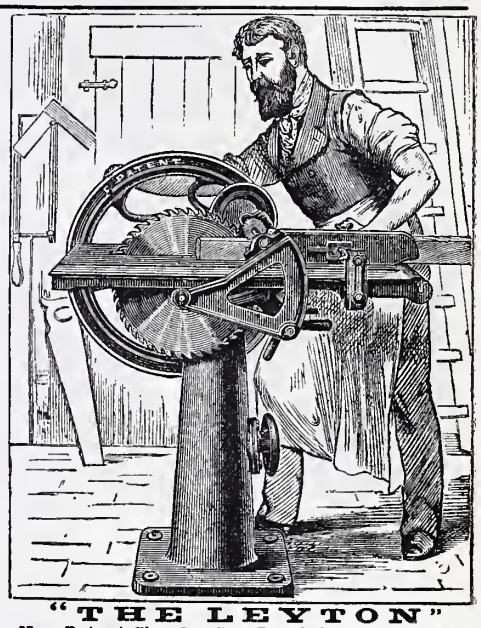
A COMPLETE NOVEL, by *FLORENCE WARDEN,* Author of "The House on the Marsh," &c., entitled "MISSING—A YOUNG GIRL," Fully Illustrated, appears in

Cassell's Illustrated Almanac and Companion for 1891.

NOW READY, price 6d.

This year's issue consists of *96 Pages,* and contains particulars with Portraits of the Champions of the Year in various Sports and Pastimes, together with a record of their achievements.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*



"THE LEYTON"

New Patent Circular Saw Bench for Hand Power.

Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.

LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

MONTHLY, *4d.*

CASSELL'S TIME TABLES.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

MELLIN'S FOOD

FOR INFANTS AND INVALIDS.

BERTIE STREETS. *Aged 9 Months.*

"*The Library, Station Road,*
"*Bexhill-on-Sea,* April 12, 1890.

"DEAR SIR,

"I have seen a good many advertisements of your Food, with photos of children brought up on your Food, but have not seen one that I CONSIDER beats my little boy. He was nine months old when his photo. was taken. I enclose a copy. "I am, yours truly,
"E. STREETS.

"P.S.—I may add he is very strong, healthy, and intelligent, and never had a doctor."

MELLIN'S FOOD BISCUITS.

PALATABLE, DIGESTIVE, NOURISHING, SUSTAINING.

Price 2s. and 3s. 6d. per Tin.

SHAKESPEARIAN WISDOM ON THE FEEDING AND REARING OF INFANTS.

A pamphlet of quotations from Shakespeare and portraits of beautiful children, together with testimonials, which are of the highest interest to all mothers. To be had, with samples, free by post on application to

G. MELLIN, *Marlboro' Works, PECKHAM, S.E.*

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores; or by Post from the **MANAGER, SALT REGAL WORKS, LIVERPOOL.**

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.
SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

PRICE, TALBOT & CO., LIMITED,
LATE DALE & Co.,
26, LUDGATE HILL, LONDON, E.C.

Post Free.

Cassell's Classified Catalogue.

TOOLS TOOLS
MOSELEY & SON
323 HIGH HOLBORN
200 PAGE CATALOGUE
BY POST 6D
ORDERS OF 10/- CARRIAGE PAID

CASSELL'S SHILLING COOKERY.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design. No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill,* with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 86.] SATURDAY, NOVEMBER 8, 1890. [PRICE ONE PENNY.

HOW TO DRAPE A BRASS OR IRON BEDSTEAD.

BY J. WHITFIELD HARLAND.

CANOPIES IN WOOD.

IN these modern days, when Tudor and four-post bedsteads are fast becoming obsolete, and bedsteads of metal are slowly but surely supplanting them, we have but one regret, and that is the sort of comfortless absence of the drapery which gives an air of coldness and, even in otherwise handsomely furnished rooms, a bare hospital-ward appearance. Nor is it in look only that the warm rich drapery is missing; in winter, be the room large or small, crafty draughts blow keen and cold upon the sleeper, leaving the memento of a stiff neck, whilst the invalid whom the breath of the east wind might throw into a relapse in the night-watches feels, and fancies he feels more keenly still, the draughts around his head. Of course, we must not in these days of sanitary science advocate sleeping as our forefathers slept, tented in with hangings all around them almost enough to stifle them; but it must not be forgotten that whilst we are up and taking exercise the throat and chest are ordinarily well covered up, and then on going to bed we throw off all this covering, and a thin night-shirt takes the place of them during the colder half of the twenty-four hours, in a room without a fire, and nine times out of ten draughty. The bed-linen, blankets, and counterpane no doubt during the early part of the night remain drawn close round the neck and shoulders, but during sleep the arms frequently are thrown out, and leave shoulders, chest, and throat exposed to the cold at a time when no exercise is being taken, whilst digestion is at rest, and therefore supplies no heat to the body; whereas if a moderate amount of drapery is arranged round the head of the bed to keep off all draughts, one would be far less liable to take cold in the chest and throat, and the air of comfort so essential in a bedroom is at once supplied.

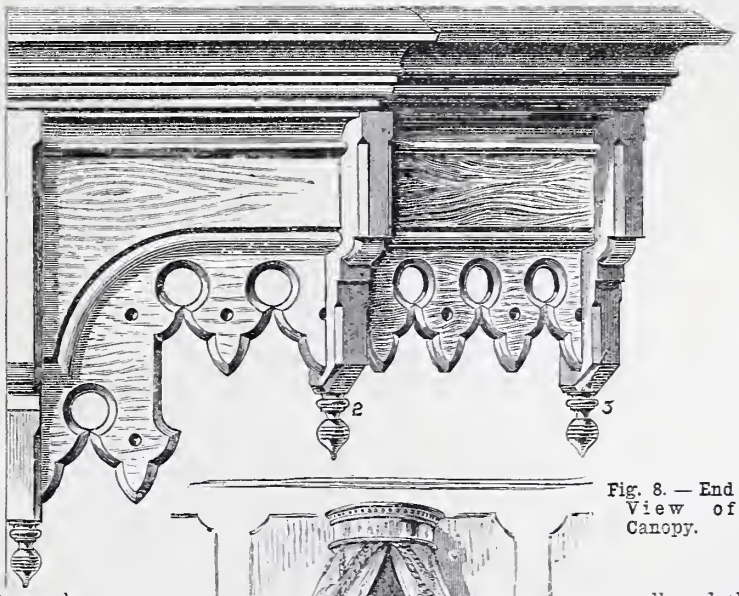


Fig. 8. — End View of Canopy.

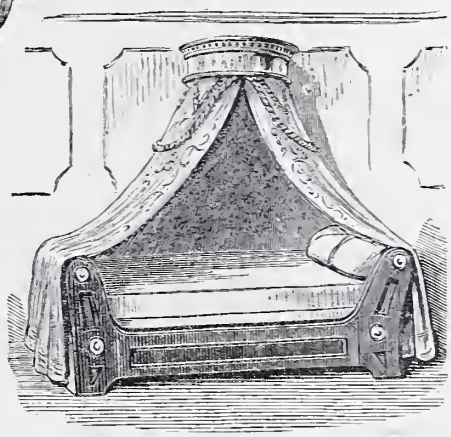


Fig. 13.—Perspective View of French Bed.

In the earlier days of metal bedsteads, four-posters, Tudors, tent-bedsteads, and half-testers were made, but gradually fell into disuse—the crusade against insanitary conditions, as is too often the case, rushing into opposite extremes.

As a consequence of the foregoing reasoning, I hit upon the idea of adapting the French plan of draping bedsteads from a *couronne* (crown) or canopy, the difference being that the French place the bed sideways against the middle of a wall, with the canopy centred against the same wall, and the hangings fall over head and foot alike (see small sketch of bed, Fig. 13), whereas I propose to conform to English usage and place the head of the bedstead against the wall with the canopy centred above the head rail, as near the ceiling as convenient (see drawings), so that the curtains may fall exactly where and only where they are really wanted.

The first step in the construction of the design for a canopy in wood, be it mahogany, walnut wood, rosewood, or plain deal, or whitewood for enamelling, is to make a frame (as shown in Figs. 1, 2) of inch stuff, just 3 in. wide, halved at each joint (see dotted lines), glued and screwed together to form the skeleton framing upon which to fix the exterior portions. Next get out four pieces of the shape shown in Fig. 3, and two more for the ends against the wall of the form of Fig. 4. The frame may be of pine, or even deal, or American whitewood, but these dropping pieces should be of the same wood as the rest of the exterior of canopy. By the section (Fig. 6) you will see how the backs of these are to

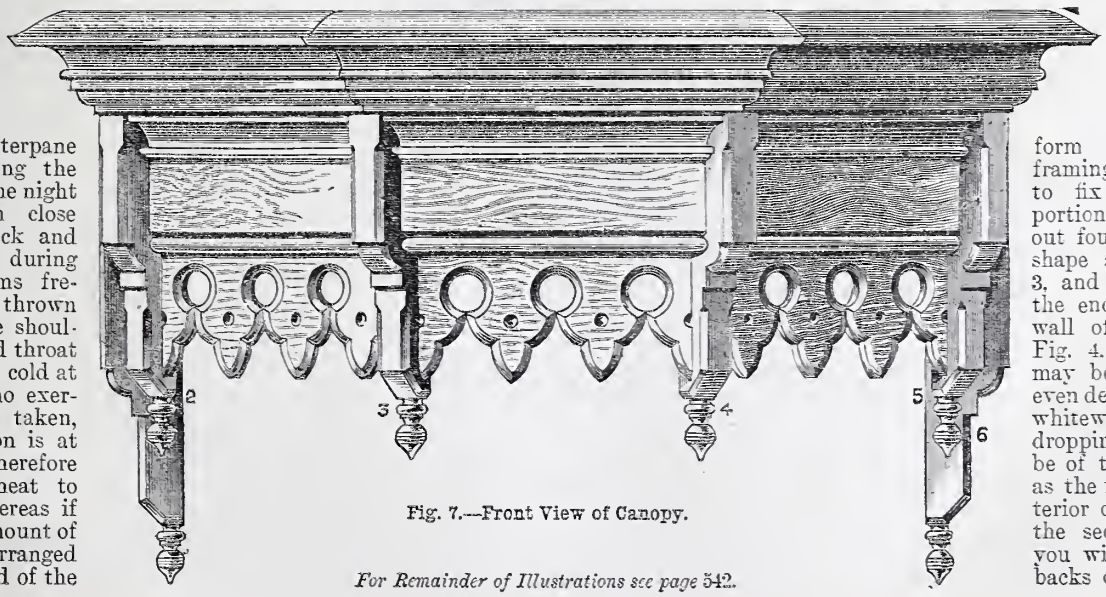


Fig. 7.—Front View of Canopy.

For Remainder of Illustrations see page 542.

be recessed to receive the various members A, B, C (Fig. 5), and the mouldings *a*, *b*, *c* (Fig. 6). What may be called the facia or architrave, A and B, should have the grain running horizontal, whilst C should consist of separate ¼ in. boards with the grain perpendicularly placed, a feature in my design upon which I lay some stress. The section also shows how the fixing can be done by screws from the back, which, with glue, ensures, even in damp places, that it will never give or get away from its berth. The dropping pieces 1, 2, 3, 4, 5, and 6 (see Figs. 7, 8), are to be chamfered and carved, and squared at top as shown. At this stage, let me advise both amateurs and workmen not to rely upon the bevel-square. I have too often seen an unnoticed movement of the blade throw everything out of truth, and entail all the work being re-mitred, with the result that the original frame requires planing smaller as each bay is shorter. As there are 360° in a complete circle, it follows that the angle of the mitre for an octagon, namely, P Q R, P R Q (Fig. 5), is ½ (180°—45°) =½ 135°=67½°. This is the angle at which make a fixed bevel-square, and, let me add, a shooting-board and mitre-box. The time spent will prove time gained. To arrive geometrically at the exact angle, get a sheet of stiff paper and turn with the pencil compasses, with a radius of twelve inches, a quadrant of a circle; bisect this, and draw a line from the centre of the circle to the point of bisection, and another line from the point of bisection to the end of the diameter of the circle. The result will be that you have constructed an isosceles triangle—the apex having an angle of 45°, and the angles at the base each equal to 67½°, the required mitre; then cut out this paper template, and make your mitre-box, shooting-board, and bevel-square exactly to the angle required. Even practised cabinet makers will tell you that it is more than twice as difficult to work to an octagon than it is to work to a square, but the greater the difficulty "the greater share of glory." Next make another sort of shooting-board, viz., one which, instead of having the bed square with the shooting-plane, must have a bed at the angle of 67½° to the plane; this is to enable you to plane on the shooting-board the ends of the pieces which go to form your bays,

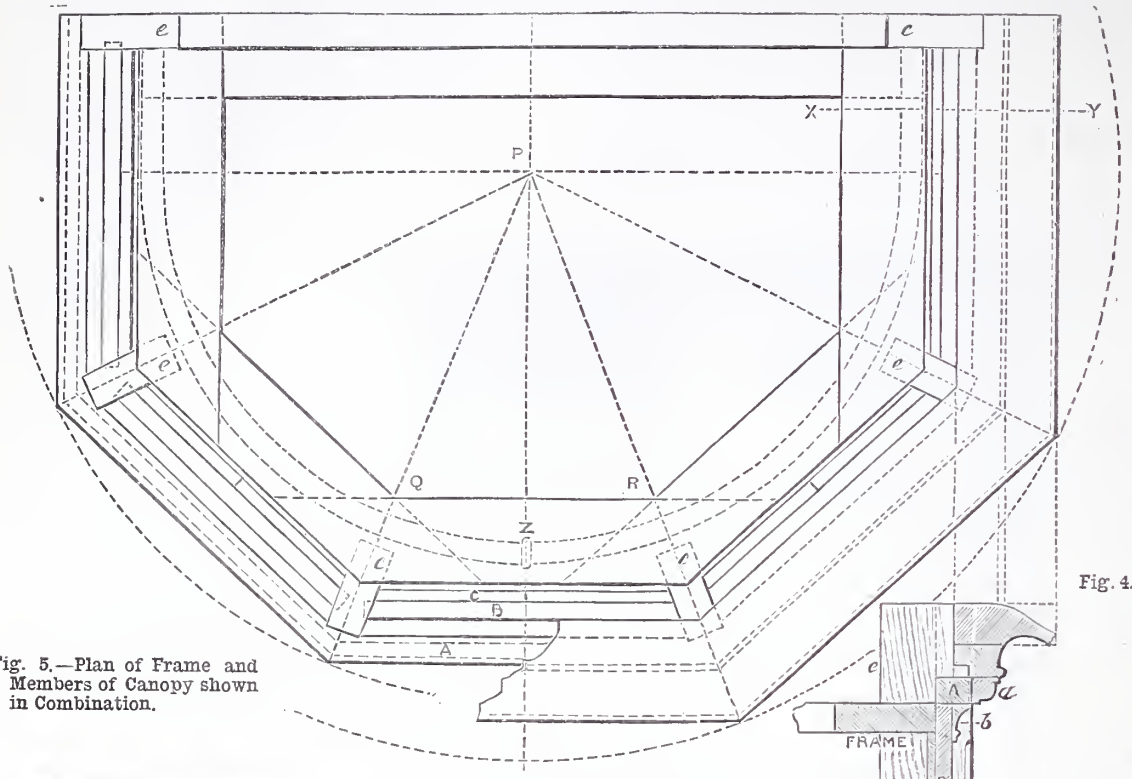


Fig. 5.—Plan of Frame and Members of Canopy shown in Combination.

Fig. 6.—Section of Frame and Canopy on X Y in Fig. 5.

Fig. 4.—Side View (A) and Back View (B) of Nos. 1 and 6.

Fig. 9.—V-Tool for Curved Beading.

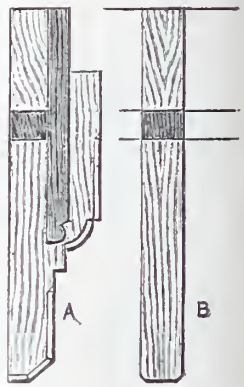


Fig. 3.—Side View (A) and Back View (B) of Nos. 2, 3, 4, and 5.

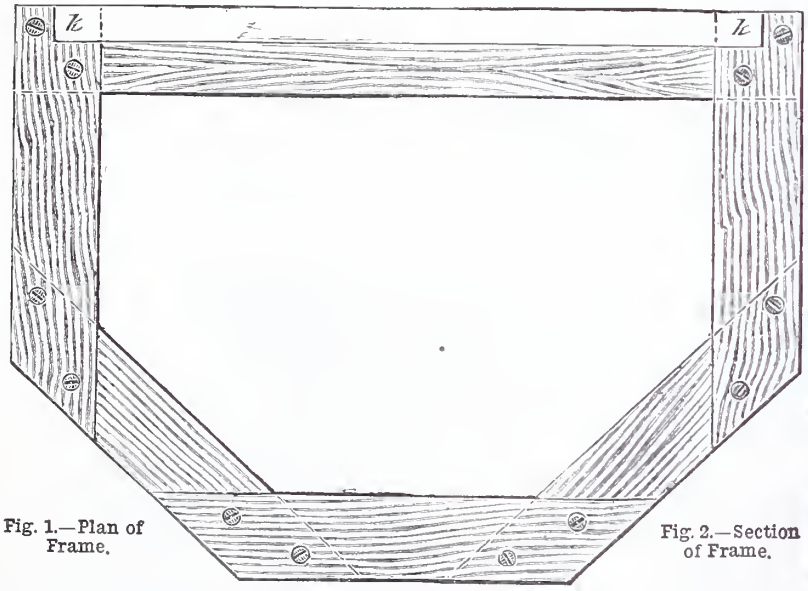


Fig. 1.—Plan of Frame.

Fig. 2.—Section of Frame.

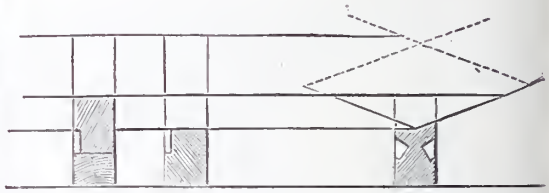


Fig. 10.—Transverse Section of Nos. 1 and 6 above Frame.

Fig. 11.—Transverse Section of Nos. 1 and 6 at Frame Level.

Fig. 12.—Transverse Section of Nos. 2, 3, 4, and 5 at Frame Level.

and the ends of your moulding so true as to avoid any misfits. Even when you have finished your canopy these tools will be available when you next require them, and will serve many a turn when you least expect it, so do not begrudge the time they take to make them carefully and well.

I have given three transverse sections (Figs. 10, 11, 12) at different heights to show how the ends of the members A, B, and C are housed into the dropping pieces dividing the bays; these will be the same in the two end pieces, Nos. 1 and 6, except that the architrave and mouldings will be housed *square* into them instead of at the angle of 67½°. In these two end bays the architrave, instead of being, as in the four other bays, 5 in. wide, must be cut as shown in Fig. 8, with a curve, and return from the 5 in. width to 9 in.; and the moulding which is planted on to the others must be carved on the edge following its curve, as shown, as it would be almost impossible to work it as a separate moulding: this carving will only require one special tool, viz., the V, or parting tool, as shown at Fig. 9, the rest being cut with a chisel, face outwards, gradually rounding off the ½ in. bead, the V tool being used only for the groove, leaning it over to form the shape.

The cornice should be made as shown in section (see Fig. 6) of two pieces, one of which, the under one, is used for the double purpose of thicknessing out the upper member of cornice, and also in its rebate, to receive the upper edge of the architrave thus concealing the joint. Measure and mark off, not from the exterior face, but from the plane of the *inside* face of the dropping pieces, otherwise errors will creep in and destroy the accuracy and symmetry of the work. Enlarge all drawings to full size (they are one-eighth full size)—*i.e.*, 1½ in. to the foot; *e e e e e e* is to be taken as the datum line from which to gauge all other planes, and unless you act on this you will be like one who sits upon two stools, and finally comes to grief between them. Note that in sticking the cornice mould the plane will not finish the deep hollow shown; this must afterwards be deepened with a gouge, but the richness of effect will amply compensate for the extra trouble. This moulding is to be found in its pristine beauty of form in many of our old cathedrals, when the then British workmen, under the influence of priestcraft, put their best work forward, and did for nothing that for which they would not move a finger for the capitalist employer of to-day. I should like to expatiate on the old majesty of craftsmanship, the glorious old system of German and English guilds, when the journeyman, after his severe apprenticeship, travelled in foreign countries. Hence the term "journeyman." Space denies my pursuing this subject further, however, at present.

Having cut the housings in the sides of the pieces Nos. 1, 2, 3, 4, 5, and 6, prepare them also as shown at *k*, *k*, to fit into the frame, taking care that they shall be quite square with it (see transverse section, Fig. 11), and also cut them away at the top to receive the back of the cornice (see plan, Fig. 5, and section, Fig. 6). Instead of planting the bead C underneath the facia B, it may be worked with a ½ in. bead-plane out of B, by getting out the stuff wider, if preferred. Having now tried your facias and the frame to see if they fit, glue the dropping pieces to the frame, and whilst the glue dries saw out the fringe-boards C, C, in plan and section, to the shape shown in Figs. 7 and 8, chamfering their edges as shown, and with a ¼ in. gouge cut half through the holes shown. These should be made of panel stuff, about ¼ in. thick, and if you make each bay out of two widths they need not be jointed together. As I said before, the grain runs up and down in these. The two bays at the sides next the wall differ from the other four (see Fig. 8), in being carried lower to carry out the idea of a bracket arching away from the wall. You may now fix on upper side of frame, next wall, a piece of deal or pine, square with it, *k*, *k*, Fig. 1, having two ¼ in. holes to hang it to wall, with brass-headed nails. This can be glued and screwed in place from the under side, as it carries not only the whole weight of the canopy, but that of the curtains as well. Presuming that the dropping pieces are now firmly glued to the frame, slide in from the top into their respective housings the facias B, B, B, etc., then cut to their proper lengths six pieces A, A, etc., leaving the ends long enough to fill the grooves, through which you slide down the facias B, B, etc. Glue these ends into their places, and fit the mouldings *a*, *a*, *a*, etc., and *b*, *b*, *b*, etc., nicely into their places, and glue them with nice thin glue, and drive a few needles in to strengthen them, taking care that the joint A *a* is flush, so as to permit of your next putting on the cornice, which is to be glued to the upper parts of the pieces 1, 2, 3, 4, 5, and 6, previously prepared to receive them, and screwed, if desired, from the backs of each of these to bring up the mitres close and strengthen the whole structure; commencing, of course, with the bays next the wall sides, working with the greatest accuracy in the mitreing and fitting. Next proceed to glue and screw to the back of your facias the fringe-boards C, C, C, bevelling off to angle 67½° those portions that are in contact with the dropping pieces 1, 2, 3, etc.; the upper ends should touch the under side of the frame and bed exactly on the backs of B, B, B, etc., to which nail or screw them, and glue as well. Now turn, or have turned, six drops to pattern, with a shank to enter holes bored in the ends of the dropping pieces (see Figs. 7 and 8), and the construction is complete. Now for the curtain rod. Procure a piece of ¼ in. gas-barrel, and bend it to a semicircle, as shown in dotted lines in plan (Fig. 5); bore with a centre-bit in dropping pieces 1 and 6 holes exactly the size of the exterior diameter of the gas-barrel, on the level shown in section, viz., exactly behind the ½ in. bead at the lower edge of the facias B, B, etc., so that the curtain, stitched to ¾ in. rings, may hang behind the fringe-boarding without showing any gaps. At Z screw into the frame a meat-hook, until the lower part of its hook shall be level with the barrel; now slip the centre of the barrel into the hollow of the hook, and so arrange that the two ends will just spring into the holes prepared to receive it, so as to hold fast enough to prevent them slipping out again, unless required, when some little force ought to be necessary to withdraw them. Drive into the wall brass-headed nails same distance apart as the holes you have bored previously in the hanging rail previously described, and you can then hang your canopy in its proper position, centrally over your bed-head, say 5 or 6 feet above the head-rail thereof.

Every 5 or 6 in. stitch firmly to your curtains, rings which will be strong enough to sustain the weight, and slipping them on the rod, *i.e.*, the ¼ in. barrel, will permit of your drawing them close together, the meat-hook alone intervening at the front. Now take two breadths of your curtain stuff if it is a yard wide, or three breadths if it is only ¾ wide, boxpleat the top to the width of the back of frame, and with tinned tacks fasten the top to it. This stuff will then hang in graceful folds between the bedstead head and the wall, closer at top and widening out to the width of the bedstead at the bottom. You will then find that by pushing the side curtains behind the back curtain you have a cosy retreat in which, when you retire for the night from the cares of the world, you will never suffer from draughts.

INDIARUBBER FELLOE-RIMS.

BY JOHN CHARLES KING.

ALTHOUGH vulcanised rubber has been in use in carriages in England and France many years, many manufacturers of parts of ironwork to standard patterns and sizes do not understand the main principles of its application to springs and scroll-irons. One of the chief uses, when applied to the pipe-eyes of springs and scroll-irons, is to cut off contact of iron and iron so as to prevent

Fig. 1.—Form assumed by Indiarubber Tyre at contact with Road.

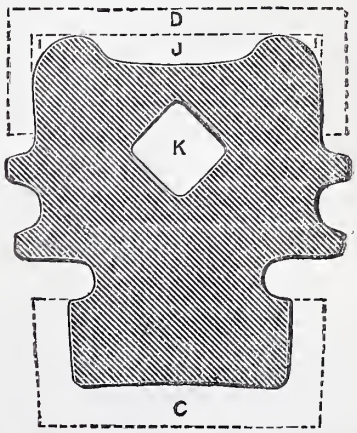


Fig. 2.—Section of Indiarubber Felloe-Rim—C, Flanged Rim holding Ends of Spokes; D, Flanged Tyre on Felloe-Rim; I, J, I, Spaces between Rubber and Tyre; K, Centre Hole running through Tyre.

jar and noise. At the late French International Exhibition, some of the best forged ironwork and springs had indiarubber applied in a way which ensured contact of rubbing surfaces of spring-eyes with scroll-irons, which allowed the jar to be communicated from the roadway to the carriage, to the annoyance of riders, who expected silence by the rubber bearings to springs to their carriages. The fault was pointed out and admitted by the expositors. Cheap warehouse ironwork is equally defective in England. Workers paid by the gross for inserting "rubbers" know nor care little whether right or wrong so long as they can take more money on Saturday.

The more rubber is applied to jointed surfaces or road bearings of a carriage, the lighter and easier it moves and springs, and more noiseless for a rider if the road be a rough one.

The rubber tyres on vehicles are a gain in silence, but on a smooth road cause the vehicle to move harder for the horse. The weight of the vehicle flattens the rubber tyre on the road, and presents a bulge of tyre in front of the advancing wheel as

at A, Fig. 1, which has to be crushed down to allow the wheel to roll forward. Now on a rough road this bulge would bed its cushioned surface into the projections of the road, thereby avoiding lifting the vehicle up over them, so that for such roads the gain is great; but as the streets and roads in our chief towns and cities are generally so smooth and level, there is a loss by the use of these tyres, and their cost and rapid wear by road friction form a serious expense to the repairs of a carriage.

To do away with the road-wear of rubber on wheels, a Mr. Ayres introduced rubber felloe-rims, of which Fig. 2 is a section. It is shut in between two steel rings: C is a flanged rim holding the ends of the spokes of wheel; D is a flanged tyre, which encompasses and protects the felloe-rim of rubber from contact with the road. It will be seen that this rim does not fit the rubber; there are spaces I, I, and J, and a central square hole K, the whole length of the rubber; these are the special means by which the utmost elasticity of the rubber is ensured, as these spaces allow the spreading and yielding of the rubber under pressure.

Here the rubber is put in its proper place on the wheel for lightness of draft and prolonged durability, and no repairs needed till worn out. They have been well tested on cabs and parcels carts. It does not argue much for the intelligence of hansom-cab builders, who make no difference in the weight of wood or ironwork, whether to be fitted with wheels with iron tyres or rubber ones, whereas with rubber tyres nearly every part of the cab might be lighter.

MODERN FORGING.

BY J. H.

Miscellaneous Examples.

Having now described in brief the elementary principles of the practice of forging, I shall take some examples of leading types of work. The subjects treated in this and two successive articles will embrace some of the common types of forgings made and used in the construction of machinery, engines, etc., such as various rods and levers, bolts, and cranks. After that will follow special chapters on some branches of smiths' work, as tool making, the working of steel, model work, country repairs, etc.

Rods and links with bosses, like Fig. 50, are used extensively in various forms and proportions, and are also differently made. At first sight, upsetting would appear to be the most obvious method of making such rods. It seems so simple to take a round or rectangular bar, as the case may be, of the same size as the intermediate portion A and to dump up the ends to make the bosses B. But upsetting tends to open or spread the grain and impair its continuity, and moreover, the operation would require several heats, and occupy a good deal of time: unless, indeed, the bosses were very small in proportion to the bar.

Three cases at least may exist:—(1) When the bosses are small relatively to their rods, and the rods are of no great length—a few inches only, as in some machinery links and levers. Then it is practicable, though not desirable, to form them wholly by upsetting. But, properly, they should be made either by partial upsetting and partial drawing down, or wholly by drawing down, according to what iron happens to be in stock. (2) When the bosses are relatively large and the eyes relatively small (Fig. 51) and the rods of several feet in length, as in the tie rods of roofs. Then they will be forged from the solid, distinct from their rods, and welded on. (3) When the eyes are large—Fig. 52—as in the truss and tie rods of bridges, jibs of travelling cranes, etc. Then the eyes are formed by turning round and welding the iron, and usually also by welding the eyes when made, to their rods.

In case (1), whether the bar be wholly upset, or partly upset at the ends, and partly drawn down in the intermediate portion, or wholly drawn down in the intermediate portion, from a piece of the full dimensions of the ends—in either case the lumps for the bosses B are at first left rough and irregular, and unshapely. Then, if they have been upset they should be well hammered at a welding heat to consolidate the metal. Always they will be finished after rough hammering by the aid of the hollow top and bottom tools or swages, operating on the curved edges (*a*, Fig. 50); by the flatter and sledge on the flat faces *b*, and by the fullering tool around the neck *c*. In repetition work the eyes would be finished in a pair of cast-iron dies, like Figs. 53, 54. Fig. 53 gives the finished curvature to the edges *a* in succession, and the fullered neck *c*; and Fig. 54 completes the flat faces *b*; and the eye *d* is punched, if punched at all (in a small boss like Fig. 51 it would be usually drilled), while the boss B lies in the die, the core falling down into the hole A, a trifle larger than the punch. The boss is beaten into the dies with the sledge, or preferably under the drop, or the steam hammer.

In Figs. 53 and 54 B is a wrought-iron bond shrunk on to prevent the cast iron from becoming burst by the concussion to which it is subject. These blocks are made of square as well as of circular form, but the latter is to be preferred, because of the greater ease experienced in fitting and shrinking on the bond.

Dies like this are often made in pairs, top and bottom being coupled with pins for use under the steam hammer. Should space allow, I will say something about die forging later on.

In case (2) the bosses are made from bar of their own dimensions, and a sufficient length is drawn down—say from three to six inches—to permit of making a scarfed, welded joint (Fig. 55), with the long plain body of the rod.

In case (3) the eye is turned round and welded, forming a short solid shank, which is then scarfed and fullered for welding, like Fig. 56. Or it is turned round to form what is termed a tongued joint (Fig. 57)—that is, a joint in which a wedge-like end is fitted into a corresponding cleft, and so welded. This is supposed to be stronger than the plain scarf, and is often used on iron of heavy section.

Fig. 58 shows a tongue joint made in solid bars. Note that the ends are upset as in an ordinary scarf joint. It is made as follows:—

First upset both ends; then for the tongue (A, Fig. 58), set in a fullering tool on opposite sides of the upset portion (Fig. 59, *a*). From thence the end will be tapered down by hammering until it has the appearance of Fig. 58, A. For the recess B, nick the other upset end inwards with a chisel, and open out sufficiently with a wedge. This will spread the end more, as well as open it out; and this spreading out is an advantage, because it gives plenty of metal for welding and swaging down to finished dimensions. The tongue joint is then made in the usual way by raising both ends to the welding heat, and when assured that the faces are clean and free from dirt and scale, hammering them together, first with the hammer, and then finishing them with the top and bottom swages. The first blows should be given endwise, to ensure union at the termination of the tongue. These may be given while the work is in the fire, provided the fire is clean, and the joint cleansed by throwing sand into the fire over the work. When the joint is being hammered circumferentially, the angular swages (Fig. 60) may be used to better advantage than by merely laying the work upon the anvil. The angles support the sides of the work, and the operation is performed more quickly—a vital matter in welding operations. The top swage may be used as well, or the sledge only. Or the steam hammer may be brought into requisition.

Levers of the general form shown in Fig. 61, but variously proportioned, are very common. The methods of their manufacture will be modified by circumstances. They may be drawn wholly from the solid, or partly drawn and partly welded—seldom, however, upset.

A lever of the proportions shown in Fig. 61 would in general be formed wholly by drawing down.

A rectangular bar, having a sectional area about equal to that of the central boss A, would be selected. First, a fuller would be driven in on opposite sides, as at *a*, *a*, *a*, *a*, Fig. 62. Then the bar would be drawn down roughly from the fuller nicks to the ends, until the ends were reduced to an area *a*, suitable for the smaller boss B in Fig. 61. Again the fuller would be driven in at *b*, *b*, and then the intermediate portion B would be reduced by fullering or by hammering until the required thickness of the web (C in Fig. 61) was nearly reached. The blows would be made to alternate on sides and faces alternately, drawing the sides to the tapered form seen in the plan view, as well as the webs to thickness. There is no attempt at finish just yet, for the centres of the bosses are probably not correct, and it will very likely happen that some further drawing down, or even a trifle of upsetting, will be required before the boss lumps will be sufficiently near to correct centres, to permit of their holding up to the required dimensions. Rough measurement will be taken from time to time with the rule, or with some form of gauge. At this stage the lever will be something like Fig. 63, with square lumps at centre and ends of the webbed portion. Now, to hammer these bosses at once into a circular form would mean a lot of labour and several heats, so the corners are cut off with a hot set, as shown by the dotted lines. When a boss is small, four corners only are cut; when large, eight, or even more. The set is driven perpendicularly first, and then horizontal cuts are made to meet the perpendicular ones, until the boss is rudely chiselled to a circular form. The set is not driven right down to the web, but stops at the radius or hollow. Then the hammer, and afterwards the hollow swage, are used to give an approximately circular form to the bosses; and the hollows shown at *a*, *a*, in Fig. 61 are shaped with the hollow fuller (Fig. 64). Fairly shaped bosses can be thus made, but not perfectly true. In repetition work recourse is had to dies. For the end bosses the die would be like Fig. 54 in this respect: that the end bosses (B in Fig. 61) would be

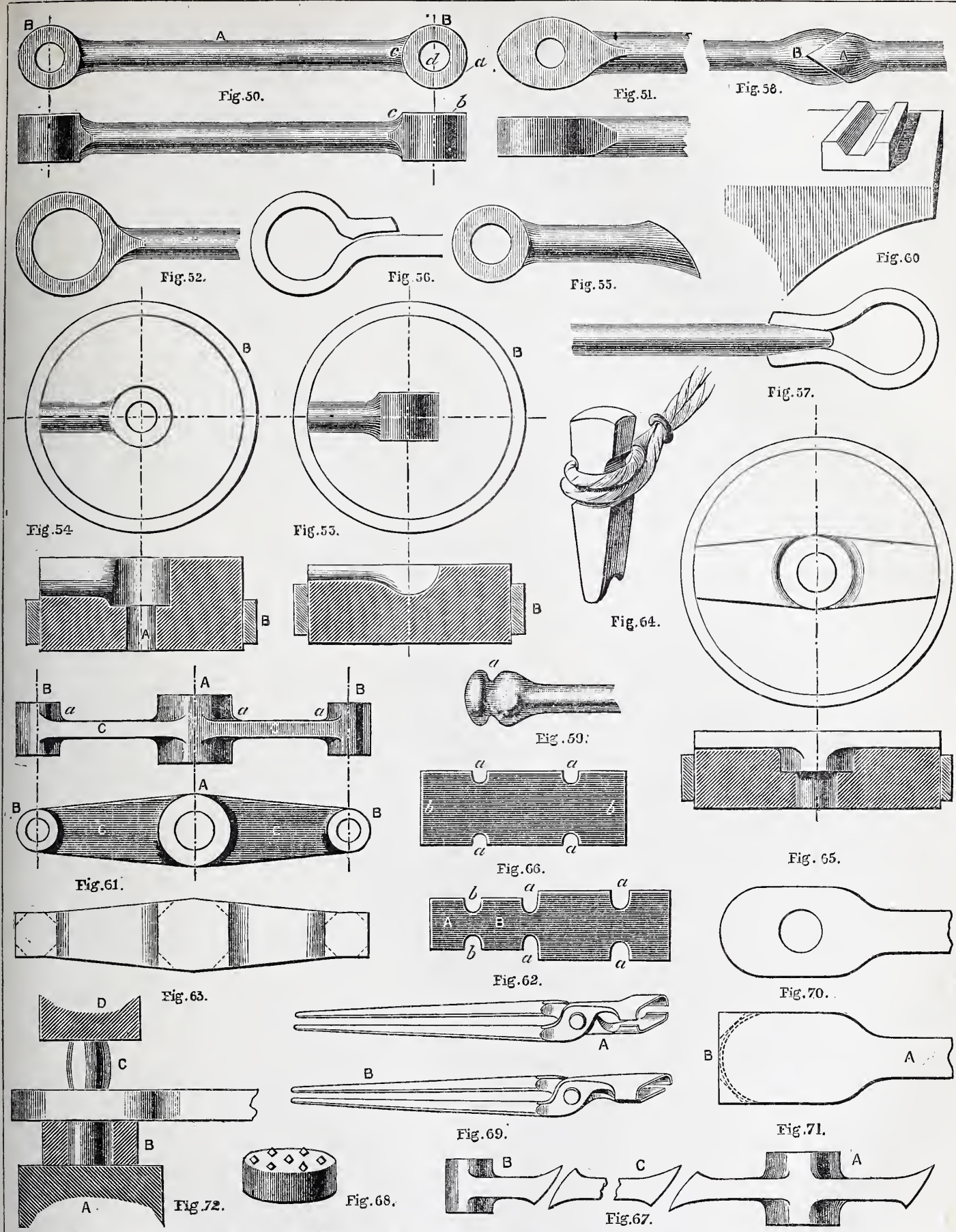


Fig. 50.—Rod or Link. Fig. 51.—Small Tie-Rod End. Fig. 52.—Large Truss or Tie-Rod End. Figs. 53, 54.—Die Blocks. Fig. 55.—Boss End scarfed for Welding. Fig. 56.—Eye turned round for Welding. Figs. 57, 58.—Tongued Joint. Fig. 59.—Fullered End for Tapering. Fig. 60.—Angular Swage in Anvil. Fig. 61.—Double-ended Lever. Fig. 62.—Fullered Lump. Fig. 63.—Lever roughly forged. Fig. 64.—Hollow Fullering Tool. Fig. 65.—Die Block. Fig. 66.—Fullered Lump. Fig. 67.—Bosses and Rod scarfed for Welding. Fig. 68.—Boss Lump prepared for dabbing on. Fig. 69.—Tongs for flat Bars. Fig. 70.—Tie-Rod End. Fig. 71.—Rough Forging for ditto. Fig. 72.—Punching Hole in Tie-Rod End.

hammered into a recess in the middle of the die, and the web would rest in a recess reaching from the centre to the outside. For the centre boss the die is shaped like Fig. 65. Bosses finished thus are so true that they can be left without subsequent turning, polishing on the emery wheel giving sufficient finish.

If the lever were of considerable length, say anything over a foot, it would be easier to take separate pieces of bar iron for the web, and separate pieces for the bosses, and weld them together. Thus a lump would be taken (Fig. 66) for the central boss, and set in with the fuller at *a*, *a*, and drawn down at each end *b*, *b*, leaving the extremer ends rather thicker than the intermediate portion (Fig. 67, A), in order to form scarfed joints for welding. The end bosses (Fig. 67, B) would be similarly prepared, and all welded to the webs (Fig. 67, C), also upset and scarfed. The shaping and finishing of the bosses are most conveniently effected previous to the welding up.

Yet another way is to weld or "dab" the bosses on the web. The boss pieces would be cut off a round rod of suitable diameter, and while red-hot, hatched up with a corner of the chisel (Fig. 68), the chisel being held diagonally and struck with a hammer. These hatchings are for the purpose of assisting the union of the welded surfaces. The flat bars and the bosses, being then raised to a welding heat, are made to adhere by a few hammer blows. The thinner the web the more intimate and secure the weld.

When forging articles of this kind, it will be necessary to test the parallelism and the rectangular form, and the winding of the various parts. Forgings are apt to develop inaccuracy quickly while the metal is yielding, and so the smith employs the eye in the early stages of the work, and squares, and calipers, and straight-edges as it becomes cooler.

For holding flat bars and levers of this type, tongs shaped like Fig. 69 are employed. In A the jaws are alike, and come into direct opposition. In B a flat jaw falls within the sides of the other. These are made in various widths and proportions, the range of a single pair being rather limited.

Large tie-rod ends (Fig. 70) are always welded to their rods. A rectangular lump is drawn down (Fig. 71) at end A to an area a trifle larger than that of the rod, and scarfed for welding. The rounding corners B are shaped by first cutting the angles off with the hot set, and then by rounding off with the hollow tool.

In these rods the eyes, being large, are usually punched, even if, as is frequently the case, they are rymered out afterwards. Such large holes are punched with difficulty under the sledge, but are easily done under the steam hammer. Fig. 72 shows the arrangement employed: A is the anvil of the steam hammer, and upon this the bolster B rests. The diameter of the bolster must be sufficient to give proper bearing and support to the eye, and its hole must be a trifle larger ($\frac{1}{8}$ in. or $\frac{1}{4}$ in.), but not much larger than that of the punch C. Two or three blows of the hammer or tup D will send the punch through. The latter is slightly bellied in order to squeeze the metal, and also to clear itself in the hole easily.

After the rounding of the edges and the punching of the hole, the flatter will be brought into requisition before the bar is quite cool, to smooth over the edges that have been slightly upset during these processes.

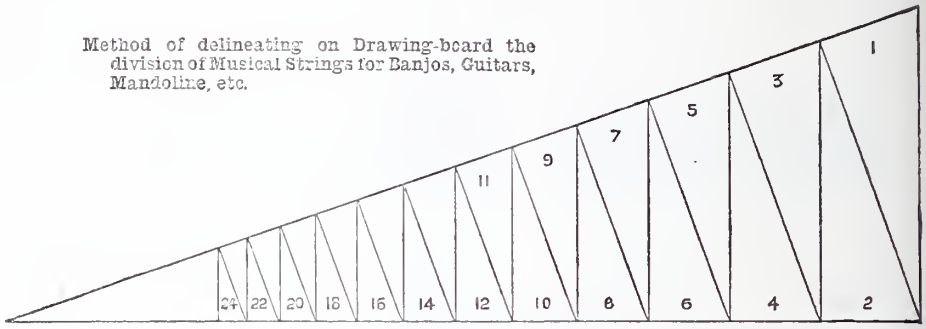
ON THE DIVISION OF MUSICAL STRINGS FOR BANJOS, ETC.

BY B. A. BAXTER.

One of our kindest contributors sent us recently, through the medium of "Shop," directions how to make a mandoline (Work, Vol. II., p. 229). In the course of the article he explained how to set out the varying distance for the frets. I have long been acquainted with various devices for determining these distances, as applied to organ-pipe scales, etc., but I was not prepared for so simple a mode of obtaining the desired result. As J. G.-W. did not claim absolute exactness for his method, I expected that the error in his plan was serious; and when one of our correspondents began to criticise the method given, in a rather elementary manner, I resolved to test the matter for myself. I did not, however, follow out the instructions to the letter, but in the spirit.

It may be well to mention here the fact that a musical string, weight and tension being the same, requires to be halved to produce the octave, and that the divisions needed to produce the seven natural tones, and the semitones which occur between, are twelve in number. Now, in order that each sound may be so related to the rest as to give similar results in *any* key, the scheme given by F. H. (*Streatham*), in page 355, will not serve; it will only do for one key, and for every change of key fresh errors will be introduced. What is wanted is a system whereby every key is as good as possible and as good as all the rest. Mr. J. Gleeson-White has done this, and although he makes no claim to perfect exactness, I find the imperfection is not greater than the accidental errors that are likely to occur in the application of a perfect system. But, speaking practically, the spacing out with compasses of $\frac{1}{18}$ and $\frac{1}{18}$ of each remainder is really a formidable undertaking, and ought not to be recommended unless there is no other way to ensure the same result.

If, however, the mandoline maker would make himself a pair of proportional compasses, having its legs in the proportion Mr. Gleeson-White suggests, he would soon find out if his plan is perfect, and how far it is from accuracy if it should not be quite true. Suppose, therefore, a pair of pieces of iron, say nineteen inches long, and pointed at each end: if these are so placed that the points are in contact, and a hole bored one inch from the end of each, and a rivet inserted through both (while the points are in contact), then it follows that if the points of the longer ends are separated to any distance, the points of the shorter ends are also separated in proportion to the length of each limb of the compass, and a trial can easily be made of the compasses as follows: Take any distance with the long arms of the compass, reduce the distance by the amount of space between the points of the shorter pair, take the remainder with the long pair, reduce again by the distance of the short pair, and so on until twelve distances have been determined; this should just halve the original line, and, if the process does not halve the line, then one or other can be filed shorter and another trial made; thus, if twelve spaces do not together occupy as much as half the original line, then the long limbs must be shortened; but if the twelve divisions overstep the half, then the short limbs must be reduced. If, however, this is deemed too troublesome—and it might be if only one finger-board had to be divided, though the use of such a pair of compasses is not confined to any length of string—still another plan may be adopted. On a drawing-board describe a right-angled triangle, having one side 17 in. and the other 18, the right angle being contained by the 17 in. and the shorter side, which will be about $9\frac{3}{4}$ in., full. Then take a set square and draw right angles, first to one side, then from the point of intersection to the other, as shown by the illustration; and, as before, twelve spaces will indicate if the plan is perfect. The drawing indicates how *very slightly* Mr. Gleeson-White's plan deviates from absolutely perfect equal-temperament division; and when it is remembered that the straight-edge or the set-square, or both, may have been imperfect, or that the operator may have been at fault in getting the intersections, I think that the readers of Work will see that it is an excellent plan that F. H. seeks to improve upon, and that the plan he would substitute is not so good as Mr. Gleeson-White's.



Method of delineating on Drawing-board the division of Musical Strings for Banjos, Guitars, Mandoline, etc.

Of course we must all come under the criticism of our readers, and as I thought Mr. White might not care to reply, I send this, as it contains a suggestion which may be useful to any makers of fretted stringed instruments.

MEANS, MODES, AND METHODS.

A Grip Vice.

Any reader of Work who may be in want of an occasional instantaneous grip vice on a small scale, may contrive one easily by fixing in his bench vice a sliding-screw cramp. By sliding-screw cramp I mean one of Hammer's cramps (I fancy that, like many dodgy things, they are of American origin), in which the screw may be loosened by a half-turn to the left, and drawn out or pushed in to its full extent, and tightened by a turn or so to the right. A 5 in. cramp will take in work from the thickness of tissue paper up to $4\frac{3}{4}$ in. full, without any loss of time in turning the screw.

Of course, as the jaws of the cramp are

not very broad, the device is not so well suited for large articles as it is for small jobs. For those who have no other instantaneous grip vice it will no doubt be of use. I have jotted it down as a useful hint for them. H. J. L. J. M.

Lathe Improvements.

My lathe, which is one of the smaller kind manufactured by the Britannia Co., has been, and is, one of my most useful tools; but at one stage of my work with it, now some years ago, I was much hindered by the great amount of time consumed in removing the slide-rest and in fixing it in its place when required, and also in removing the hand-rest and tail-stock when not in use. To obviate this waste of time I filed out so much of the iron between the two flat bars that form the bed of the lathe as would enable the slide-rest and tail-stock and other movable parts to be put in their places simply by loosening the nuts by which they are kept in position. I rounded all the edges of the nuts, and reduced them a little in thickness, so that I might not have to file away more of the lathe than was absolutely necessary.

No doubt some dismal croakers will say that I weakened my lathe by so doing, but I will say that the weakness exists in theory rather than in practice.

Another improvement I made was to raise the lathe from the floor by placing a piece of stout quartering under each of its legs. This was done with a double object: firstly, to bring the lathe bed up to a more convenient level for working, as the height of the lathe table, 33 in., was too low for me to work at long with comfort; secondly, by raising the treadle from the floor, to prevent my toes and those of my pupils from some occasional reminders—distinctly unpleasant reminders—that the treadle was there.

Lately, I substituted boxes about 2 ft. by 6 in. by 6 in. for the quartering. These boxes raise the lathe to a still more convenient height, and, being left open at the front end, form a convenient place for the hand-rest and tail-stock when not in use. H. J. L. J. M.

"Rubbing off" Brass Plates.

"Rubbing off" is the process of fretting down the superfluous wax after the waxing of the engraved letters. It is rather a laborious job, especially when the plate is large and the letters numerous.

Those who have to experience this process, will find it greatly to their advantage to mix with their fretting medium a little *common soda*. It acts as a solvent on the wax, greatly facilitating the removal of that which is not required. It should be used very carefully at first, until a proper acquaintance of its properties are determined.

After you have worn the wax rather thin the soda should be dispensed with, and the plate effectually finished with pumice-stone and water only. This will remove every trace of soda, and impart a proper surface to the wax. Probably if you neglect this, the after processes for completing the plate—the polishing especially—will render the wax below the level of the brass; because the upper part of it being made soft with the soda, will be unable to withstand the friction, and, consequently, will be worn down a little.

Neither should any water saturated with soda, or the soda itself, be permitted to remain inert on the plate for any length of time. If you have to leave the plate before it is finished, thoroughly swill it with water, rubbing the wax with the palm of the hand to remove any soda which may be incorporated with its surface. R. G. N.

Ebonising White Wood.

Ordinary white wood can be given the appearance of black walnut by first thoroughly drying the wood, and then, when warmed, coat it two or three times with a strong aqueous solution of extract of walnut peel. When nearly dried, the wood thus treated is washed over with a solution made of one part (by weight) of bichromate of potash in five parts of boiling water. After drying thoroughly, rub and polish.

J. H.

Stretching Canvas, etc.

To stretch a cloth material upon a frame —*e.g.*, the canvas for an oil painting—so that there may be no puckers, and the whole shall be evenly strained, seems a simple matter, but often proves a difficulty to the amateur, who, in nine cases out of ten, will first tack one side and then the side opposite, with the invariable result that the corners will not come right, or that there will be an excess of material at some point in the work, especially in the case of a large frame, such as the leaf of a screen, etc.

To obviate all difficulty and ensure a good job, begin to tack the material at any point —say, a corner—and, keeping the covering moderately tight and evenly stretched, go round the frame, etc., until you arrive at the point from which you started.

Opifex.

FITTING AN ELLIPTIC CHUCK.

BY JAMES LUKIN.

Fine Filing and Finishing—Tapping, etc.

After the several parts are fitted as described (see page 429), the fine filing and finish may be taken in hand. The holes in the guide bars are to be filed somewhat elliptic, with the long diameter across the bar to allow them to be tightened up if the slide move too easily from wear, and also during the present fitting of the slide; and it will therefore be advisable to drill, tap, and insert screws in the thickness of the plate, the heads of which must be in contact with the bars so as to set them forward. As the bars do not overhang the plate the heads must be recessed to enable them to act, such recess being made by means of a pin-drill, or cheese-headed countersink, after the holes are drilled and before they are tapped. Four screws will be needed, two to each bar. A bit of oilstone pounded in a mortar until sufficiently powdered, if oilstone powder cannot be got, will now have to be mixed to a paste with a little oil and smeared on the edges of the bars and V groove of the slide, and the two worked together until the fit of the parts is perfect and the motion smooth. It is then to be wiped off, and the action repeated with oil alone.

All parts requiring it may now be gone over with a finer file, and ultimately with a smooth one, but let it be distinctly understood that elaborate finish of exposed surfaces is not nearly so important as a true fitting of the moving parts.

The nose of the chuck will require some slight correction, which cannot be effected until after the ring has been fitted, therefore, it will now be necessary to take this part in hand. Two views are given of the ring and plate to which it is attached in Fig. 8, which is copied from one in the writer's possession. The plate A is $\frac{3}{8}$ in. thick, the lugs C, C, are $\frac{1}{2}$ in., and $\frac{3}{4}$ in. including the turned part. The ring D is $\frac{1}{8}$ in. thick at the edge, but more solid further down. It is filed away, however, after being turned, as shown by the dotted lines in the profile, so as to produce an opening wider than itself in the main plate. I do not consider this a good pattern, because it has not sufficient bearing against the face of the poppit, when by means of the adjusting screws B, B, it is set over on the side. There is no reason to have so large a central opening, as the only motion the ring has is about an inch or two horizontally. It is better, therefore, to have a broad, flat surface like Fig. 9, with a central oblong opening to allow it to free the mandrel. In all positions it will then take an ample bearing against the face of the poppit, which is there dotted in, the mandrel being marked M. The top of this plate is filed true with that of the mandrel, and has one inch or so marked in tenths, to read against a line on the poppit. This is denoted by the word "scale" on the drawing.

Mount the casting upon a wooden chuck by its ring, with the lugs towards the poppit, or mandrel headstock, and trim up the outside of the ring and face of the back plate, using a slow speed, and, of course, a slide-rest. True up also the front edge of the ring; next grasp it by the outside of the ring in a self-centring chuck, and bore out the inside and face the back as far as the lugs will permit. If no such chuck is at hand, make a wooden one, and bore to fit the ring already turned. With a flat file finish the bevelling of the back where the tool was interfered with by the lugs.

To mark and drill these lugs for the diametrical screws, stand the piece upon its ring, face downwards, upon a true surface (the lathe bed may be pressed into service for such work), and, setting the marker of a scribing block as near as possible to the height of the centre of the boss only, scratch a line across it at both ends. This will mark both lugs alike. The centre may now be readily judged by the eye, and a punch dot made in the centre of the scribed lines. Deepen these marks and mount between the lathe centres to shape the turned part of the lugs, which will also then become a guide for rounding off their edges neatly. With a $\frac{3}{8}$ in. drill—or a $\frac{5}{16}$ in. if a $\frac{3}{8}$ in. screw is to be used—drill at these marked centres, placing the drill point in one while the back poppit centre is in the other hole, and a true line will be ensured. These holes may now be tapped, and a pair of screws fitted. Use three taps to secure accuracy. The entering one will go far enough into the hole to ensure parallelism, for it is at the commencement, if anywhere, that the tapping will be other than true. After the first tap has passed clean through correctly, the intermediate will readily follow it, and the plug will bring up a full thread. For such work in taps, I confess to a prejudice against the Whitworth standard as giving too coarse a thread; but it is not very easy now to obtain taps of a given pitch as well made as the standard ones. For the size of ring we are dealing with, each screw may be three inches long, and should be of steel, with brass milled heads screwed on and riveted. They must be turned and nicely coned at the ends, but need not be so sharply pointed as to necessitate the obliteration of their drilled centres. If

preferred they may have heads or thumb-rings forged in the solid, flattened, and filed up to shape. This will depend, probably, upon the castings supplied by the firm to whom the order is given, and is of no special importance, one being as easy to fit as the other; and while some will use the lathe wherever possible, others prefer a little work with a file. It is essential that both screws point to the centre of the ring, and that the alignment with each other is perfect. A slight correction of the outer surface of the ring has to be made, but for this it must be first of all secured in its place upon the headstock; the latter must therefore be marked and drilled to receive it. Place a centre point in its hole in the mandrel, or mount a centre chuck in the nose as for turning a bar of iron: see that it runs true. Then set the needle of a scribing block to the height of centre, and scratch a line with the needle on the face of the poppit on each side of the mandrel as far as the edge (or, at any rate, mark it close to the edge), keeping the base of the scribing block upon the lathe bed as a surface plate. Then, by the help of a set square carry this line round each side of the headstock, and it will, of course, be at the exact height of the lathe centres. On this line the hole has to be drilled for the points of the screws which are already fitted to the ring. Hold the ring in place against the face of the headstock, and carefully setting up the screws, each upon its own bore, until they will just support the ring, the position of their points upon the line can readily be seen and a mark made close to each, which mark, when the ring is again removed, can be transferred to the lines. Another method is, after marking the lines, to set a gauge or a pair of spring dividers to the distance of the screw points from the back of the ring plate, and to measure the same distance on each of the scribed lines from the face of the headstock. Then with a sharp punch prick a hole to secure the point of the drill. As very much depends upon this drilling operation, it should be carried out with great care, and as soon as the holes are just deep enough to receive the points of the screws, the ring is to be put in its place and examined to see if its base rests against the face of the poppit, and to see how nearly the ring itself is concentric with the mandrel. To test this, screw on a drill chuck, carrying, instead of a drill, a bit of wire about four inches long, and bend it so as just to clear the outside of the ring as it rotates with the chuck. You will very quickly see whether you can set the ring so that the wire gauge shall touch it exactly as it revolves; it will probably do so, but if the ring appears, when thus tested, to be too high or too low, an attempt must be made to correct it in the process of deepening the holes in the headstock. These holes should tend slightly forwards towards the face of the headstock, so that the screws may have a tendency to draw the back plate of the ring firmly against the face of the headstock. They need not exceed a quarter of an inch in depth, and should be nicely coned to fit the screw points. Proceed carefully and with deliberation, trying the ring frequently in its place, testing and retesting its centrality, and a successful result will be attained. For final correction of the ring a cutter must be contrived that can be adjusted to finish the outside surface, and the old plan of Bergeron's will be as easily carried out as any other. At any rate, it will illustrate the sort of apparatus needed for this work.

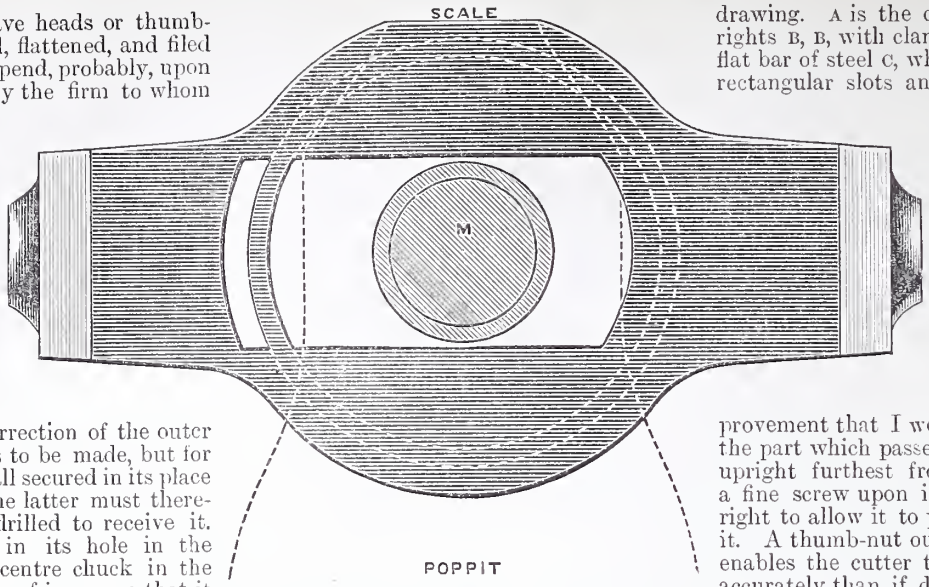


Fig. 9.—Alternative Arrangement for Plate and Ring.

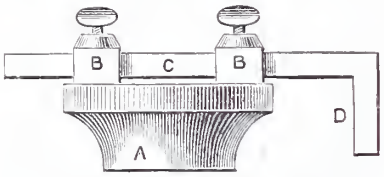


Fig. 10.—Cutter for final Correction of Ring.

Fig. 10 is a reduced copy of Bergeron's drawing. A is the chuck carrying two uprights B, B, with clamping screws to hold a flat bar of steel C, which passes through the rectangular slots and is sharpened on the inside edge, D, of the bent arm. This is the part which cuts the outside of the ring as the chuck is slowly revolved with the mandrel, and the clamping screws allow it to be set in closer as the operation goes on. It is easy to see that this simple apparatus is capable of elaboration, but the only improvement that I would suggest is to round the part which passes through the left-hand upright furthest from the cutter, and cut a fine screw upon it, and to drill that upright to allow it to pass just easily through it. A thumb-nut outside the upright then enables the cutter to be set in much more accurately than if done by hand as in the first case. In another design the main bar is fixed, and the cutter made to slide upon it, but although it is easy to elaborate a tool of this kind, the simpler it is the better it will work; and when it is needed to make, perhaps, only one chuck in a lifetime, any contrivance that will serve, even of wood, with the cutter wedged in, may be made use of. With such an appliance the ring can be made absolutely concentric with the mandrel, and then a mark is to be made upon the poppit head to coincide with the zero of a few divisions which are to be engraved upon the top of the ring plate, which is filed for that purpose flat and true with the top of the headstock. When the two marks, therefore, are at any time made to coincide, the ring will be in its normal concentric position, and will not affect the slide of the chuck. One inch of the flattened part of the ring is generally divided into tenths, so that the ring may be set out of centre accurately to a given degree. These tenths ought to be numbered, and may be subdivided by shorter lines or dots.

When the ring has been thus fixed, the chuck must be screwed upon the mandrel to enable the palettes to be adjusted, and a final touch to be given to the chuck screw. The palettes, or pallets, must be advanced to touch the ring with light pressure, and kept up by the screws already described; and when it is found by gently revolving the chuck that they go round smoothly, and that the slide does not move, a steady hole is to be drilled through both plates, and reamed out slightly conical, and a steel pin is to be fitted so as to keep the slide in position and remove all strain from the parts. The nose of the chuck is then to be trued, and a few touches of the chasing tool should render the screw perfectly true also. The chuck is now finished, unless it requires to be further touched up with a planisher, and here and there with a fine file where the turning tool is unable to reach it. In our next the movable nose piece will be described.

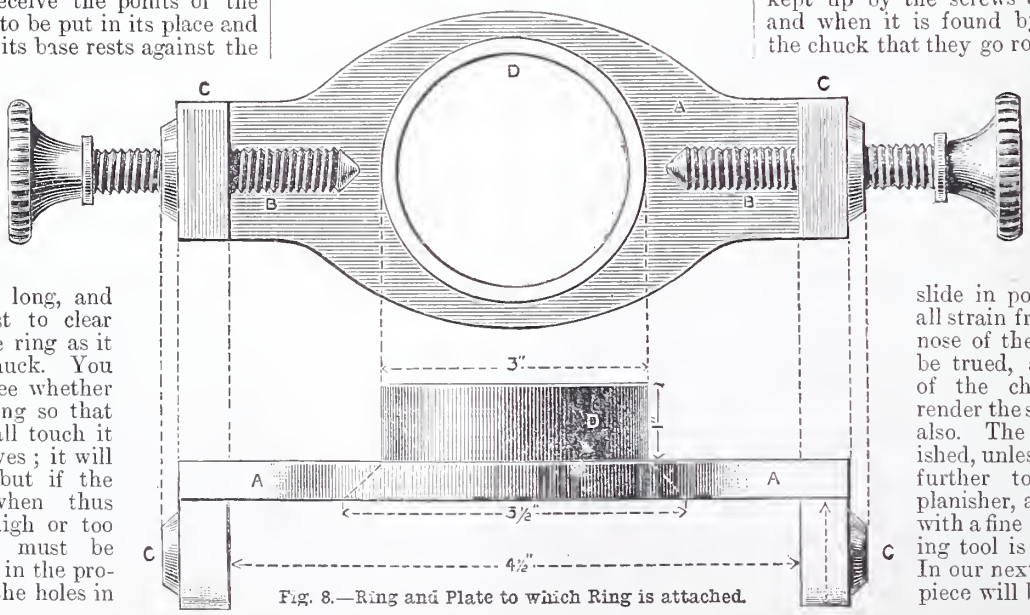


Fig. 8.—Ring and Plate to which Ring is attached.

OILSTONES: HOW TO CHOOSE AND MOUNT THEM.

BY FREDERICK CROCKER.

THE oilstone is one of the most important tools in a wood-worker's outfit; and these few notes are written by a practical worker as a slight guide to anyone who has to select one, and wishes to keep it in working order. There are a good many varieties in the market, but I will confine my remarks to two or three of the commoner kinds.

The Turkey stone is of a dark-bluish colour, with white spots and a whitish grain. This cuts quickly, and will put a good edge on a tool, but wears away irregularly, therefore requires frequent rubbing down, and is liable to break across the centre. A fair-sized one costs about six shillings.

The Ouachita, or "Washita," stone is of a yellowish-grey colour, cuts quickly, soon wears hollow, but more evenly than the Turkey, and is much cheaper, being about half the price. It does not leave so keen an edge as the other kind.

The Charnley Forest oilstone is of a greenish slate colour, with small brown or red spots. These, however, are not always to be found.

The greener and lighter in colour the stone is, the better; the dark varieties are liable to hardness. A good-sized one will cost about three shillings, and should last a lifetime.

The objection to this kind of stone is that it takes longer to sharpen a tool with it than with the other kinds; but I think the extra labour involved is fully repaid by the fine keen edge; and my opinion is that there is no stone in the market to beat it.

In selecting a stone, some test them by rubbing with the thumb-nail, but this cannot be a good guide, as there is always a rough surface left by the stonecutter in dressing. For the same reason, you cannot tell by sharpening a tool on it for the first time how a stone will turn out. A good plan is to wet it, and see that the grain runs as near as possible parallel with the length. Uneven grain or uneven colour will probably lead to uneven wear, and this means frequent rubbing down.

After buying an oilstone, the first thing to do is to make a case for it to protect it from the dust and grit, always to be found in a workshop, from sand-papering, and other causes. This may be done as follows: Procure two pieces of wood (I prefer mahogany) 1 in. wider and $1\frac{1}{2}$ in. longer than the stone; we will say the stone is $1\frac{1}{4}$ in. thick, then the bottom piece should be $1\frac{1}{4}$ in. and the top 1 in. thick; but this latter will depend upon the style of ornamenting the case. Some make them as plain as possible, as Fig. 2; others chamfer the lid (Fig. 3); others, again, mould, bead, and ornament them as much as possible (Figs. 1 and 4). I have seen them with the lid carved; it all depends upon the taste or skill of the worker.

Having procured the wood, place the bottom of the stone upon the piece intended for the bottom of the case, mark round with a lead pencil, and mortise out $\frac{3}{4}$ in. deep. If you have a brace and a large centre-bit, you may bore a good deal of the waste timber out, and a router will be found useful to gauge the depth. Fit the stone in loosely, so as to allow room for the cement which is used to fix it to the wood.

Perhaps a few words about the cement to be used for this purpose will not be out of place. Some use thick white lead. This is not a good material for the purpose, because the stone sucks the oil out of it, and becomes loose; waste oil gets in, is also sucked up by the stone, and has a tendency to make it hard. I have used the following with success. Melt some glue, and mix dry red lead with it till it forms a stiff paste. Spread this over the bottom and inside of the case, press the stone into it, and allow to set. This, it must be remembered, should be used as hot as possible.

The other piece of wood is mortised, and fitted over the top of the stone in a similar manner, but, of course, is not cemented on. The two are then put together, cleaned up level with each other, finished, and should be either varnished or French polished. The bottom should be hollowed out between the ends, as shown in the sketches, to give a good bearing on the bench, and two small steel points driven in at one end, and allowed to stand out about $\frac{1}{16}$th of an inch, to prevent the case slipping.

Fig. 1 is a section through the stone and case; S is the stone, L the lid, B the bottom.

In Fig. 2 the lid is hinged, and provided with a hook and eye. When made in this manner the cover is not so liable to be left off or lost.

After using the stone, the oil should be wiped off, as it has a tendency to make it hard, and the cover put on. Boiling is said to be a remedy when a tone becomes hard, and I have known them to be boiled for days; but it does not make much difference.

When an oilstone becomes hollow or uneven from wear, it requires rubbing down. Perhaps the easiest way of doing this is to tack a sheet of emery-cloth on a piece of level board, and rub the stone on it till level. Some fine sand sprinkled on the board will answer the same purpose. Another way is to get a plate of iron or piece of old plate glass, sprinkle sand and water on the surface, and rub the stone on it, adding more sand and water as may be required. This is a very good method, as it leaves a smooth, even surface. Some level them by holding on the side of a grindstone while it is revolving, others with an old file, others sand-paper till level; but the first-mentioned methods are best.

Oil slips are used for sharpening spokeshaves, hollows, bead-planes, etc., and are generally made to the form shown (Fig. 5). They vary in price from 3d. to 1s., according to quality and size. If a special shape is required, it may be obtained by rubbing as described above. The same remarks as to quality apply to them as to oilstones.

The prices are taken from Mr. Routledge's Price List, of Bull Street, Birmingham.

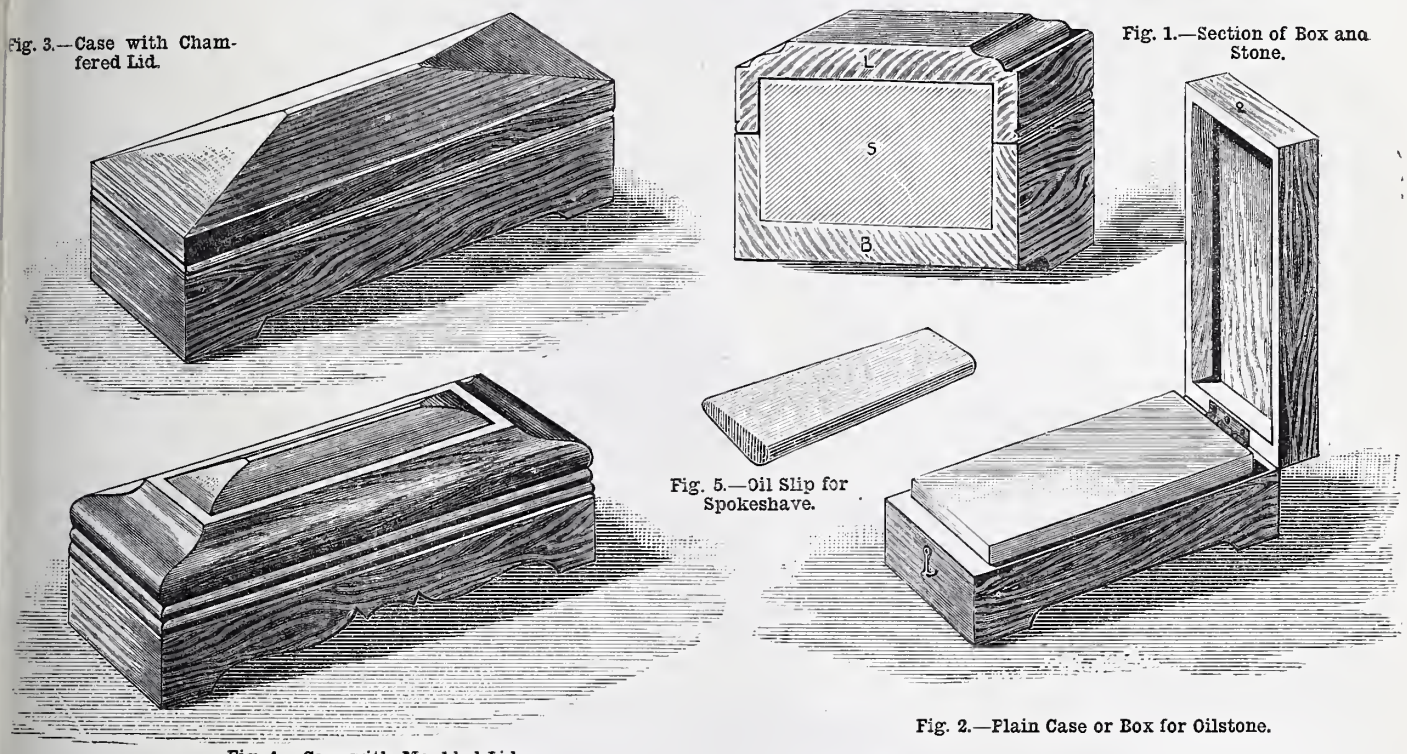


Fig. 3.—Case with Chamfered Lid.

Fig. 1.—Section of Box and Stone.

Fig. 5.—Oil Slip for Spokeshave.

Fig. 2.—Plain Case or Box for Oilstone.

Fig. 4.—Case with Moulded Lid.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

87.—Wyatt's Patent Perfected Chromatic Double Slide Trumpet.

The old double slide trumpet may be regarded as an instrument that reigned in its day by its inherent power and modulation of tone, but keyed instruments supplanted it for some purposes of execution and seem to have left the slide trumpet to take a place of limited range in bands and orchestras. Mr. Wyatt, 123, Portman Buildings, Marylebone, London, N.W., the inventor and patentee of the modified instrument which he has called the Perfected Chromatic Double Slide Trumpet, has, by his genius and a series of experimental efforts extending over nine years, made it transcend in power and modulating effects the keyed instruments that were superseding it, by using a double slide for the old single slide, so that its power is extended to E flat in the base, and from this note every semitone upward can be played with a graduated evenness, which needs to be heard to convince a listener of its wonderful flow of tonic power, obedient to the lightest or most rapid touches. The shift notes are only half the distance of those on the ordinary slide trumpet, and this tends to make manipulation easy. The open notes are the same as those of the old slide trumpet, so that in this respect there is no difficulty for any player to use it. When "crooked" in C, amateurs can play piano or organ music with it, without any transposition of notes. When "crooked" in E flat, the trumpet parts for a military band can be played, which was unattainable by the old slide trumpet. Thus, in the hands of a trumpet player or cornet player, it will be a masterly instrument for rendering notes, and admirably adapted to accompany the organ or piano, as well as for a full orchestra. In completing this instrument, of which an illustration is given in Fig. 1, the inventor has improved the three principal crooks, C, D flat, and D, by his plan of construction. A contributor to WORK has told me that he had the advantage of hearing Mr. Wyatt's instrument played by Mr. W. J. Cubis, formerly Trumpet Major, 2nd Life Guards, and that its combination of power and sweetness of tone was very striking in difficult pieces of music. Mr. Cubis, speaking of the instrument in a letter to Mr. Wyatt, says:—"I have this day given your double slide chromatic trumpet a good trial, and find it everything that can be required in a perfect instrument. Well in tune and of splendid tone, the facility which the double slide gives for the production of all the notes on the chromatic scale fully carries out everything you claim for it in your prospectus, and must stamp it as the coming instrument of the age." The illustration shows in what way the double slide supersedes the single slide of the old instrument. It represents the trumpet crooked in C as a non-transposing instrument. It is fitted with six crooks, namely, C, D flat, D, E flat, E, and F, and also with bent bit, tuning bits, slide cleaner, and silver-plated mouthpiece, all highly finished in the best style. At present it can only be obtained from the inventor and patentee. The price of the trumpet complete, in lock-up case, is £15, or silver-plated, best plate, £18. The instrument will be exhibited by Mr. Wyatt at the forthcoming "Work" Exhibition at the Polytechnic Institute, Regent Street, from Dec. 29, 1890, to Jan. 10, 1891.

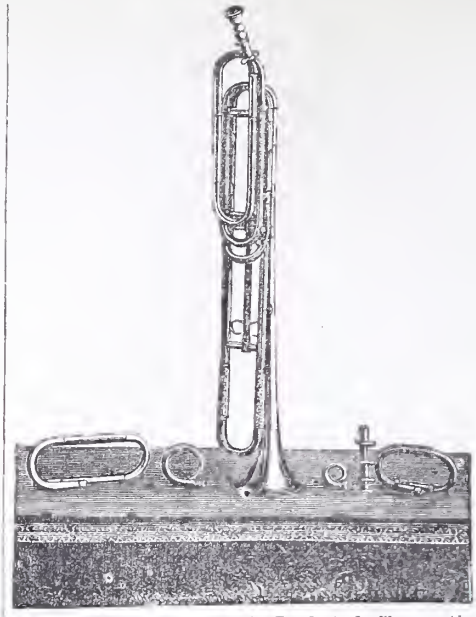


Fig. 1.—Wyatt's Patent Perfected Chromatic Double Slide Trumpet.

88.—Lewis's Improved Automatic Plate-rocker, Patent Adjustable Stand-holder, and Kallitype Paper.

Messrs. John Lewis & Co., 99 & 100, Gladstone Road, Sparkbrook, Birmingham, have submitted for inspection and trial three of their specialities, namely, the Patent Improved Automatic Plate-rocker, the Patent Adjustable Stand-holder, and "Kallitype" Paper and Printing Process. The paper may be had in a full sheet, 26 in. by 20 in., three of which are supplied for 2s. 6d. post free, or cut in various sizes to suit the various requirements of photographers, and sizes of cameras. It may be procured direct from the manufacturers, Messrs. Lewis and Co., who will forward price lists to any applicant, or from any photo depôt. The photographer who tested the paper and process at my desire says:—"I have tried the Lewis Kallitype process as per directions and find very good results can be had with it, but I did not find the paper so sensitive as stated. Great care has to be exercised in the process to avoid abrading the surface, which is most easily injured whilst wet. The process seems an easy one, and suitable especially for thin clear negatives." The nature of the Patent Adjustable Stand-holder may be gathered from Fig. 2, although it is far smaller than I like, because excessive smallness in a cut is detrimental to clearness. However, I suppose almost everyone knows what a tripod camera stand is, and will understand me when I say that in the adjustable stand-holder there are three holdfasts which are gripped, one to each leg, by screw clamps with milled heads. From these proceed cords, which pass through a central plate, and being weighted at the far end, tend to keep the stand steady and prevent slipping. It can be adjusted in a moment, and being flexible and only a few ounces in weight, folds up with stand. Its price is 4s. The Improved Automatic Plate-rocker is designed to keep the negatives in motion during development, intensification, reduction, etc. The rocker, as may be seen from Fig. 3, is placed on a stand, within which is a clockwork movement, which keeps the rocker in motion, and when wound up, may be set going or stopped at pleasure by pulling out or putting in a stop inserted for this purpose in one end of the stand. It is silent in action. It is claimed for it that by its use under-exposed negatives may be fully developed without fogging, and that intensification and reduction of negatives may be safely accomplished by its aid by taking time over the process and using moderately weak solutions. It is certainly a time-saver, because the photographer can place his negative on the rocker and turn his attention meanwhile to other work; and it is cleanly, because those who adopt it will avoid the stains inevitably caused by holding the tray in the hands during development. The price for whole plates and under is 17s. 6d.; for 15 in. by 12 in., and under, 25s.

Fig. 2.—Patent Adjustable Stand-holder.

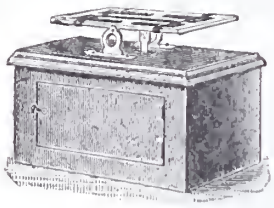


Fig. 3.—Patent Improved Automatic Plate-rocker.

89.—Warbey's Improved Fire Extinguishing Apparatus.

Messrs. P. and J. Warbey have invented and patented a new system and means of extinguishing fires, to which they have given the name of "Warbey's Improved Fire Extinguishing Apparatus." Judging from the engraving of the apparatus supplied in Fig. 4, it consists of a system of hydrants and perforated pipes laid in or attached to the ceiling of every floor of a building, having in addition the ordinary fire hydrant with hose and nozzle attached, as shown on the third floor of the building represented in the engraving. The principle of the invention is this:—A supply pipe from the main is connected with a multiple hydrant placed in the basement, although it should be said that it is by no means necessary that the multiple hydrant should be actually within the building, and by means of separate branches connected with the hydrant and the main pipe, water is conveyed to each and every floor of the building by pipes, as shown in the illustration. Each division of the multiple hydrant is fitted with a valve, and the main pipe also is similarly fitted, and these valves are opened and closed by a spanner or key attached to the hydrant, so that an emission of water can be caused on any floor where it may be requisite by turning the valve in the division leading to the floor in question, or the whole building can be flooded by turning on all the valves. Nor is the utility of the apparatus confined to the interior of the building, for it is said by the patentee

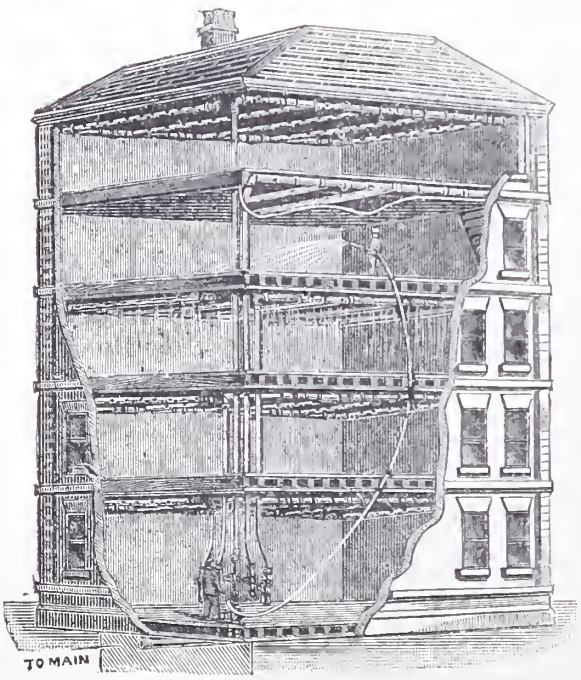


Fig. 4.—Warbey's Improved Fire Extinguishing Apparatus.

it it can be applied for washing down the tside if it be desirable, and for protecting any operty from fire in its immediate vicinity, it this, of course, is accomplished by means the ordinary fire hydrant with its independent hose and nozzle. The invention seems useful one, and no harm could possibly arise om its adoption unless the valves in main pipe id multiple hydrant got out of order, which not likely. Whether or not the attachments the ceilings of a building in the form of perrated pipes are unsightly can only be judged om seeing them in position, but the inventors y that they are by no means an eyesore.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

* *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

n answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

"WORK" EXHIBITION.—NOTICE.

In answer to numerous correspondents, the Secretary has made inquiries as to the Hire of Packing Cases for the term of one month by intending Exhibitors in the London district, and announces with pleasure that Messrs. DREW and CADMAN, High Holborn, W.C., are prepared to lend on hire, cases of various sizes, on moderate terms for that period; on application by letter, or personally, they will give every information.

JNO. W. HARLAND, Secy.

I.—LETTERS FROM CORRESPONDENTS.

A Photographing Expedient.—J. B. (*Westminster*) writes:—"Having a little idea as regards a photograph changing bag, I explain it, as it may be of some use to my fellow photographers. It is by taking the coat off, laying it on the ground, and thrusting the arms through the sleeves, and kneeling on the collar of the coat. Any amount of work may be done in this way if care be taken not to raise the coat too high. My idea is of little use for London work, but will be found an advantage to tourist and cyclist."

Netting Needle.—J. H. B. (*Pendleton*) writes:—"Having seen an article in WORK, No. 79, on netting, I enclose a sketch of a needle which I like much better than the one you show, which has a very weak point in the peg round which the string is put. I have done netting by the yard, hammocks, tennis nets, etc., and always used this sort."

Netting Needle.

Wood-carving Patterns.—AMATEUR CARVER writes to W. J. H. (*Redhill*) (see No. 83, page 504):—"I am copying some very fine old English carved panelling, which I obtained *on hire* from Mr. Jarvis of Church Road, Hove, Brighton, and have no doubt W. J. H. could be accommodated in the same way. I find it excellent practice as an amateur, and have gained much information from the study of it."

Perpetual Motion.—W. S. writes:—"I wish to ask a question about 'perpetual motion' in 'Shop'—if there is anyone that makes it, and how it is made; a sketch would kindly oblige." [No human being can make, or in other words cause, perpetual motion. Only He that is omnipotent can do this, and omnipotence belongs to God alone. It is made or called into action by the feat of God's Word alone. The only thing approaching to a sketch of perpetual motion that I can suggest is the heaven above us, studded with heavenly bodies that have been performing from the beginning, and are performing, and will perform their circuits and functions with unerring exactness until it be the Almighty's will and pleasure that they shall cease. —ED.]

Erratum.—R. F. (*Norwich*) writes:—"A slight error occurs in my reply to SCOT on page 440, No. 79. Your comp. makes me say 'harmonics' instead of 'harmonics,' in line 9. The difference, although of only one letter, is really so great that it quite alters the sense of the whole."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Cement for attaching Metal to Marble.—A. M. (*Willenhall*).—Your query as to a suitable cement for fixing a piece of German silver to a marble timepiece is a wide one, and would take over a column to answer fully, but I will do the best I can for you. If I were going to fix the metal plate myself, I should solder two short pieces of copper wire—rather stout in gauge, like that used by bellhangers—on to the under side of the plate, one at each end, about half an inch from the edge. Next I should drill holes in the marble into which the wires might fit, rather loosely if anything, countersinking the holes just as if screws were to go into them, so that the plate with its soldered wires might fit quite close on to the marble. Then I should fill the holes with resin, or the shellac cement sold sometimes as panel wax, or the cement referred to below; heat the wires as hot as possible without melting the solder, and press them firmly into the holes. The heat of the wires will easily melt the resin or cement, as copper retains its heat for some time, and the plate will be firmly fixed. Another method that could be adopted if the plate is large is as follows:—Drill in the plate as many holes as you think necessary, and drill holes in the marble exactly to correspond; plug the latter with chips of wood dipped in liquid glue or other good liquid cement, and then with round-headed brass screws, silvered or otherwise whitened, screw the plate into its place. This plan I should recommend if your inscription plate is lacquered, because there is no heating of the plate required. If the plate is to be let into the marble, cement would do, as the plate would be less liable to sudden knocks or blows, and there are many that would answer your purpose such as jewellers' cement, Armenian cement, often sold in china shops under other fancy names, and many what I may call chemical cements. These I should not advise A. M. to make, as they require some considerable nicety and some chemical knowledge. I have just tried cementing a piece of German silver (roughened with a graver) to plate glass with the cement described by me in WORK, Vol. II., page 354, and it seems to answer very well, though detachable with a hard blow.—H. J. L. J. M.

Smoke Consumer.—A. T. G. (*Bowes Park*).—The Acts of Parliament referring to smoke consumption may be obtained through any law stationer. They merely amount to a statement that under certain circumstances no smoke is allowed to be discharged into the atmosphere except for a few seconds after stoking the furnaces, and it is not likely that they will assist you in your design. Your attention requires to be directed to the scientific and practical requirements of the case, in order to avoid or overcome the difficulties which have rendered useless the majority of the hundreds of appliances that have been patented in this connection. From a theoretical point of view, the matter is very simple. To avoid emission of smoke, there must be perfect combustion of the fuel before leaving the chimney. To obtain perfect combustion of fuel, there must be a sufficient supply of air to furnish the requisite quantity of oxygen, and the temperature of furnace and combustion chamber must not be lower than the temperature of combustion of the products generated in the furnace. This latter requirement has proved a great practical difficulty, and the methods that have been devised to overcome it are almost innumerable. In most furnaces combustion occurs in two stages—primary and secondary; the first consists in the ignition of the solid fuel fed into the furnace, and the second comprises the combustion of products evolved by the primary combustion and of carbonaceous particles carried along by them. Assuming that sufficient air is supplied with the fuel for complete combustion, this will not—when an open draught is used—occur near the front of the furnace, because the cold fuel will lower the temperature below that necessary for the consumption of the gases evolved, and, in fact, the evolution of these gases will locally lower the temperature of the furnace. What then is required for the consumption of smoke is so to arrange the back part of the furnace, or a chamber in connection with it, as to have there always a sufficient supply of air at a temperature sufficiently high to ensure the combustion of all the products passing from the fire grate. I should advise you, before expending much time on this matter, to read up what has been patented in this direction in connection with furnaces and steam boilers, in the specifications in the library of the Patent Office in Southampton Buildings, Chancery Lane. As to the proceedings of the Committee for Testing Smoke Preventing Appliances, you may obtain particulars from Mr. Fred. Scott, Secretary, 44, John Dalton Street, Manchester.—F. C.

Relacquering Brass, Nickel-plating, and Polishing Celluloid.—J. C. J. (*Hepworth*).—Cleaning and lacquering brasswork has already been treated in WORK, Nos. 55 and 58, Vol. II., pages 35 and 82. Nickel-plating steel goods can scarcely be properly treated in a reply. Use a fair-sized depositing vessel of slate or wood, lined with pure lead, put together with burned joints. The upper edge of this vat must be furnished with a wooden ledging made in the form of a step, to which is attached a rectangle of brass tubing or stout copper rod, a binding screw being soldered to one corner of this for the purpose of connecting it with the zinc of the battery. A similar rectangle is likewise fitted to the lower step of the ledge, and this also is provided with a binding screw which connects it with the carbon of the battery. A series of brass rods, about ¾ in. or ½ in. diameter, and each of about the length of the tank's width, are laid across the outer rectangle, and from these the work to be plated is suspended, similar but shorter rods being placed across the inner rectangle for the purpose of supporting the anodes; all these conductive fittings being kept scrupulously clean by frequently rubbing them with emery cloth. For a small bulk of solution, and work not exceeding a square foot of surface, three quart bunsens will be found sufficient, but for larger work they should be double this size. The anode, which is a roughly-cast plate of nickel, is hung in the solution in the vat from the anode rods by means of S-hooks; its function being to supply the solution with fresh metal as it is deposited upon the work. These anode plates can be had in all sizes at about 3s. 6d. per pound; a ⅜ in. plate 10 in. by 4 in. would weigh about 2 lbs. As nickel is a bad conductor of the current, it will be necessary to have the anode considerably larger than the work to be plated. The plating solution for the vat is made from the double sulphate of nickel and ammonia (usually sold as nickel salts). Dissolve the salt in distilled water or clean rainwater in the proportion of 2 lbs. of salt to every 3 gallons of water, the solution being filtered through a piece of fine linen or calico into the vat. As you desire to re-nickel old work, it will be necessary to first strip off all the old plating by immersing the work in the following stripping solution:—Sulphuric acid 4 lbs., nitric acid 1 lb., water 1 pint. Add the sulphuric acid to the water (do not reverse this), and when quite cool, pour in the nitric acid and then stir the mixture with a glass rod. The articles to be stripped must be dipped in the solution by means of a piece of bent wire, and the appearance carefully noted, as some articles, by reason of the extremely thin coating of nickel, are stripped almost immediately. As soon as the plating is dissolved off, the work should be rinsed well in cold water, after which it is dipped in boiling water and allowed to dry spontaneously. The articles must now be well scoured with very fine sand, applied by means of a stiff brush—this will leave a good surface upon steel goods; and immediately after the work has been scoured it should be put into the vat, in order to get a coating of nickel on the surface as quickly as possible before the air has had time to affect the metal. The work may now be hung from the cathode rod by means of stout copper hooks bent in the form of an S. The full battery power should be employed until the metal has been uniformly deposited over the entire surface, when one cell may be taken off in order that the deposit may be worked at a lower tension. In judging of the thickness of the deposit, it is a good plan to note the time taken to cover the surface of the work with a coating of nickel, and then to allow two or three times as long, according to requirements. On removing the work from the vat, rinse well in cold water and then polish with either tripoli, whiting, or rouge. The operation of scouring serves the double purpose of cleaning the work and at the same time providing it with an almost imperceptibly rough surface, to which the plating will adhere. It is a most important matter to place all steel work into the plating-vat immediately after cleaning, as a very slight exposure in the air will be sufficient to cover the surface with a thin film of oxide, thus preventing the proper adhesion of the metal. With regard to the polishing of the celluloid pianoforte-keys, you should rub them with very fine glass-paper and then with powdered pumice-stone applied on a wet rag, afterwards finishing off with washed whiting or tripoli applied by means of a soft linen or woollen rag dipped in soap-suds. Or, if preferred, you may polish them by means of finely powdered pumice-stone, Russian tallow, and elbow grease.—C. A. P.

Bookcase.—J. T. D. (*Nottingham*).—You should purchase the Index to Vol. I. of WORK from your bookseller, price one penny. From that you will be able to ascertain all that has appeared in that volume of WORK upon bookcases. All back numbers of WORK can be had of Cassell & Co., Limited, Ludgate Hill, London, E.C.

Sycamore Wood.—BANGOR can buy sycamore wood any size at Messrs. Snewin Bros., Back Hill, Hatton Garden, E.C.—A. J. H.

Filling Compo for Brass Plates.—W. M.—(*Southampton*).—You do not appear to have succeeded with sealing-wax. Grind up with black (or coloured) wax sufficient gold-size to make the mixture run freely, fill in the letters, and allow the filling to thoroughly set, and clean off with spirits of wine. A pinch or two of Prussian blue will give a brilliancy to the black.—N. M.

Silver Chasing.—ARGENT.—Mr. A. Foster, Rockingham Street, Sheffield, and Mr. T. Dennil, Eyre Street, Sheffield; write to either, and ask them to procure and chase for you three or four (or more) Britannia metal teapot bodies with patterns suitable for sterling silver. If they will not comply with your request, write me through the Editor, and I will try to get them for you.—N. M.

Bassinette.—A. M. (*New Brighton*) and others are informed that a paper on this subject is already in the Editor's hands.

Leclanché Battery for Electric Lights.—G. A. B. (*Sunningdale*).—D. O. W. (*Ipswich*) has kindly replied to your letter, and I give herewith an extract from his remarks, together with some further comments of my own on the subject. The lamp will give light "sufficient to distinguish the various articles of furniture, and look for a match-box to light the gas, but not to read by. I only use it for a few seconds when I wake, as I very often do during the night, to see what the time is, or in case of illness, to see about the room for a short time. I believe it to be a 2½ c.p. lamp, and it cost me 3s. 6d. The sealed cells in a cool place will go for twelve months with the little use proposed." From our friend's description of his lamp and battery I find that his lamp is a 6-volt 2½ c.p. Woodhouse and Rawson incandescent lamp, and his battery is a 25 cell Leclanché arranged in five rows of five cells in series. He has 40 feet of No. 22 double line wire, silk covered, to convey current from battery to lamp. The Leclanché battery soon polarises when used on such heavy work as electric lighting, hence it can only be used for a few minutes at a time, and at intervals of several hours. When a large battery of cells is made up in parallel sets, as, for instance, in the battery employed by our friend, where twenty-five cells are arranged in five rows with five cells in a row, a larger negative and positive surface is exposed to the action of the current, the internal resistance of the battery is lessened, and the cells do not so soon polarise. But the same result is better attained by using large cells with flat plates of carbon and zinc, instead of small blocks of carbon and small zinc rods.—G. E. B.

Nickel-plating.—M. R. (*Huddersfield*).—A nickel-plating plant must consist of the following articles:—(1) Enough solution of the double sulphate of nickel and ammonia to cover and surround the articles to be nickelled. (2) A vessel large enough to hold the nickel solution. (3) Anodes or plates of cast nickel to hang in the solution. (4) Rods of brass to support the anodes and the articles and conduct the current. (5) Hooks of brass or of stout copper wires to support the articles and anodes. (6) Stout copper wires to convey the electric current from the machine or battery to the vats. (7) A battery or a dynamo electric machine. (8) Several acid-proof stoneware vessels to hold pickling acids. (9) An iron tank to hold hot potash solution. (10) A polishing lathe and set of circular brushes, mops, buffs, dollies, etc. (11) Polishing materials, such as tripoli, crocus, pumice, Sheffield lime, etc. (12) A scouring trough and brushes. There are many other useful appliances. The size and number of all these will depend on the magnitude of your intended business. You will find Watt's "Electro-Deposition," price 9s. 6d., the best book on the subject. Shall be pleased to advise you at any time.—G. E. B.

Fine Mainspring.—W. W. (*Carnforth*).—You must surely be mistaken when you speak of getting eight and a half turns out of the mainspring of the watch job to which you refer. They must be half turns which you have been counting. If, however, they really be full turns, the spring must be, out of all proportion, too weak for the watch. Five and a half turns are considered a liberal allowance, and out of this one turn may be "set up," if you know what that means. I cannot understand why your watch does not go for thirty hours if there are as many turns in the barrel as you mention. Your watch will possess a "stop work" unless it has been removed by some careless jobber. Perhaps the fault is in the stop work. The springs to which you refer are evidently very common ones. The best thing you can do under similar circumstances is to send the barrel and bit of old mainspring to the tool shop and allow them to fit the spring. The best place in the North of England, and the nearest to your place of residence is the firm of C. Rowson & Son, 44, Sir Thomas Buildings, Liverpool. This firm will do all you require. The time you mention for getting done the repairs stated is quite out of the question. The people to whom you sent the work must be dilatory beyond measure. The firm mentioned above, and, indeed, all business-like people in the trade, whether in London or the provinces, would execute such jobs as those you mention in two or three days. To return to your question about fitting mainsprings, it is my duty to tell you that the old spring is not always a guide for the strength of the new one. It is the commonest thing in the world for unskilled workmen to fit a wrong spring into a watch. Then the spring breaks, and the next workman, unless he is experienced, fits a new spring of similar strength as the old one, and hence perpetuates the mistake. A good guide for the fitting of a mainspring is that the barrel should not be more than two-thirds full. It should then make, say, five and a half turns in winding. Of course, in common watches which have been badly handled and require plenty of driving, it may be necessary to have a spring so powerful that it makes only a little more than four turns in winding. It needs experience and judgment to find out exactly what is required. The finest mainsprings I have ever obtained in this country were purchased from Muller Brothers, 58, Dean Street, Soho, London (watch material dealers). But Rowson & Son will be handier for you and will suit all your requirements; they will also promptly deal with your jobbing work. The best thing for cleaning watch movements is benzine, or benzoline. Buy a little glass jar with a glass top, and fill it with, say, half an inch or an inch deep with benzine. Take your watch to pieces and drop it bit by bit into the benzine, and leave it there for a few minutes, or longer if you like. Then take the pieces out one by one and brush them carefully with a clean brush. After having brushed the wheels as clean as possible, take a pointed peg and go through the leaves of the pinions, as the dust and dirt always accumulate there, and brushing will not always remove them. I am glad to hear that the articles in WORK "have been a great help" to you, and I am sure it is a pleasure at all times for myself and other writers to help one who is so anxious to learn as yourself.—HERR SPRING.

Butter of Antimony.—W. W. (*Chelsea*).—Butter of antimony is the liquid form of antimony trichloride ($SbCl_3$), and should be obtainable of, or through, any druggist at about 2d. per oz. If unable to obtain from your regular druggist, you could certainly be supplied by any dealer in chemical reagents, such as Townson & Mercer, 89, Bishopsgate Street Within, E.C., or Becker, 34, Maiden Lane, Covent Garden, W.C. The chemical in question is largely used for staining gun barrels, as an ingredient in French polish revivers, and, to a less extent, in medical practice as a caustic. It is an ingredient in several proprietary corn cures, and it is said that a few drops dissolved in a wine-glass of water, and the liquid applied with a feather, is incomparable as a remedy for unbroken chilblains.—P. W. S.

Mincing Machine and Varnishing Tins.—W. T. B. (*Somerset*).—What sort of tins do you want to paint and varnish? Any kind of paint, from the common paint sold in tins at 3½d. per lb., up to Aspinall's special bath enamel at 1s. 3d., will adhere to tin equally well, and the same remark applies to varnish either clear or black. For machines for such purposes as you require write to Messrs. Kent and Co., Holborn, or to John Thent, Baldwin Iron Works, Bolton, who will send you full particulars and prices.—R. A.

Paquelin Lamp.—J. A. C. (*Canewdon*).—The paquelin lamp is sold by Crowden & Garrod, Falcon Works, Southwark Street, London, S.E.; a card of instructions as to filling, lighting, etc., is sent out with each; the price is 12s.—R. A.

Circular Saws.—H. G. (*Little Bolton*) will be glad if any correspondent will furnish the title and name of publisher of the best book on the practical working and management of the circular saw.

Chimney Shaft.—FOREMAN BRICKLAYER.—The thickness of the walls depends in a great measure on the purpose for which the chimney is required: thus, a chimney in which a great amount of heat is to be brought will naturally require thicker and stronger walls than one in which the heat is not so great. In the case named, if it is for an ordinary boiler furnace, make the base three bricks thick, the first quarter of the shaft two and a half bricks, the second quarter two bricks, the third quarter one and a half bricks, and the fourth quarter one brick in thickness. Line the inside for half the height with fire-brick, half a brick in thickness, binding it every four courses. You will see a drawing and description of a furnace chimney in the articles on "Bricklayers' Work," now appearing in WORK. If there is any particular case in which you require information, if you send me particulars through the Editor I will give you any information I can. There is a work on chimney building published by Messrs. Spon, Charing Cross, called "Chimney Construction," by Messrs. R. and F. Bancroft, price 6s. 6d., but I have not seen it.—M.

Soldering.—H. M. (*Manchester*).—An Index to Vol. I. can be had for 1d., and you will then be able to see what articles have appeared on "Soldering." The papers on "Sheet Metal Work," appearing in Vol. II., would be useful to you.

Waterproof Red Ink.—BARTLETT does not say whether he requires this for paper, canvas, calico, or walls, etc. I presume, however, that the former is the most likely. I do not know what the usual ingredients are, but it occurs to me that a solution that I have found most useful for outdoor scene painting, instead of size, is likely to be of service. Take a sufficient quantity of borax, and dissolve in warm water all that the water will take up. This is technically termed a "saturated solution" of borax. Then break very small "white shellac" into an earthenware jar, and pour on it—warm—the borax solution, letting it stand on a warm hob or oven top, not too hot, stirring it awhile; if all the shellac dissolves, add more until it ceases to melt. Let it stand to cool, and bottle it close from the air. This solution, the only *aqueous* solution of shellac, has the property of drying quickly and being afterwards insoluble in water, and should be more widely known. It may be used for gumming paper together, and damp will not affect the gumming. I have used it for mounting photographs, as it never mildews, and, let down with a little milk, for fixing crayon drawings, sizing paper, and for scene-painting, outdoor pictures, and illumination transparencies. If BARTLETT chooses to make the trial, it only costs a few pence; and I think if he mixes up his ground vermilion (dry colour) with this vehicle, he will find it will stand the weather either on paper, calico, or canvas. It must be used quickly, or it dries, and you cannot soften it again.—J. W. H.

Electric Machine.—W. A. (*Hulme*).—Your "electric machine" is a shocking coil. You should have no difficulty in making another with the very slight difference of having a sliding brass tube over the core instead of winding the wire direct upon the core. It involves the employment of a little more labour and a little more material, that is all. The connections are the same for both. First make up the bundle of iron wires to form the core, bind into a perfectly round bundle with string, and soak in melted paraffin wax. When cool, unwind the string and fit the bundle into the thin brass tube which will go over it. Allow the back end of the core to project about 1 in., and *fix* this into one of the reel ends of the coil. Now make a paper or an ebonite tube to slide over the brass tube, and let this form the body of the coil, bobbin, or reel, on which the primary is to be wound. The core is fixed at one end. Over the other end slides the brass tube in the ebonite or paper tube on which the primary is wound. If you do not now understand, please write again and state your difficulty.—G. E. B.

Platinum Points.—E. G. (*Dalston*).—If you mean the little points of platinum used in tipping the contact screws of electric bells, these are merely little bits of platinum wire inserted in small holes drilled in the ends of the screws. Drill the hole with a very fine drill, then get a piece of platinum wire a little larger than the hole, file the tip of the wire carefully to go tightly in the hole, nick the wire where it should be broken off when in the hole, drive it in tight, break off the surplus, and neatly hammer the end into the form of a rivet head. If you cannot get a piece of platinum wire large enough to suit the hole you have drilled in the screw tip, solder this up, heat the end of the platinum and sweat it into the solder, then break off the surplus and file off the rough burr on the point instead of hammering it smooth. Platinum wire is very costly. You will probably have to pay after the rate of from 40s. to 50s. an ounce, and will get but a very small piece for 6d. Any jeweller will get it for you, or you may buy it of a dealer in electrical goods. Should any reader experience a difficulty in getting such little things as these, and will write to me, enclosing stamped addressed envelope, I will try to help him.—G. E. B.

Book on Electrical Experiments.—AMATEUR ELECTRICIAN.—In all elementary text books on magnetism and electricity will be found directions for performing electrical experiments; but I do not know of a book devoted specially to the wants of amateurs. The field of electrical science is very large, and contains material in abundance for electrical experiments. This you will find if you get an illustrated catalogue of electrical sundries from such houses as Messrs. Price & Talbot, 26, Ludgate Hill, E.C.; and Messrs. King, Mendham and Co., Western Electrical Works, Bristol. When applying for one of those catalogues, enclose four penny stamps for postage. I shall be pleased to assist you with instructions for performing any experiment you may select, and also advise you where to get apparatus and materials at a low cost, if you will write to me and state your requirements.—G. E. B.

Castings of Model Dynamo.—X. Y. Z. (*Rugby*).—The castings of a small model dynamo of the Siemens pattern, to light up two 6-volt 2½ c.p. lamps, will cost 10s., and may be had of Mr. Bottone, Wallington, Surrey. Castings of small dynamos can also be obtained of Mr. H. Jones, 14, High Street, Lambeth, S.E. The small dynamo above mentioned will do useful work if driven at the rate of 3,000 revolutions per minute. This speed might be obtained from your model steam engine, if well made and finished, and supplied with steam at sufficient pressure. Respecting the boiler for the engine and a safety valve for the boiler, I can say nothing until I know the dimensions and form of your boiler and the material of which it is made. Send me full particulars of your boiler and I will then try to help you.—G. E. B.

Connections of Coil.—R. J. N. (*Fulham*).—From the sketch and description of your coil, I suppose it to be a combined shocking and induction coil. That is, it is furnished with a very long thin secondary coil for giving sparks, and a shorter secondary for giving shocks. The four-way switch throws in the spark coil with the condenser, at the same time as it throws out the shorter coil. The two loose wires form the terminals of the spark coil, and were once connected to two insulated handles or points which could be made to approach each other gradually until brought within striking distance of the spark. The ends of the primary go to the contact breaker and the binding screws or pillars. Connect these pillars with a pint bichromate cell. If you do not understand this, or if your coil will not work, send me your name and address, and I will try to arrange with you to see it, and put it in order.—G. E. B.

Electric Bell Failure.—READER.—If you make the parts of your bell as advised by me in Nos. 12 and 18, Vol. I. of WORK, pages 179 and 279, you will not fail to make a bell that will ring. On referring to the table showing the proportionate parts of magnets, on page 180, Vol. I., you will see that your magnet is wrongly proportioned, and is wound with the wrong size of wire. Had you given me the size of the gong of your bell, I would have told you the proportionate sizes of the other parts. The bobbins on a magnet 3 in. by ½ in. should have a diameter of 1¼ in., and these must be *filled* with No. 22 wire. Your chief cause of failure, however, lies in not knowing how to adjust the contact screw. When the armature simply vibrates to and fro at a distance of ⅜ in. from the core, the adjustment is right. When you screw it up closer so as to allow only ¼ in. play, there is no break of current, and therefore the armature sticks to the

gnet. To make the armature work more briskly th ⅛ in. play between it and the core, either add re battery power in the shape of two or three ls instead of one, or add more wire to that already the cores. If you wish to practically test your rk as you go along, use the same battery you end employing to ring the bell when finished. will not serve your purpose to use a bichromate ttery in testing the strength and capabilities of electro-magnet intended to be worked with rrent from the Gassner battery, as the E.M.F. the bichromate is much higher than that of the ssner, and its internal resistance is also much wer. You do not tell me how many cells you ed in testing the magnet, nor how many you ought of using to work the bell, so I cannot advise u further now, but shall be pleased to do so at y other time if you need advice. I would advise u to get the numbers of WORK mentioned above, d read the articles on "Burglar Alarums," before riting to me again.—G. E. B.

Mirror Painting.—F. C. (*Londonderry*).—The irror or glass must be *perfectly* cleaned, either ith soda and water or weak acid and water, so at its surface may be, as it is termed, chemically ean, care being taken, of course, that the back of e window be not injured in the cleaning process. he colours used are the ordinary oil colours, and e painting is done precisely in the same way painting on canvas is done, with this difference, at it is not possible to trace the design on to the lass with any greasy tracing paper, like the carbonised or carbonic paper sold for tracing designs n to metal surfaces. It is far better to trust to e eye and paint from a carefully drawn sketch r model. The most important thing in mirror ainting is the medium, or the vehicle, which assists e colours in adhering to the surface of the lass. There may be many such mediums, and o doubt excellent ones, but the best I know, without wishing to puff anybody's wares, is that sold y Lechertier, Barbe & Co., under the name of "Sosi-crystallograph," which is undoubtedly an xcellent medium for the purpose. Besides this, f any reader of WORK tries mirror painting with his medium and fails, or is dissatisfied with his vork, he has the satisfaction of knowing that he medium mentioned above will not be wasted, ut will serve admirably as a medium for painting on metal, wood, or china—in the latter case, iring with a very good glaze. It is not at all prejudicial—in fact, the opposite—to the transparency of the colours used; it dries well and quickly, and he glass when finished may be cleaned like an unpainted mirror. One of the secrets of success n mirror painting is the extraction of any superfluous oil with which the colours used may have been ground up, by squeezing them from their tubes irst on to blotting-paper instead of on to an ordinary palette; this has the effect of removing without difficulty any excess of oil, and the colours after standing awhile can be mixed in the usual way on a palette.—H. J. L. J. M.

Riddles.—DANDY ROLLER.—You ask what is the B.W.G. of the wires used. The book entitled "The English Wire Gauge" tells us that great variance exists among the gauges at present in use; the numbers adjacent to the knotches in one gauge differing greatly to many of those on the same sized knotches in other gauges. And several of these different gauges are known in different districts under the name of B.W.G.'s (Birmingham wire gauges). Therefore you will understand that if I tell you what gauge the wire is that is used n the shop whence I gain my information, the chances are that in your district wire of the same thickness would be known by another number. The author of the above-mentioned book gives over two dozen different gauges, each varying in some particulars from the remainder, and speaks of mistakes arising from this state of things. In my forthcoming papers on wirework, I shall adopt a certain gauge, according to which I shall number the imaginary wires in my sketches, and of which I shall give a drawing in order that no mistakes may arise.—J. S.

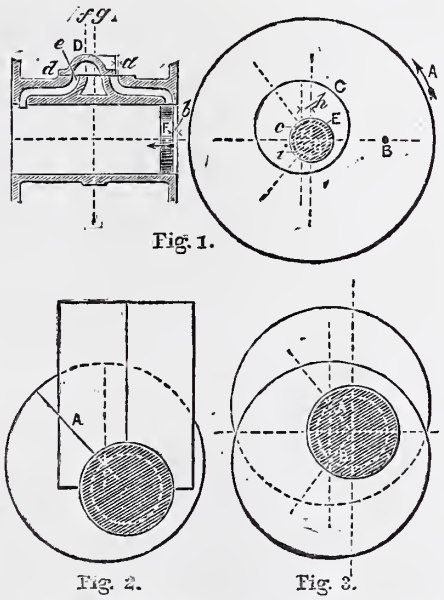
Re-covering Bagatelle Table.—W. A. F. (*Woolwich*).—Get all the old cloth off and clean the bed from all grit or dirt; also clean the cup holes and fit in the cups before putting the cloth on. Then lay cloth on, and if it is an open table—not folding—glue the cloth across at the end. Let it dry, and then tack the cloth on, stretching it as much as possible; and when the cloth is on, take a penknife and cut the cup holes across, so that the cloth will drive down when putting in the cups. Mind the cups are put down just level with the cloth. But if the board is one that folds up, it would be as well to glue the cloth on all over, and put cups in in the same manner as the open table. After this is done, put the cushion in with small brads without heads: drive them through the cloth of cush.—G. E.

Watch and Clock Cleaning.—F. S. (*Hoxton, N.*).—You cannot do better than advertise in our cheap "Sale and Exchange" column.

Practical Book on Preserves.—W. T. B. (*Somerset*).—I know of no separate work on this subject, but many recipes for preserving are given in Cassell's "Dictionary of Cookery," price 7s. 6d.—K.

Turkey Stone.—R. R. (*Belfast*).—You doubtless need this for sharpening tools. It seems impossible that you cannot get this in such a town as Belfast. If no tool maker there really has the real article, send to Moseley, 323, High Holborn, London, or to Buck, Tottenham Court Road, London, for prices.

Quarter Horse-power Engine.—FOUR AMATEURS.—By laws I assume you mean the ordinary eccentrics of common engines. We will take first the case of an engine running in one direction only—that is, without reversing gear. Say the fly-wheel is to turn in the direction of the arrow A in the diagram, Fig. 1. Then the relative position of the crank pin B, and of the centre *c*, of the eccentric C, will be as shown, when the valve D is set with the edge nearest the crank pin open to a very small amount *a*, which is called the opening to *lead*. In a ¼ horse-power engine this lead opening *a* would not be more than a full $\frac{1}{32}$ in., or bare $\frac{1}{16}$ in. In addition to the lead, the lap of the valve must be determined before you can fix the distance *b* by which the centre *c* of the sheave C is set in advance of the centre of the crank shaft E. The lap in your case may be from ⅛ in. to $\frac{3}{32}$ in., and its amount is determined by the fractional part of the piston's travel at which you want to cut off steam. Perhaps I had better explain these two matters of lap and lead in case they may not be clear to some of our amateur friends. Note particularly the relative positions of the piston F and valve D, Fig. 1. Here the valve is open to lead *a*, and the piston F has just reached the same end of the cylinder and is returning in the direction of the arrow. But as the valve had already opened before the piston reached the end of the cylinder, this means that some steam



Quarter Horse-power Engine. Fig. 1.—Diagram of relation of Eccentric and Valve. Fig. 2.—Templet for setting Eccentric. Fig. 3.—Double Eccentric for reversing.

was admitted to the clearance space *b*, as the piston was nearly terminating its motion towards that end. This small quantity of steam admitted by the lead of the valve acts, therefore, as a buffer or cushion in bringing the piston to rest and preventing shock. Looking now at the other end of the valve, it is seen that its edge *d* has *overlapped* the edge of the port *e* so far that the port must have been closed to the admission of steam some considerable time before the piston could have reached the end *b* of the cylinder In a model engine it should cut off at about ⅔ the stroke, or less if the boiler pressure is high. By this early cut off the expansive action of the steam is taken advantage of, and the action is easier than it would be if steam were admitted right up to the end of the piston stroke. The amount of *lap* is estimated as the distance by which the valve covers the edges of the ports when in its middle position—that is, when the centre *f* of the valve coincides with the centre *g* of the ports. Now adding the lap, as just explained, to the lead *a* in Fig. 1, we get the distance *h* for the advance of the centre c of the eccentric sheave in front of the centre of the crank shaft E. That distance is measured on the circle G, which represents the eccentric circle whose diameter is equal to twice the *throw* of the sheave C, equal to twice the lap added to twice the width of a steam port, provided the valve opens the entire port to steam. So that now you have all the elements of your gear, namely, the diameter of the eccentric circle G, equal to the total travel of the valve D, the distance of advance *h*, equal to the lap plus the lead measured on the eccentric circle; and the distance *h* set off plus 90° in advance of the crank pin B, with the valve just open to lead in the near side. Different people adopt different metods of setting the sheaves. About the simplest plan is to use a templet something like Fig. 2. Then having set the valve open to lead *a*, as in Fig. 1, with the crank pin B in exact dead centres and the templet plumb, the line A will indicate the angular position of the sheave. Before pinching or trying the sheave on, the engine is brought into the exactly opposite position and the position of the parts tested, and any discrepancy in the two positions altered by moving the sheave or altering the rods. If your engine is wanted to run in the opposite direction to that indicated by the arrows A in Fig. 1, then the centre of the sheave must be placed at *i*. If you are going to fit it with reversing gear, then there must be two sheaves, either separate or cast together (Fig. 3), whose centres will be at A and B. Then, according as the reversing link is raised or lowered, will one or the other sheave be rendered operative.—J.

Exhausting Tins.—W. T. B. (*Somerset*).—I do not know of any machine supplied for this purpose. The exclusion of air from provision tins when containing liquid is effected by raising the contents to the boiling point, and soldering the case up while it is filled up with steam, which prevents the entrance of air while the closing operation is performed.—F. C.

Replies to Questions.—S. R. (*Newry*).—You should have repeated your questions. When you and other correspondents find answers to questions delayed, it would be well to repeat the question, and thus afford a clue as to what you are referring to.

Canvas Canoe.—H. D. W. (*Manchester*).—You want to know whether the ribs can be built up. This can certainly be done, but they ought to be made a little wider and screwed together. Then take care to give them sufficient lap; but I strongly recommend the method shown in the article—that is, steaming, which is very easily done.—J. B. F.

Graining.—HULTA.—A most comprehensive and reliable work upon the art of imitating woods is now being published from Manchester by the Decorative Art Journals Co., Limited, 15, St. Ann Street. This is illustrated from samples grained by the best living British grainers, and reproduced in colour in a very masterly manner. Its price is two guineas, but facilities have been offered to apprentices, etc., to acquire the work at an easier rate. Compared with such a costly work, my own papers on the subject in WORK are but elementary; after mastering the latter you could then with advantage procure the Manchester book. The same source might help you *re* real panels; but you would not want them with the book. My own woods were veneered by a professional friend.—LONDON DECORATOR.

Calcarium.—H. J. M. (*Pembroke Dock*).—This product is a water paint or distemper—a preparation of lime. "Shop" is scarcely the place for a discussion of the relative merits of calcarium or alabastine. The proprietors of the former are A. T. Morse & Co., Stratford, London, E.; their nearest branch to you is at Perry Road, St. Michael's, Bristol. Calcarium is now made in forty-eight tints, and is supported by a string of testimonials. According to the proprietors, it is "non-poisonous, odourless, washable, does not rub off, durable, cheap, and easily used and made ready for use." Alabastine, as it is now termed, is a product prepared from gypsum, that has long been used in America, but only lately made here. Its virtues have already been explained in WORK. As a substitute for size and whiting colour it is a valuable acquisition to the country at large, whilst as a material for relief decoration its capabilities are enormous.—F. P.

Painting.—COUNTRYMAN.—As the window faces north, and therefore gets but little sunshine, I should advise—were it my own client and job—a warm treatment. The next question is what cost will they run to. If from £10 to £15 they could have a Japanese dado—dark terra-cotta and old gold—with wooden rail above same; total height from skirting, about 30 in., but that would depend upon the design and how it cut up. The filling might then be flatted and the cornice also—three coats and flatted, as per lessons in WORK, Vol. I., the colour being a soft salmon, or light terra-cotta in tone with the dado. A dado is a more serviceable and advantageous treatment for a dining-room, and, if of Jap. leather, would partly furnish the room, and could be varnished if desired. In any case, it would last a great number of years. The *reveals* of recesses must not have the dado carried across them: they and the arches should be painted and left plain, or stencilled with suitable design of darker shade. For a room the height you mention, brass picture rods, or iron ditto painted to match, should be fixed under cornice, but no frieze. The cornice can be of darker shades of terra-cotta, with other parts in soft aerial blue and dull greeny buff tints. These colours, if mixed and arranged with knowledge and taste, will make a nice harmonious combination. The ceiling could be either tinted a warm cream or very light salmon, or papered with a ceiling design in these tints if the "latest style" is desired. The woodwork had better be terra-cotta shades, light panels, as filling; darker stiles; panel mouldings still darker; the chamfers or bead gilded, and all varnished, save the gold. If a little gold can be used in the cornice on prominent beads and between the contrasting tints, the effect will amply repay cost. As the lighting is north, this kind of colour scheme is the right one, and it does not require an artist to make it successful. I could give you a dozen other treatments, but they would require a good colourist and decorator to personally control them.—LONDON DECORATOR.

Paint.—F. M. (*London*).—Paint for garden woodwork is best made with boiled linseed oil, driers, and the pigment according to colour. For white, take the best white lead (in paste form), add about one-twelfth part weight or bulk of paste or liquid

driers, then mix to working consistency with three parts boiled oil to one part turpentine. This will do for first or second coating equally well. For pea-green tint, the white paint with a little green pigment, purchased, if able, in paste form also. For stone colour, add a little of each, or both, according to tint desired, of yellow ochre and burnt umber, ready ground in oil.—F. P.

Gold Leaf.—J. L. (*Old Trafford*). — Since gold leaf is used in a dozen different classes of work, and generally for decorative purposes, I have no idea what particular phase of the process you refer to. The outlay of 1d. for No. 51, Vol. I. of WORK, will be a good investment for you, as a useful *résumé* of the tools, process, etc., is given therein.—F. P.

Paint Manufacturers.—G. M., JNR. (*Aberdeenshire*).—I append a few very reliable makers who could probably ship to you at low transit rates:—Storry, Smithson & Co., Bankside, Sculscoates, Hull; Heywood, Clark & Co., Caledonian Works, Vauxhall Road, Liverpool; The Yorkshire Varnish Co., Limited, Ripon. Remember *price governs quality* in all cases, and that no small quantities can be more advantageously purchased than from firms near home.—F. P.

Mattress and Polish.—J. K. (*Bethnal Green*). —The springs of the mattress can be fastened down with staples to the box bottom, or fixed in any way that may be most convenient to yourself. Tie them on top in the usual way. If you are not acquainted with this get some friendly upholsterer to show you. The best stuffing material is curled hair. Any number of dealers supply it in the neighbourhood of Bethnal Green, Curtain Road, Old Street, etc. To get the colour you want for your overmantel, go over the work with weak walnut stain, and use a red polish over it. The red polish may be made by putting a little Bismarck brown in ordinary French polish. By this method you get a good rich mahogany colour, which is far superior to the horrible bright red which is so often seen on common imitation mahogany furniture. Instead of filling, or as filling, use size. Do not oil. Polish otherwise as you have done before on your overmantel.—D. D.

Stitches in Upholstery.—J. H. B. (*Pendleton*). —The "mysterious pieces of string" you found in the seat you were re-upholstering were, no doubt, what is called the "tack stitching." They are necessary in order to keep the hair or other stuffing well up to the edge of the seat. The string is passed under the tacks and up through the stuffing in a slanting direction. It catches some of the stuffing, and so—in conjunction with other rows of stitches —pulls and retains it well in the corners. It is a pity you did not more closely examine the stitching when ripping the seat, as you would then have had a better notion of how to do the work than could be conveyed by mere written description. Your treatment of the old hair was decidedly wrong. It should not have been washed unless you were able to remake. The virtue of hair as stuffing material consists in its being springy. This springiness is imparted to it by twisting it into rope, which, after it has been properly prepared, is loosened. Water will effectually remove the curl which is given to it by being twisted into rope, and leave the hair as dead and useless as tow would be for stuffing. Remaking hair is not suitable work for amateurs, and when you have any more send it to some good upholsterers, who will get what is necessary done for you by the people who supply them with curled hair. The charge will be a very small one; but, unless the quantity is large, you will find it better to buy new hair, and get the value of the old allowed for. If you merely wish to get rid of dust and dirt, you can do so to a certain extent by loosening the old hair thoroughly; but whatever you do, do not wash nor wet the hair. You can now do nothing to restore the seat from its sunken and flabby condition except by re-upholstering it and using fresh stuffing material.—D. D.

Rusty Tools.—N. L. (*Huddersfield*). — Never keep steel or iron tools near steam pipes. Nothing short of a bath could more effectually rust them. Give them all plenty of sand-paper to thoroughly clean them, then keep them well oiled and, above all, thoroughly dry.

Change of Trade.—A COUNTRY INQUIRER.—You tell me very well what you want, but I cannot help thinking that there is another side to the question. If you apply for employment anywhere, the first questions put to you will be, What can you do? To what work have you been accustomed? Surely you ought to give some idea of what you can do best. As to managing a planing machine, that is very good if you have a good amount of that peculiar faculty for seeing faults, and still more important, seeing the remedy. Do you possess any ability in metal-working or machine-tool sharpening? for to *manage* a planing machine demands a knowledge of sharpening cutters to a great nicety, and setting the same (if several) so that the same duty is done by all. If you only mean to *wait upon* a planing machine I would say "Don't," as *Punch* said in answer to quite another question. In my ignorance of country life I had thought it most excellent for the workman. I had pictured the young carpenter repairing almost every wooden article used in the country. I had imagined he would be employed in making new fittings, when required, not only on the farm, but for the dairy and the homestead. Were I to be in your place I should see to it that I could repair or make a wheelbarrow or a village cart. I should make kitchen tables, try my hand at doors and sashes, and try boxes, tool-chests, etc., for my own use, if not good enough to charge full prices for, and try to avail myself of every opportunity that offered itself. It is manifest that it is not possible to tell you what you ought to get in Glasgow for your services, the value of which may be either great or small; but my advice is to eschew all unknown people who ask for improvers, especially those who have some patent or other speciality: they usually keep the young hand to one thing to their profit, but to his loss. Go in for variety, never mind the work being a *little* beyond you; but if you always do your best you will not be blamed if sometimes you fail.—B. A. B.

Cement for Cistern.—AQUA.—You had better take out your glass, clean up the work, and reglaze the aquarium, using a cement as follows:—To 1 lb. of putty add ½ lb. red lead. work it together with sufficient gold size to form a soft mass—it should leave a clean hand without sticking. Smear the edge of each piece of glass with gold size where the cement will have to touch; to ensure contact press the glass well home, and do not use more cement than necessary, and only just enough inside the corners to make a neat joint; when dry and hard, give two coats inside of copal varnish. If your frame and glass are strong enough this will be all right.—C. M. W.

Annealing Zinc, etc.—A. W. R. (*London, W.C.*) —There is no way that will render zinc permanently soft, and at the same time enable it to retain its other qualities. Zinc works best at about the temperature of boiling water; any great heat renders it rotten, as you have found by experience. You have used too stout a gauge of zinc for your crosses; No. 12 is what is used mostly for roofing purposes; I use No. 10 for nearly all crosses and wreaths. If over 20 in. long, use No. 11, which is strong enough for anything. For your fencing masks, if you want to use binding wire, why trouble to tin it when you can easily get it already tinned very cheaply? Try Harrison's, in one of the streets leading out of Drury Lane, close by you, or Henry Pinder, Drury Lane, where you can get anything in the metal or wire line. I think it will be best to solder after binding. Resin is the flux for lead if you want to dip it in that metal, but it must be got bright and clean before dipping by means of pickling and scouring. The gluing of the woodwork seems a very simple matter. You have failed through using bad glue, or not getting it hot enough. Try Le Page's liquid glue. Glue the pieces, place them in position, and lay a weight on them for twenty-four hours, and they will stand any reasonable strain.—R. A.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Coloured Patterns on Canvas. — To Po writes:—"Will readers please say how I can stain or otherwise fix permanently coloured patterns on canvas, suitable for hammock, chairs, etc., and in lengths, say, of three-quarters to a yard and a half? Of course they are wanted to stand wear well, and, preferably, put on with stencil patterns, or some such mechanical process, for lack of skill in free-hand drawing or painting. Particulars as to colours, medium—in fact, the whole process—would greatly oblige. Only a few at a time required, and in as economical a way as may be."

Working Fan-Mounter. — A. HANDICRAFTSWOMAN writes:—"I shall be greatly obliged if any reader could give me the address of a working fan-mounter."

Razor Setting.—J. C. (*Plymouth*) asks for the best directions for setting razors. [There is a cutting air about this query, but, withal, it would be an aid to J. C. and thousands of fellow workmen "to be up to" a keen edge that would hurl destruction at hirsuteness.]

Whalebone.—H. C. (*Maidstone*) will be obliged to any reader who will inform him where to obtain whalebone such as is used to make collapsible landing rings, as sold in the fishing-tackle shops.

Bursting Water Pipes.—GLASGOW writes:—"Being a sufferer from water pipes bursting during the night, owing to the great increase of pressure from the main supply, would some of your readers kindly inform me if they know of any regulator that can be attached to the pipes so as to prevent this great strain?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Glass Calculator.—J. F. M. (*Codsall*) writes in reply to G. M. (*Clapham*) (see page 457, Vol. II.) that he has a glass calculator for sale. [J. F. M. should advertise full particulars in our cheap "Sale and Exchange" column.]

Cork-cutting Machine.—ONE IN THE TRADE writes to AB UNO DISCE OMNES (see page 504 of WORK): "You can get a machine to cut cork into strips of any length from Mr. J. Lowman, cork cutter, Albany Road, Camberwell."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—MAC; F. MCA. (*Barrow*); R. R. Y. (*Canada*); XMAS; F. F. L. (*Leytonstone*); B. S. (*Edinburgh*); A. W. D. (*Perth*); OVERHEAD; PHYNIC; BATHONIAN; ANXIOUS LEARNER; J. S. R. (*Kettering*); T. G. P.; A SUBSCRIBER; DUSTY; OLD TIPTONIAN; OPTICUS; M. D. C. (*Liverpool*); A. J. S. (*Birmingham*); BERNHARD; H. D. H. (*Baltham*); T. H. N. (*Cockermouth*); AN OLD SUBSCRIBER; E. D. G. (*Ely, Cardiff*); W. B. (*York*); A. F. (*Sheffield*); D. T. (*Chatham*); J. M. (*Bacup*); C. E. H. (*Tottenham*); HANDY MAN; POLISH; F. M. R. (*London, E.C.*); J. B. (*Louth*); H. M. B. (*Wakefield*); GILT; JACK OF ALL TRADES; F. H. W. (*Wolverhampton*); B. F. (*Birkenhead*); M. A. (*London, W.*); BRAZIER; QUERIST; IMPROVER.

Trade Note.

A DISPLAY of seamless copper tubes and cylinders of all sizes up to 18 in. in diameter were lately on view at 56, Queen Victoria Street, E.C. The tubes are made by Elmore's Patent Copper Depositing Co., Limited, of London and Leeds. At present the Company's plant laid down is capable of turning out five tons per week, and this is being increased to a fifteen tons capacity. The specimens on view range from threads which have been passed cold through dies of $\frac{1}{1000}$ in. in diameter drawn down from spirally-cut sections to this dimension, up to pipes 18 in. in diameter and 14 ft. long. Of the thread, 40 miles in length go to the pound and it looks like a bunch of hair; while the pipe shown are a ¼ in. thick, though the thickness may be increased to any desired extent. When it is understood that these results are achieved direct from Chili bars, without any annealing whatever and therefore without any detriment accruing from this operation, some idea will be formed of the purity. Specimens have been exhibited that had been treated very severely, yet no harm had been done to the metal. It was as homogeneous as before it was touched. The invention accomplishes all this by eliminating the foreign matter always found with copper in its usual form. Amongst the branches of trade the process will be likely to affect, we find mentioned — beside steam pipes — torpedo discharge cylinders, high pressure air reservoirs, calico-printing rollers, weldless pans, and high conductivity copper wire. The Elmore tubes are deposited at the rate of ½ in. in thickness per week of 144 hours, or 6 lbs. per square foot of surface. The process by which they are produced differs only in one respect from that hitherto followed in the electro-plating of rollers for calico-printing machines. The surface of the copper is continuously burnished by an agate the whole time, and as rapidly as the particles of copper are formed they are rubbed and matted into those beneath and beside them, thus forming a fibrous plate of perfectly uniform structure and great strength. So closely are the particles interlaced that the specific gravity is increased until a plate ¼ in. thick weighs 6 lbs. to the square foot. The material has a tensile strength of 25 tons per square inch, with an extension of 20 per cent. in breaking, and has therefore about double the strength of ordinary copper tubes.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

SALE AND EXCHANGE.

Belt's Patent Enamelled Adhesive Waterproof Advertising Paper Letters and Figures in all colours and sizes. Best and cheapest. Liberal terms to agents. Sample sheets, gratis. Factory, 17, Arthur Street, London, W.C. [1 s

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [2 R

Joiners' Tool List free. — BOOTH BROTHERS, Dublin. [6 R

Fretwork, Carving, Brass, Leather, and Poker Work.—Speciality in ornamented ivorine for painting. Illustrated Catalogues of tools, 800 Illustrations, 6d.—HARGER BROS., Settle, Yorks. [7 R

Amateur Engineering.—FLEMING, 63, Stirling Street, Glasgow. [9 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [2 S

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [3 S

Elliptical Chuck, as page 468, WORK.—If sufficient demand exists, BRITANNIA CO., Colchester, will supply parts, either rough or machined, at a moderate price. [11 R

On Hard Soldering.—A useful work issued by CHARLES E. ROSE, Jeweller, Bolton. With sample of solder, 1s. 6d. [12 R

Complete Outfit for Making Real Photographs; printed instructions; ready for instant use. Carriage paid, 1s. 9d. Particulars of £500 prize competitions free to all purchasers. No fees.—"Work" Dept., PHOTO NOVELTY CO., Alvaston, Derby. [13 R

Model Engine Castings. — Illustrated Catalogue, 4d.; Screws and Bolts; list, stamp.—STIFFIN & CO., 324, Essex Road, London, N. [4 S

Splendid Violin for disposal; owner having no further use for it; beautiful mellow powerful tone; first-class instrument; perfect condition; baize-lined case, mounted bow, 5s. tutor. Accept 17s. 6d. for the lot. Rare bargain. Worth much more. W. DEBOIS, 34, Hill Street, Ipswich. [5 S

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,
84, 85, 87, Fetter Lane, LONDON.

WATKINSON & LONSDALE.

WRITE FOR PRICE LISTS

MANUFACTURERS OF
Photographic Apparatus,
NEW BRIGGATE, LEEDS.

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,
TOOL MAKERS,
DUBLIN.

For Christmas Decoration!!

USE

JUDSON'S LIQUID GOLD

6d., 1s., and 5s. per Bottle.

(READY MIXED).

SOLE MANUFACTURERS,
DANIEL JUDSON & SON, LIMITED.
SOUTHWARK, LONDON, S.E.

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Important to Decorators.—STENCILS.—100 Working Stencils for 10s. 6d. Full-sized for dadoes, friezes, panels, borders, pilasters, corners, breaks, etc. Excellent designs artistic, well drawn. On cartridge paper, ready for cutting, 100 different designs sent free by post on receipt of Postal Order for 10s.6d. The Stencils are believed to be the best value ever offered the trade. Send 1s. for sample sheet of Original Designs. Thirty years' experience.—WILLIAM DAVISON, Art Decorator, Designer, and Stencil Cutter, 14, Larchfield Street, Darlington. [1S

Post Free on application.

Cassell's Complete Catalogue.

A COMPLETE NOVEL,

BY

FLORENCE WARDEN

(*Author of "The House on the Marsh," &c.*),

ENTITLED

"Missing a Young Girl,"

FULLY ILLUSTRATED, appears in

Cassell's

Illustrated Almanac

and Companion for 1891,

NOW READY, price 6d.

This year's issue consists of ***96 pages,*** and contains particulars with Portraits of the Champions of the Year in various Sports and Pastimes, together with a record of their achievements.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

THE

POLYTECHNIC SERIES.

Consisting of practical Illustrated Manuals specially prepared for students of the Polytechnic Institute, Regent Street, London, and suitable for the Use of all Students.

Elementary Chemistry for Science Schools and Classes. By ROBERT AVEY WARD. 128 pp., crown 8vo, cloth, 1s. 6d.

Forty Lessons in Carpentry Workshop Practice. By CHARLES F. MITCHELL. Revised by GEORGE CAMPION POPE. 1s.

Practical Plane and Solid Geometry, including Graphic Arithmetic. Vol. I. Elementary Stage. By Prof. HENRY J. SPOONER, C.E., F.G.S. 3s.

Forty Lessons in Engineering Workshop Practice. By C. F. MITCHELL and E. G. DAVEY. Revised by J. ROGERS, M.A.S.E. 1s. 6d.

The Polytechnic Technical Scales. Ten Scales printed on card, in Case, 1s.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

For Sunday and General Reading.

NOW READY, *price* ***6d.***

The FIRST PART of the NEW VOLUME of

The QUIVER.

Being the

NOVEMBER PART.

"THE QUIVER is an Amazing Sixpennyworth; the illustrations are so good, and the style is so fresh and attractive, combining solid instruction with much that is entertaining and bright."—*The Rock.*

"There are several complete stories in THE QUIVER better worth a guinea and a half than many for which that sum is charged; and there is a mass of varied reading of the highest possible character."—*Sunday School Times.*

"THE QUIVER is the Best Magazine devoted to Sunday reading."—*Saturday Review.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers.*

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

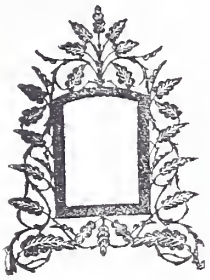
These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.



The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our ***New Catalogue*** of all Requisites, with instructions. Acknowledged the most ***Complete and Cheapest*** List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

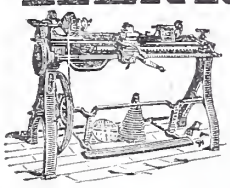
Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6d. OR FOR 7 STAMPS. BIRMINGHAM. [33

London Warehouse: **124, NEWGATE ST.**

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores; or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). ***An Archimedian Drill,*** with brass handle and Three Bits, will be ***SENT GRATIS*** with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 87.] SATURDAY, NOVEMBER 15, 1890. [PRICE ONE PENNY.

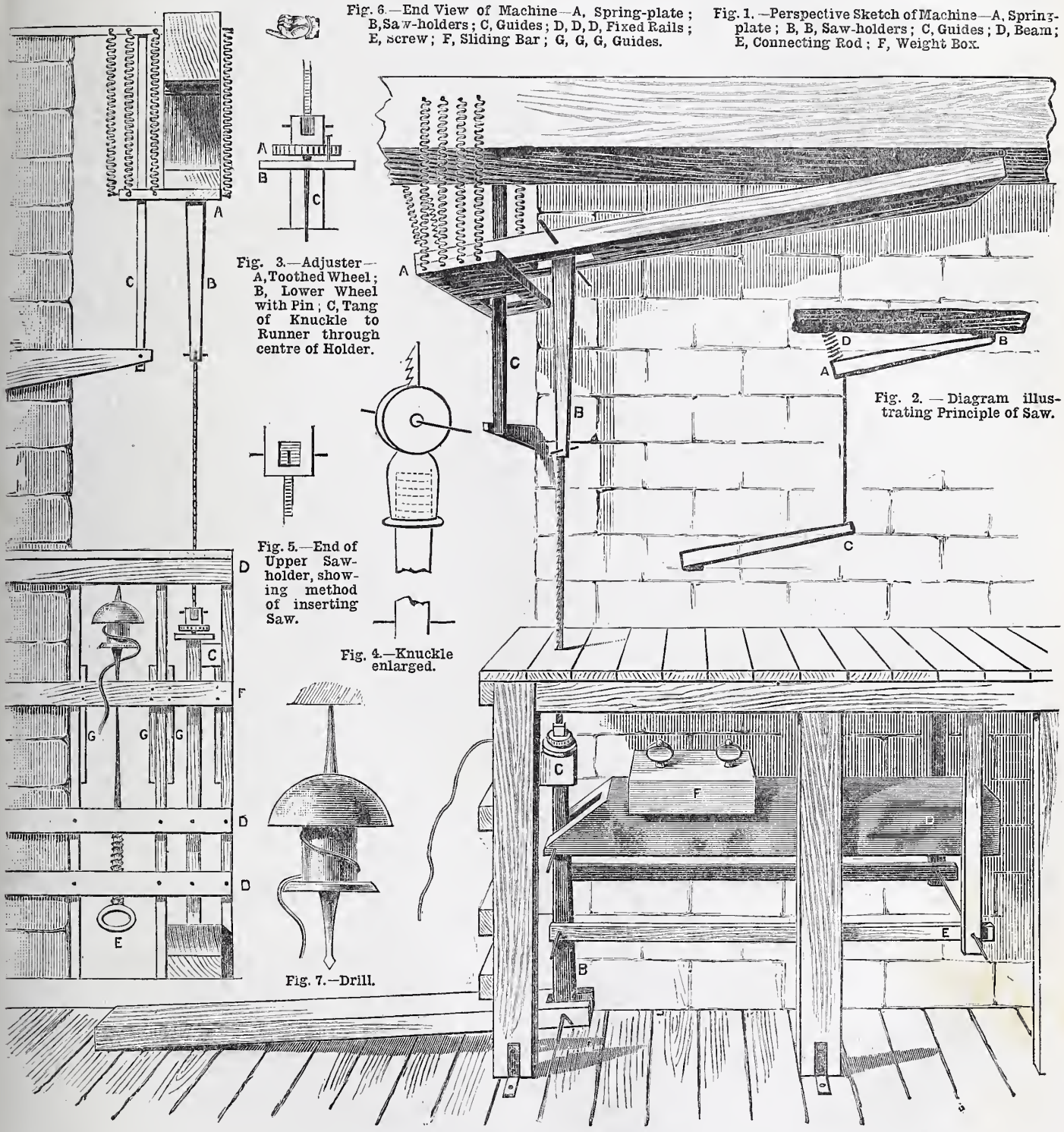


Fig. 6.—End View of Machine—A, Spring-plate; B, Saw-holders; C, Guides; D, D, D, Fixed Rails; E, Screw; F, Sliding Bar; G, G, G, Guides.

Fig. 1.—Perspective Sketch of Machine—A, Spring-plate; B, B, Saw-holders; C, Guides; D, Beam; E, Connecting Rod; F, Weight Box.

Fig. 3.—Adjuster—A, Toothed Wheel; B, Lower Wheel with Pin; C, Tang of Knuckle to Runner through centre of Holder.

Fig. 2.—Diagram illustrating Principle of Saw.

Fig. 5.—End of Upper Saw-holder, showing method of inserting Saw.

Fig. 4.—Knuckle enlarged.

Fig. 7.—Drill.

A POWERFUL MACHINE SAW AND DRILL.

A POWERFUL MACHINE SAW AND DRILL.

BY F. HALLIDAY ROPER.

Who would not like to be the possessor of the above—easy to work, and most inexpensive? Well, such a machine is now before the readers of Work. It is not intended to take the place of the highly finished and costly machines which are to be purchased by those fortunate individuals who have plenty of means—they can readily be supplied by the various tool-makers, many of whose productions are so excellently described and illustrated in Work; but for those who have little money to spare and none to waste, and will take the trouble to construct it—and the construction is easy—it is the very thing. The cost is almost nominal. I really had only to purchase the bow-saw, which cost about a shilling, the drill, for which I paid 4½d., and the steel wire for springs; the rest is all made out of oddments, but then, I never throw anything away. I rescued two rails from imminent danger of destruction one fifth of November, and out of gratitude—let us give them credit for it—they work the saw that saws the wood that lights the fire that cooks the food of all in the house that we live in! Surely the old proverb, "Keep a thing for seven years and it will come in useful," applies with great force to the inventive workman or amateur.

This saw has a 9-in. stroke, and will cut wood, hard or soft, up to 4½ in. I have not tested it beyond this, but it is certainly not the limit of its powers; and as for anything under an inch, it is like cutting paper—you just tickle it with your foot, and away it goes. It also cuts curves beautifully, up to the 4½ in. to which I have tested it. I may also say that I have never had a saw broken.

And now a few words as to the main principles of the machine, before I give details of construction. If you take a rail A (Fig. 2), and hinge it to a roof-beam at B, and connect it by a string to a similar rail C, hinged to the floor, you will find that although the rails move in sections of circles, the resultant motion of the string will be, for all practical purposes, up and down in a vertical line. The string represents the action of the saw, and you require a spring D to pull the saw up to position, after the downward stroke obtained by pressing the treadle B with the foot. This by itself, however, entails unnecessary labour, as there is not only the exertion required to saw the wood, but also to overcome the resistance of the springs D. We now take advantage of one of the principal forces of Nature—that of gravity; and, by loading and adjusting the saw, obtain great power at a very little expenditure of labour, on the same principle that a rocking-stone weighing many tons is easily moved with a very little push, or a heavy, but well-balanced, scale is turned by a small weight.

Construction of Saw.—Procure two rails—say 6 ft. long by 3 in. by 2½ in. I will here remark that the sizes given need not be exactly followed; they may be varied according to convenience. My workshop is a very small one, and I had to build the saw to suit. For instance, I have only a space of 11 in. from centre of roof-beam to wall; this, unfortunately, cramps it very much, and gives me very little space on the left hand. It really should be in the centre of a workshop, with plenty of space all round, so as to have room to manipulate a large piece of wood. The saw-bench, also, is only 3 ft. 6 in. from floor; this may possibly be too low for some. It should be arranged at a convenient height to suit the workman. Having procured the rails, then, cut the slots to receive the saw-holders and bore holes for the pins. Screw the spring-plate A (Fig. 1), made of inch wood, and about 8 in. by 6 in., to the end of the upper rail. Hinge the rails as shown, one to the roof-beam and the other to the floor, connecting them by the string as before mentioned. The springs next claim our attention. Procure steel piano wire, pretty strong—it is sold in suitable lengths—and, to make the springs, proceed as follows. Put a spindle in your brace—I used a piece of old stair-rod, about 10 in. long; these lengths of stair-rod, by the way, made all the larger pins—and having passed one end of the wire through two pieces of wood tightened up in the bench vice, or in any other way having got sufficient tension, wind the wire closely and regularly round the spindle, and capital springs are made. You will require many of these to balance the heavy weights with which the saw has to be loaded. I have, in addition, a clock movement, not shown in sketch, fixed between the beam and the wall, from which I get additional power; but where this cannot be used, additional springs will be required, as you can hardly have too many or have them too strong. Get as much power as you can, as any excess can easily be compensated. This is an important part of the saw, and took me a deal of trouble to get right. Do not use indiarubber; I tried it, but as it constantly breaks, it is useless. Having got the springs fixed, and the upper rail so that it will pull up sharp and strong, construct the bench of inch wood, firmly fixed to floor; mine is 6 ft. long by 13 in. wide. It must be placed so as to allow the string to pass through a small hole, 7 in. from end. Now plane up two pieces of inch deal for saw-holder, length to suit the height of room, and tapering somewhat, as shown at B. The upper end of the saw is inserted in a brass plug, drilled for pin, and let into the wood, as shown at C. The lower end is treated in the same manner, with the addition of an adjuster to keep the saw true. This is made of two wheels connected by a screw knuckle in centre; the holder is cut 2 in. from upper end, and the parts connected by the adjuster. The tang is drilled and pinned to holder, the bottom wheel of adjuster being screwed to upper end, the upper, or toothed wheel, being fastened to the small piece of holder cut off, the knuckle connecting the screw, the play of the screw in knuckle being sufficient to allow of adjustment, which is effected by a pin in the lower disc, holding the upper or toothed wheel in position. Old clock works do very well for these wheels. Having pinned the saw up, you will find the adjuster most useful for correcting any error which may have crept in, and by it you get the saw true to the front. You must now fix the guides C to keep the saw steady. A glance at the drawing will show how they are fixed—the upper one through a slot in the spring-plate, and the lower one to the bench. They allow the rails to work vertically, but prevent any lateral movement. The loading of the saw is the next step. For this purpose you procure a beam D—say, 4½ ft. long by 4 in. by 3 in Cut a slot for the saw-holder to work freely in, and having drilled a hole at each end with a twist drill, pin it through the holder about the middle, the other end being pinned through the two vertical rods which swing from the saw-bench, and are likewise pinned at the bottom to the lateral rods, which in turn are pinned to the holder. The effect of this arrangement is that the whole apparatus under the bench works freely with the treadle, and resists without friction all the strain caused by the pressure of the wood against the saw. You now complete the affair, as far as the saw is concerned, by loading the weight box F with lead or iron to complete the balance. The saw should now work easily and beautifully, cutting with the greatest ease.

The drill is fixed to front of bench, and is very useful for drilling with great ease and rapidity small holes through metal. It goes through ⅜ in. iron very quickly, and there is no labour attending the process; you have only to pull a string, and the drill does its work. It is formed of a wood bobbin, a steel pinion being fixed at the top, pivoting in a piece of brass let into the topmost fixed bar D (Fig. 6). Two other fixed bars are also used, through which the long screw E passes, giving the necessary pressure to the sliding bar F, which is held in position by the guides G. To use the drill, lower the sliding bar a little by means of the long screw, insert the metal to be operated on, screw up again, and pass a cord round the bobbin, the other end of cord being attached to a piece of indiarubber about 18 in. long, under the bench. On pulling the string the drill revolves rapidly, and you get all the necessary pressure by the screw E.

Intending constructors may modify this machine in order to suit their requirements and the materials at hand. The springs may be bought, if desired, ready made and the drill made more powerful by using a fly-wheel on the bobbin. The heavy weights and the beam give sufficient tension to the saw, and in order to get it to work easily and cut true, the guides should be carefully adjusted; but the whole construction is so simple that it is quite within the power of anyone of average ability to produce, and as it has stood practical tests there is no fear of any part refusing to do its work properly. The principal point to be attended to is accuracy of construction, as, if not hung true, it will not cut straight. Before fixing the guides, test this by means of a plummet and line, and see that the saw moves up and down in a true vertical line. See also that all the holes are bored straight, and that the weights are properly adjusted to strength of springs, which should be kept well oiled; and if the guides, where wood works against wood, are blackleaded, the saw will work without perceptible friction. The bow-saw I use is 18 in. long. The weight box should have a cover, screwed down, and the weights packed in sawdust to prevent rattling. If, however, there are any difficulties, I will be most happy to give every assistance in "Shop."

TEMPORARY DECORATIONS FOR THE INTERIORS OF BUILDINGS.

BY ARTHUR YORKE.

Decoration of a Temporary Concert-Room—Arrangement of the Platform—Treatment of an Open Roof—Of a Flat Ceiling—Fern Baskets—Rough Brackets—Window Decorations—Paper Flowers—A Temporary Ballroom—Setting up Pilasters and Dado—Slapdash Painting for the Walls—Temporary Gilding—An Extempore Fountain—Conclusion.

Occasionally, and more especially in the festive Christmas season, large rooms which in their ordinary state are by no means ornamental, such as schoolrooms,

warehouses, etc., are required for balls or concerts, and have to be made as ornamental as possible. It is in such rooms that the decorator has most scope for his ability. In the church he has to keep his work subordinate to that of the architect, but here he has everything to do, and may claim the whole credit of the result.

We have, we will say, such a room on our hands to decorate for a *concert*. Probably it is a schoolroom. We wish to make the decorations as effective as possible; but whilst doing so, we shall doubtless need to be economical—for amateur performances of this kind are generally expected to make a profit for some charitable purpose. First we have to arrange a platform. The chances are that at one end of the room there will be a door leading to some class or committee-room, which will serve as a retiring-room for the performers. If so, we shall choose that end, but instead of carrying our platform quite to the wall, we shall do well to leave a passage behind it, so that the performers can mount the platform at *both* its back corners—which is a decided advantage. If there are loose forms belonging to the school, we can set them lengthwise and lay the boards which floor our platform across them, nailing or screwing a strip of lath along the under side of the boards at each end to prevent them from slipping, and to make them clip the forms firmly together. If there are no available forms, we must borrow or hire trestles from a builder; or failing even these, we can make a very good shift with empty barrels (small) from a neighbouring public-house; the floor boards we get from the nearest timber-yard, paying a trifle for "deterioration."

By-and-by we shall carpet our platform, and for a back to it shall borrow from some of our friends a couple of Japanese folding screens, which will in themselves add to our embellishments; but at present we leave the platform as it is. It will be useful as a table on a large scale on which to lay out, arrange, and finish our mottoes and other devices. When, in due time, the carpet has been tacked down and the piano set in its place, we shall find that the front, where footlights come in a theatre, needs something to ornament it, and in a degree to hide the feet of the performers. For this we can have no better makeshift than a row of flowering plants in pots, which we can readily borrow. We shall range them the lower ones in the centre, and the higher ones rising gradually towards the sides; last of the row against the wall at each end a large and effective plant will be required. These pots, it must be remembered, should not have saucers, which would chatter with the vibration of the music. A stool or hassock at each end of the passage left at back of the stage will serve as a step by which the performers can mount.

The roof of our room will most likely be one of plain timbers, and open either to the straining-beams or to the ridge-piece. Of the ugliness of this roof we can entirely rid ourselves by some such arrangement of festoons as that shown in Fig. 12 of the former article (p. 512). Possibly we may not, as in the church, have anything of the nature of a corbel to which to bring our festoons at the walls, but we can fix up rough temporary brackets in their places. How to make these brackets will be shown later.

When we find such an arrangement of timbers as that shown in Fig. 12, we shall doubtless have a gas-burner, or if not, a hanging lamp or a chandelier, suspended from the middle of the lower beam. This will have its decoration of evergreens, and will thus harmonise with and add to the effect of the roof festoons.

Or if, instead of a timbered roof, we find a high flat ceiling, we have at our disposal the means of converting it into a series of bowery Gothic arches, in a manner which will astonish as well as delight those familiar with the room in its plain state. This we do by "springing" deal boards—that is, by bending them and fixing them in a bent position, as in Figs. 14 and 16—our temporary arches being, of course, covered with greenery. These would be placed about as far distant from each other as the timbers usually are in a timbered roof.

Into a flat-ceiled roof nails cannot be driven, and this has to be borne in mind in making our arrangements. In Fig. 14, the two sprung boards A, A have, therefore, their tops fastened together by hinges at *a*, as is shown enlarged in Fig. 15. At *b*, *b*, Fig. 14, these boards are sawn half through, so as to permit them to be bent to an obtuse angle, below which they are nailed to the wall, their ends resting on the rough brackets *c*, *c*. Purlin strips *d d* pass from arch to arch throughout the length of the room, and the boards are screwed to them; the whole is thus held firmly together. All parts of this woodwork are dressed and hidden with evergreens.

In Fig. 16 is shown a second arrangement of sprung boards, forming one of a series of depressed arches, and suited either to a ceiled or timbered roof. In this, B, B are two straight planks meeting in the middle where they are hinged, if against a ceiling, and nailed if against a beam. C, C are two short sprung boards. D, D are struts from the strips to the corners, which are needed to resist the upward thrust of the bent boards.

We must, however, take care that we do not bring our roof decorations too low, or they will interfere with the acoustic qualities of the room. I speak under the supposition that we are preparing for a concert; if the room is to be used for a ball or a bazaar, less care in this respect will be needed.

Another detail of roof decoration, if it can so be called, may be found in fern baskets, which can be hung from the timbers near the walls on either side. The construction of such a basket is seen in Fig. 17. The bottom is a square piece of rough board, with holes bored at the four corners; the sides are made of rough natural sticks, overlapping at the corners and bored through near the ends. Four strings pass through the holes in the board and the holes in the sticks, serving alike to hold the basket together and to hang it up. Or these rustic baskets may be made rather more quickly if the sides are upright instead of sloping outwards. In each a root of fern is placed, which is kept fresh by filling the basket with damp moss.

At the platform end of the room the lower part of the wall will be hidden by the Japanese screens—which will, we hope by-the-bye, have plenty of gold lacquer about them—and above might come a large motto, appropriate to the occasion; this will be bordered with ivy-ribbon. Reference to Figs. 6, 7, and 8 in the former article (p. 509) will suggest ways of so placing the scroll about as to be most ornamental and best to fill the space. Higher still will probably be a triangular piece of wall, the centre of which may be filled by some monogram or device in ivy-ribbon, or three rough brackets may be ranged there: the central one, rather higher than the others, may carry a bust, the two others vases. As the occasion is a concert, the bust of some noted composer will most appropriately occupy this post of honour.

The rough brackets, mentioned more than once, are made of unplaned inch board nailed together, as in Figs. 18 and 19. A number of them, large and small as required, are quickly knocked together by a carpenter, and there are many places in which we shall find them useful. Each bracket is fixed to the wall by two or more strong nails, and it is dressed with evergreens *in situ*.

Supposing that we have blank spaces on the side walls, we may, in the middle of these spaces, half-way between the beams and their decorations, fix up some of these brackets 6 ft. or 7 ft. from the floor, and place on each a statuette or a vase; but these situations will generally be occupied by windows. If the windows are of good shape, we may simply put a border of broad ivy-ribbon round them; but if they have square ugly tops, we may relieve them by hanging a festoon over them, looped up by a nail in the centre. And here it may be said that whenever a festoon is thus looped over a nail, or otherwise makes a sharp angle, it will be sure to look thin and poor at that place, and will need a few more sprigs tucked in. The wall can further be relieved by carrying a horizontal band of ivy-ribbon from window to window, on a level with their bottoms, and (if there be no roof decoration to interfere, and if the height of the walls seems to demand it) a second on a level with their tops. Panels will thus be formed in which may come brackets, or, perhaps, arrangements for lighting.

Speaking of lighting, it is presumed that at the present day no one will (in default of gas) think of doing so with

> "Candles that shed their soft lustre
> And tallow on head-dress and shawl,"

but will use the more cleanly paraffin lamps. Country ironmongers generally keep suitable ones to let out on hire for such occasions.

To return to the windows. We spoke of diapering church windows, and there is a somewhat similar way of making windows decorative for such purposes as the present. It is by cutting out fleurs-de-lis in gilt paper, and pasting one in the middle of each pane—the gold side of course inwards. By artificial light this produces a pretty glittering effect. Even coloured paper only looks well.

Some mention has been made in a former place of paper flowers to be used as bosses on ivy-ribbon. For occasions like the present, when the decorations are to be seen by artificial light only, they are exceedingly useful, and they are easily made. The paper should be as stout as the middle qualities of writing-paper, for if too thin, the petals do not form themselves into good circles. In many places ribbon-like strips of suitable white and coloured papers are to be got from the waste of workshops, and time and money may be saved by using them. We take a strip of paper, say from ¾ in. to 1 in. wide and 4 in. to 5 in. long, and fold it lengthwise and crosswise, as at the dotted lines *a a* and *b b* (Fig. 20). We then cut away with the scissors the part left unshaded in Fig. 21, the folded lines being those at *a b* and *b b*. We open the paper at its transverse fold, which gives us a still doubled paper of the form seen in Fig. 22, and which, if opened, would be of the form shown in Fig. 23. Of these papers we take, say, a dozen, and laying them side by side, tie them tightly

together by their middles with cotton. We now have a fan-like appearance at each end of our bunch, but as yet nothing like a flower. To get this, we have to open the petals, and run the thumb-nail down the middle of each, when we shall find them spread out into a circle, as in Fig. 24.

If the paper is of proper thickness and the work is properly done, there will be no gaps where the two semicircles of petals join; but if owing to any shortcoming some little gap should happen to show, it is easily hidden in fixing up by using an additional needle point. If desired, a centre may be given to each flower by going through the same processes with shorter pieces of paper of a different colour, and fixing the circle thus made in the middle of the original flower; and this may be repeated with circles decreasing gradually in size till a boss of the double dahlia type has been formed. But this would be unnecessary labour; these flowers are not meant to be examined closely, and for their purpose in decoration the single ones are all that is needed; indeed, no attempts to imitate a natural flower will approach them in effectiveness. As these paper flowers will always be placed on dark evergreens, light tints will tell best.

A room to be prepared for a temporary *ballroom* will, as a rule, be larger than that used only for concerts—possibly it may be the rifle drill-hall or the corn exchange of a small town. In such a room the decorator will have no small amount of plainness to get rid of. The suggestions already given will furnish him with many resources for doing this, and to these some others can be added. As regards the roof, some modification of the methods above mentioned will amply suffice, but for breaking up the (presumably) long, straight, plain side-walls into manageable portions a new expedient may be needed. This may be done by a range of pilasters at regular intervals up each side.

We can make these at a very moderate outlay of money and trouble. They will be formed of deal planks (probably 9 in. by 2½ in.) hired from a timber-yard. These should be long enough to reach to about the top of the wall; at the bottom they will be fastened to the floor, and at top to the wall by a couple of iron hooks. The upper part of one of these pilasters is shown in Figs. 25 and 26. The "caps" are of rough board roughly nailed on, and they need corresponding bases, which may be equally rough—boxes from the grocer's, when enough of a suitable size can be got, do very well, an opening being sawn in them to admit the plank. Single pilasters, as in Fig. 25, are the least trouble, but a better effect may be got by ranging them in *pairs*, the two shafts (planks) being kept 2 in. or 3 in. apart. Having fixed our pilasters and nailed on capitals and bases, we cover them with marbled wall-paper; for the shafts we use a yellow sienna, for the bases a dark colour, and for the caps a very light one—in fact, for these a plain white paper might do, as they will be covered with evergreens tacked on. In the angles at the sides of the pilasters light pendants of ivy should be made to fall; and from cap to cap, curving downwards considerably in the middle, should hang festoons.

In the recesses between the pilasters, seats will be eventually set, and behind where these will come, and high enough to be above the heads of the sitters, we may carry a dado. This we shall make with a top strip of lath nailed to the wall, and a bottom one nailed to the floor, canvas being stretched over the two. We cover our dado with a formal wall-paper: one divided into large quarries will look best; it should be tolerably dark in colour, but still somewhat lighter than the bases of the pilasters. As a surbase to the dado we shall nail along its top a broader strip of lath covered with a somewhat darker paper; and along this and overhanging it will be laid a festoon.

Instead of affecting an imitation of stone in our pilasters and dado, we may, if we choose, give a much more realistic imitation of ornamental woods. This we do by veneering them with American leather-cloth, which is, of course, somewhat more expensive. For the pilaster shafts we take a light grained maple, mahogany for the bases, and walnut for the dado; and with strips of the cheap German gilt moulding we arrange mouldings and cut up our work into panels, so as to hide all joinings of the cloth. This material imitates polished wood remarkably well. I may mention that at the Paris Exhibition, where I was fitting a show-case for a firm of English manufacturers, I found myself at the last moment, so to speak, unable to get a grainer to finish my woodwork. Time pressed; and I had recourse to the above dodge. The result was so good that no one guessed the veneers to be other than genuine wood till the pulling down of the case at the close of the Exhibition revealed their real nature.

As centres to the panels formed between the pilasters, the dado, and the hanging festoons, we can place brackets, devices in ivy-ribbon, or decorated lights; unless these spaces happen to be occupied by windows: and it often happens that rooms of this description have skylights only. The dado will frequently require to be carried along the ends of the room also, where there will be no pilasters.

As an alternative to filling one or both of the higher spaces at the ends of the room by methods already suggested, temporary paintings may be executed for them. The way of doing this may be briefly described—not that it is supposed that any person unaccustomed to drawing and the use of the brush can be thereby enabled at once to dash in a distemper picture. That would be absurd. But in every party of volunteer decorators there will be tolerably sure to be one or two with some skill in ordinary oil or water colour painting, and such persons need find no difficulty in doing the required work.

It will be in what is known as "distemper," and there are two ways of setting about it. In one the picture is painted on calico, and in the other on the wall itself. This last is to be preferred, as then nothing of the nature of stretcher or easel will be wanted. If, however, the painter elects to use a calico ground, he will first have to prime it with a coating of glue and whiting.

If he paints on the actual wall, no preparation is really necessary, though to ensure uniformity of tone it may be well, if the wall is in any way dirty, to give it a coat of ordinary whitewash. The picture is sketched in with charcoal. The colours are the common powdered ones used by whitewashers, and are ground up with stale beer. The keepers of oil and colour shops will generally grind up the colours if requested. They are to be laid on broadly and boldly, not with artists' brushes, but with house-painters' "tools." Sable, camel-hair, and badger brushes would be immediately ruined by this rough work, but an artists' "hog-hair" may be useful for the finer touches. The chief difficulty that will be experienced (remember that it has been premised that the painter is accustomed to the practice of painting in other methods) will be in the colours drying very much lighter than when laid on. It will be well, therefore, to try them on paper before beginning, and to dry them at the fire. The difference will then be seen, and due allowance can be made.

It should be noted that these "slap-dash" colours, being thin and rapidly laid on, are sure to be so splashed about as to make a mess; therefore, if the work is done on the actual wall, it will be well to finish the painting before the parts near it are decorated. Neat and careful painting is neither attempted nor expected in this work, for at the distances and beneath the light at which and by which it will be seen and judged, rough and bold handling tells best. Of course such paintings are not expected to be permanent.

There are reasons why in choosing a subject a *winter scene* should be preferred. The sparkling effect of snow and hoar-frost, which will add not a little to the attractiveness of the picture, is to be got very cheaply. All that has to be done is, before painting, to brush over the space with whitewash in which a quantity of alum has been dissolved. This must be put on hot. The alum in cooling will crystallise, and assume a sparkling appearance similar to that of hoar-frost or of frozen snow. In painting, we have then simply to work up the other parts, leaving the untouched ground to represent those parts where frost or snow is to appear. The picture, whether on calico or on the wall, will need a frame of ivy-ribbon.

If gilding is desired about the picture (or indeed elsewhere, as it well may be in our temporary decorations), it will be done in the cheap and rapid manner used at the theatres, with Dutch metal and "madong." The madong, which serves as gold-size, is put on *hot;* one person brushes it over the parts to be gilded, and another follows to dab on the leaf metal *at once.* Here are two receipts for making madong:—Pitch, resin, beeswax, of each 4 oz.; Venice turpentine 1 oz.; Russian tallow 2 oz.; and gold-size, to be put in after the other ingredients are melted together, 2 oz. Or, pitch, resin, beeswax, of each 4 oz.; and boiled oil, gold-size, and turps, of each 1 gill. This for our purposes will look as well as careful and real gilding, and that it will not last does not matter to us.

When we have space for such a luxury, and when there are water-works to furnish the necessary supply, an *extemporary fountain* may be made a pleasing feature. This will, perhaps, be most practicable when we have at our command a second room of good size—it may be as an entrance-hall, a refreshment-room, or what not. The construction of such a fountain is shown in section in Fig. 27. To make it, we first need a shallow vessel of zinc or galvanised iron as a basin (A A). That shown in the figure is pierced for the passage of the supply-pipe (B) and the waste-pipe (C); but should the vessel be merely a borrowed one, it cannot well be pierced. We can then carry the two pipes over its edge, but in that case we must take care that the supply and exhaust are equal, or we may have difficulties with our waste siphon.

The square pedestal which supports the jet-pipe (D) may be of terra-cotta or zinc; but it will suffice to make it of wood, to paint it, and whilst wet to dust sand over it,

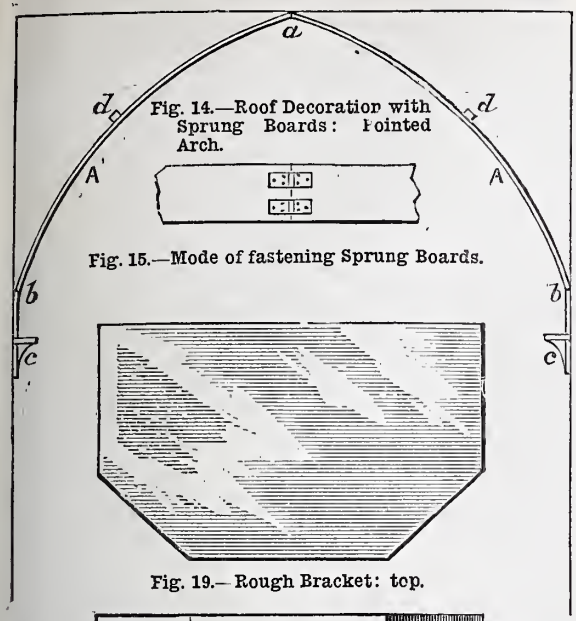


Fig. 14.—Roof Decoration with Sprung Boards: Pointed Arch.

Fig. 15.—Mode of fastening Sprung Boards.

Fig. 19.—Rough Bracket: top.

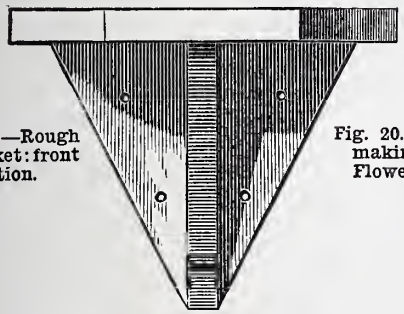


Fig. 18.—Rough Bracket: front elevation.

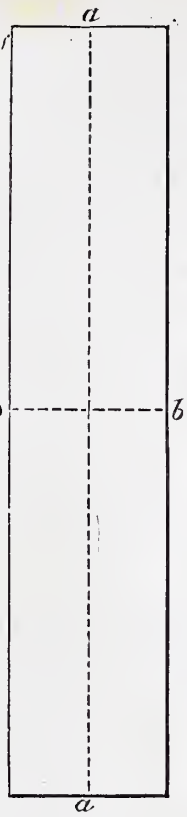


Fig. 20.—Mode of making Paper Flowers.

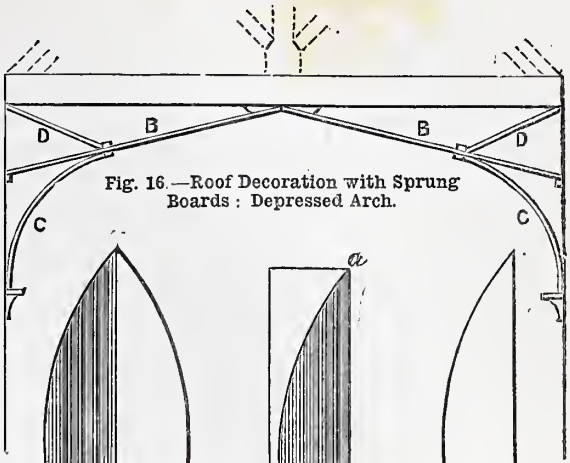


Fig. 16.—Roof Decoration with Sprung Boards: Depressed Arch.

Fig. 21.—Paper for Petal folded.

Fig. 23.—Paper Flower: Petals opened.

Fig. 22.—Paper Flower: Petals closed.

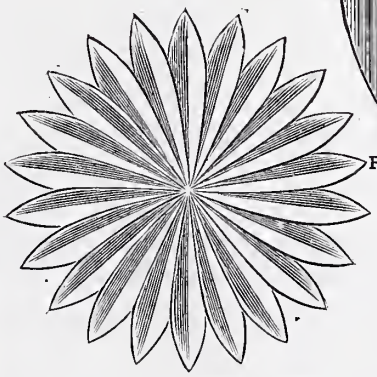


Fig. 24.—Paper Flower finished.

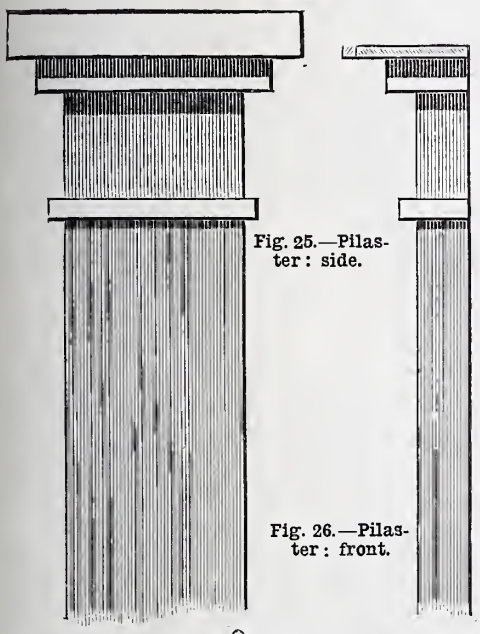


Fig. 25.—Pilaster: side.

Fig. 26.—Pilaster: front.

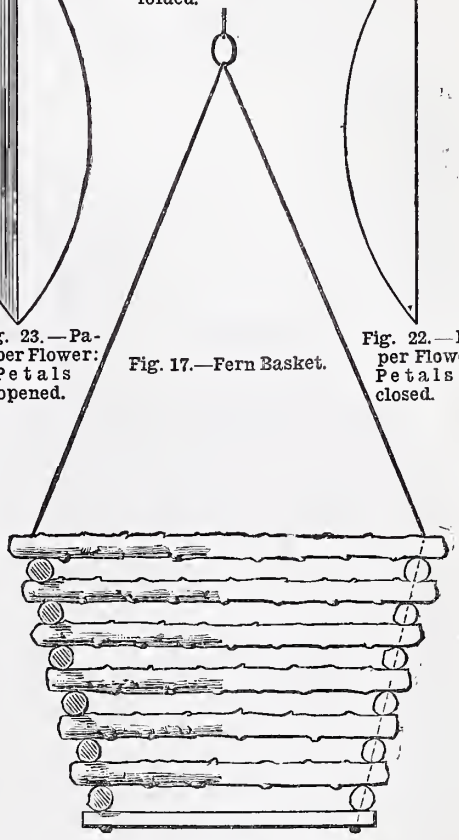


Fig. 17.—Fern Basket.

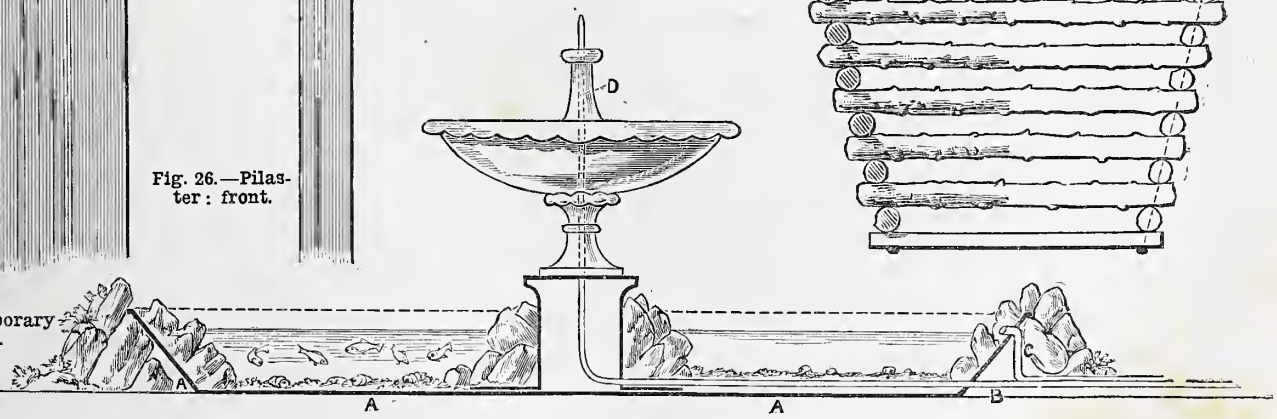


Fig. 27.—Temporary Fountain.

which will produce a passable imitation of stone. To keep it steady in the water it is, as shown in the illustration, made with ledges at the bottom, on which are piled lumps of some ornamental stone—say of Derbyshire spar. The jet-pipe (D) is shown as passing through a vase (probably of terra-cotta), set upon the pedestal, but should nothing of the sort come readily to hand, a rockery centre simply may be piled up. Sand will have to be spread over the bottom of the basin to such a thickness as to cover the supply-pipe, and about the top of this some sea-shells should be scattered; whilst to hide the inner slope of the basin, spar can, as shown, be piled up against it. Some gold fish will be an acquisition. Round the brim on the outer side water-loving plants in pots should be placed at intervals, and to hide both the pots and the outer edge of the basin, more rockery work should be piled, moss being used to fill up crannies and to add to the effect, with here and there, perhaps, a large shell or two; but the natural taste of the decorator will suggest the touches necessary to completion.

The supply- and waste-pipes will, of course, be carried to the fountain on the side which is least exposed. If they must be where visitors will pass over them, it will

be well to brad a strip of lath along on each side of them for their protection, to cover them with sawdust, and to tack floor-cloth over. In a hot ballroom a fountain will always be attractive, and such an one as has been described is readily made; where there is not room for one on the larger scale, a smaller one on the same lines for the refreshment counter might be put up.

This will be the last of my suggestions for temporary decorations. Some readers may perhaps think that hints for the decoration of the home might have occupied some part of the allotted space; but I would remind them that the greater includes the less, and that in the suggestions given above will be found abundant resources for the comparatively simple task of decorating an ordinary house.

HOW TO MAKE A WOODEN REST FOR A LATHE.

BY E. A. PENROSE.

PERHAPS there may be many readers of WORK who will like to hear how I overcame a difficulty in regard to obtaining a suitable rest for a lathe.

My lathe is a 6 in. centre one, which I made according to "Self-Helper's" second article on "Lathes for Everybody," and the rest which I had at first was similar to that which he described in his article on the dead-centre lathe.

I found, after using the rest for some time, that it had many defects, one of which was its fixed height, which was very inconvenient; besides, it was apt to give if any strain was brought to bear on either end of it.

Being unable to obtain a proper iron one anywhere in the vicinity, and not wishing to go to the expense of sending away for one, I set about making a wooden one; it has been in use for some time now, and gives great satisfaction. Of course, if a proper iron rest is at hand, it would be folly to discard it for such as I am about to describe, yet I hope the description may be of use to anyone who may be in a similar fix as I was.

The wood of which mine was made was well-seasoned mahogany and beech; the mahogany was a piece of an old tea-chest: it was very dark in colour, even and hard in grain.

First of all I took a piece 15 in. in length by $2\frac{1}{2}$ in. broad by $\frac{1}{2}$ in. thick; this I planed up true. I next bored a hole A with a $\frac{7}{8}$ in. bit two inches from the end and exactly in the centre; then with a gauge set to an inch I drew two lines, one from each side from the hole to within three inches of the other end; this left a space B in the middle of the board 10 in. long by $\frac{1}{2}$ in. broad, then with a key-hole saw I cut out the marked space. A glance at Fig. 1 will show more clearly than I can describe what I mean. B is the space cut out, and is intended for the holding-down bolt to go through.

I next took a block of beech $4\frac{1}{2}$ in. by $2\frac{1}{2}$ in. by 2 in.; this I shaped like Fig. 2, of which A is front elevation and B side view or section; on it I cut the two tenons C and D, and morticed it into the end C in Fig. 1. A slot was cut in E, Fig. 2, for the rising and lowering bolt. When morticed together it has the appearance of Fig. 3, of which A is the sole plate, B the upright with the bolt; C is the slot for holding-down bolt.

My next move was to make the T. For this purpose I took a piece 8 in. by 4 in., and shaped it like Fig. 4, bevelling the top and cutting mortice A for the rising and lowering bolt. To prevent side play I screwed on the two slats B and C, leaving the distance between them exactly the breadth of B, Fig. 3. A side view or section of T through B or C is shown at A.

The rest was now complete, as all I had to do was to bolt the T-piece to upright, putting the T inside and leaving the nut outside the upright, then with a spanner the T can be clamped at any height pleased.

Fig. 5 is the rest complete. If anyone has any difficulty in making it, I will be only too glad to help him through "Shop."

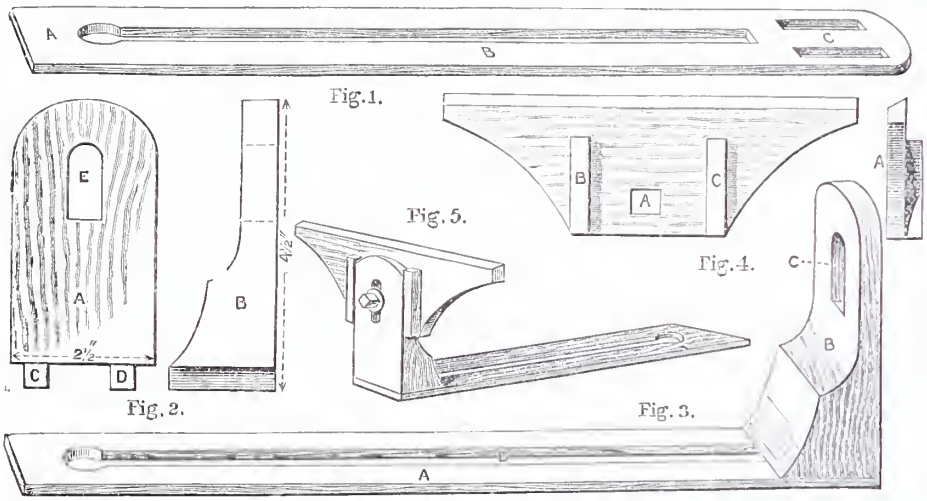


Fig. 1.—Base or Sole Plate of Lathe. Fig. 2.—Block at End of Sole Plate in Elevation (A) and Side View (B). Fig. 3.—Sole Plate with Block attached. Fig. 4.—T-Piece—A, Side View or Section. Fig. 5.—Perspective View of Rest when completed.

A TURN-TABLE FOR MICROSCOPIC SLIDES.

BY H. J. L. J. MASSÉ.

A FRIEND of mine came to me begging me to contrive a turn-table for him to use in mounting his microscopic slides. At first I thought of utilising a pair of small bevelled cog-wheels that I had by me, using a weight and a string for the motive power. But I soon resolved to keep the cog-wheels for some other time, and to use a small clock movement that I had been presented with as "quite a useless thing." I may mention that I always keep clock and watch wheels by me in a separate box, and have quite enough loose parts to repair a friend's Waterbury, or Ansonia or Busy-bee clock.

First, I found a small, square, wooden box, which, when stained and varnished, formed the case for the instrument. Inside this case I fixed the movement with the portion that carries the hour-hand projecting through the case. Next, I turned up two discs of $\frac{1}{4}$ in. mahogany (about $4\frac{1}{2}$ in. in diameter) and screwed them together, with some liquid glue between, taking care to put the two pieces so that their grain lines crossed at right angles, to prevent future warping. Exactly in the centre of this disc—for, of course, it was now one—I drilled a hole, and by this hole it was attached to the projecting portion of the clock movement.

The clockwork was to be set in motion by my friend's finger, when required, simply by passing his finger through a hole in the side of the box, and working round one of the smaller wheels one way or another, according to the direction the disc was to be made to revolve. Two small brass springs were fixed on the disc to hold the slides in their place while the disc was revolving; but indiarubber rings would do equally well.

This turn-table answers extremely well; but when I make another, as I hope to do some day for myself, I shall use a clock movement with a perfect mainspring and in fair going order. To work the turn-table, I should remove all the escapement, and fit a brake or some kind of detent to one of the smaller wheels. The turn-table would then be ready at a moment's notice if the clock were wound up, and both my hands would be quite free to manipulate the building up of asphalt rings, etc.

I may add that the disc was lightly marked with concentric circles while revolving in the lathe, as a guide in putting slides in their place on the turn-table.

THE TRIUNIAL OPTICAL LANTERN: HOW TO MAKE IT.

BY CHARLES A. PARKER.

THE METAL LINING OF THE LANTERN BODY—MATERIALS EMPLOYED AND NATURE OF THE WORK—MARKING AND CUTTING THE VARIOUS APERTURES—HOW TO WIRE THE EDGES OF THE LINING—PUTTING THE LINING TOGETHER WITH FOLDED SEAM—PREPARATION OF THE JET SHELVES—FIXING METAL LINING IN OUTER WOODEN BODY—PREPARATION OF THE LANTERN HOOD—LINING THE DOORS.

THE sets of tools possessed by amateurs are generally of such a varied description that it would be scarcely reasonable to suppose that the average worker will be able to construct the triple lantern entirely himself. It will, therefore, be found advisable with any difficult portion—for instance, the metal lining about to be described—to get the requisite amount of work supplied by some competent professional, should the operations involved prove to be beyond the capabilities of the amateur workman. Working in sheet metal requires a considerable amount of care, as anyone who has had practical experience is well aware, and although the average amateur turns out this class of work in a slipshod style, this may rather be attributed to a lack of suitable appliances or a want of knowledge than to anything specially difficult in the work.

The best sheet iron — usually called Russian iron, which, by the way, generally comes from Birmingham or Sheffield—should be employed in the construction of the inner metal body of the lantern. Assuming that the reader intends occasionally to employ the upper lantern as a separate instrument, it will be necessary to make the metal lining accordingly in two portions, each lining being cut from a single sheet of tolerably stout Russian iron, which must be provided with openings for the condensers, doors and jets of the same size and shape as the corresponding apertures in the wooden carcase described in the previous paper. These linings, when ready, are put together with what is known as a folded seam, and the top and bottom of each are wired in order to stiffen the edges, and render the body rigid when finished. The supporting shelves for the jet tray are secured to either side of the lining by means of small copper rivets on a level with each of the jet apertures, and the upper or third lining has a bent hood riveted to the upper edges.

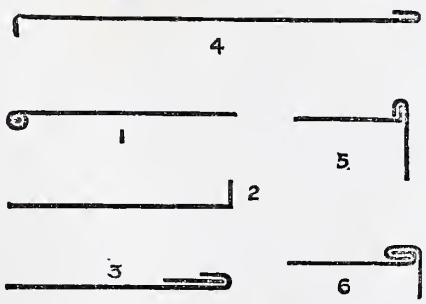
Having gained an idea of the work to be done from the foregoing brief description, it will be advisable to turn to the constructive details involved in making these two metal bodies or linings of the lantern. Select a perfectly flat sheet of iron of a suitable size, and then proceed to mark out the form of the four sides of the lining, as shown in Fig. 12, cutting the metal, in the first instance, to the full height required for the triple instrument, as in the case of the wooden body. First mark the outside dimensions of the lining by means of a sharp steel point, *on the surface of the metal*, the exact measurement being 28½ in. by 24¾ in.; then run a line along each side at ⅜ in. distance from the edge for the folded seam and wired edge, after which draw three lines equidistant from each other, to indicate the position of the four sides, as shown by A, B, and C in Fig. 12, each of these sides being 6 in. wide. At 10 in. from the top draw a line at right angles across the metal from side to side, as shown by D E, and then draw another line on either side of and parallel to this, in order to indicate the metal that is to be turned over when the edges are wired. Having got the lining planned out in the above manner, the next proceeding will be to mark the position of the various apertures, as shown by the black portions of Fig. 12. Taking the four sides in rotation from the left-hand side of the cut, we shall first require these apertures 5 in. square for the doors. In marking out these, the lower aperture should commence at 2⅜ in. from the bottom of the lining, with a space of 4 in. between the top of this and the next one, and 4¾ in. between the second and third. The cause of this space between the second and third apertures being ¾ in. more than the first and second apertures will be understood when it is remembered that ⅜ in. on either side of the line D E will have to be turned over a piece of wire. These apertures should be cut to measure 4½ in. square in the first instance, in order that half an inch on all sides may be turned over and hammered down flat on the inside, so as to bring the openings to the requisite size of 5 in. square.

The jet apertures, which occupy the next side of the lining, are 6 in. high and 4 in. wide at the lower portion, tapering to 2 in. wide at the top. The lower aperture should be situated at 1 in. from the bottom, with a space 3 in. between the top of this and the lower portion of the second one, the space between the second and third apertures being increased to 3¾ in., for the reason above mentioned. This being finished, so far, the next side is left quite plain, and the three circular openings for the condensers are then marked and cut in the fourth or remaining side. Make a centre punch-mark at 4½ in. from the bottom, and then by means of a pair of compasses strike out a circle this diameter, and as soon as this has been done make a second centre punch-mark at 9 in. above this, and strike out another circle the same diameter for the condensers of the second lantern, after which the punch-mark is again made at 9¾ in. above this to indicate the axis of the third circle, which is marked out on the metal in a similar manner—all these apertures being afterwards cut with the greatest possible care in order to avoid buckling the metal, as this would be a source of endless trouble.

If the reader is unequal to the task of cutting these apertures, it will be found advisable to take the sheet of metal, when marked, to a tinsmith, or a simple way of cutting them is to lay the metal flat on a sheet of lead or zinc, and then cut the openings to the form of the outlines by means of a cold chisel. The cutting of the circular apertures may be facilitated to a considerable extent by making a series of small punch-marks all round the outline, just about the sixteenth of an inch apart; it will then be found an easy matter to cut through the intervening spaces by means of a small cold chisel, care being taken to afterwards smooth the edges well with a half-round file.

When furnished with the apertures above described, the lining, which should now present the appearance of Fig. 12, will be ready to be cut in half, as indicated at D E, by means of a pair of shears, after which the top and bottom edges of each portion must be wired by folding the metal over a piece of iron wire. This is done by carefully turning up ⅜ in. of the edge to right angles where marked, by means of a series of well-directed blows with a hammer or mallet, the sheet of metal being meanwhile supported on a hatchet stake or suitable substitute. The edge is then turned down over a sufficient length of No. 10 B.W.G. iron, which must be slipped underneath the fold before the metal is quite closed. A nicely rolled appearance may be given to the edge by hammering it down by means of a punch having a semicircular concavity at its end, the wired edge presenting the appearance shown in No. 1 when viewed in section.

When the two linings have each been wired at the top and bottom, they will



be ready for putting together. If they were to be joined together by means of ordinary soldered seams, there would be some danger of the great heat to which the lining is subjected melting the solder, and thus rendering it useless; it will, therefore, be found safer to put the metal together with a folded seam. This form of seam, which is now very much used for all kinds of tin and metal utensils, is very simple to make when once its construction is understood. In the first instance, the ⅜ in. of metal on either side of the lining, previously marked off for this fold, will require to be turned up to right angles as in No. 2, by hammering it over a suitable iron edge, after which a flat piece of metal $\frac{1}{16}$ in. thick, and provided with a perfectly straight edge, is then placed in the angle against the upturned edge of one of the sides, for the latter to be hammered down flat, as in No. 3, the two edges being turned up in alternate directions, as in No. 4, in order that they may be sprung together as in No. 5, and afterwards turned over and hammered down flat in a similar manner to the folded seam of a Colman's mustard-tin, the lining presenting the appearance of No. 6 when viewed in section.

In putting the lining together, it will be necessary to see that the four sides are each bent in the right places, in order that it may be quite square and true when put together.

Before proceeding further it will be necessary to prepare the jet shelves, on the upper sides of which the supporting trays of the jets slide. Each of these must be formed of a single sheet of iron, measuring 8 in. by 4½ in., cut in the form of Fig. 13. It will be requisite to provide each shelf with a groove, on either side, to act as a guide for the jet trays to slide along. These grooves may be readily formed by turning up to right angles ⅜ in. of each of the long sides for 6 in. of the full length of the shelf, and afterwards hammering them down flat over a piece of metal about ⅛ in. thick, in order to form a groove on either side of the tray, thus ⊏⊐ : one inch of the metal at the front and back of each shelf must then be bent up to right angles, and furnished with three rivet holes, after which the shelf may be affixed in the inside of the lantern lining by means of three small copper rivets, driven through corresponding rivet holes punched in the lining. They must, of course, be fixed on the same level as the apertures in the back of the lanterns through which the jets slide, in order to be certain that the bends at each end of the shelves are made in the right place; it will be found advisable to accurately measure across the interior of the lantern before bending the metal. The appearance of one of the shelves when ready for fixing is shown in Fig. 14. For the rivets which secure the shelves in the lining a few ordinary copper tacks will be found to answer very well. Cut off the head and a small portion of the stem of each, and insert the latter in the holes previously punched in the metal, and then hammer the stem until a second head is formed.

It will now be time to secure the metal lining to the interior of the wooden body. For this purpose twenty-four holes should be punched in the lining in the position indicated by the black dots in Fig. 12. In actual work, however, these holes should be made previous to the lining being folded together. Anyone used to metal work will employ a bolster on which to support the metal while the holes are being punched. This tool consists of a piece of steel about 2 in. square with a hole in the centre, and is similar in appearance to an ordinary screwed nut, the latter, by the way, forming a capital substitute for a bolster. Having provided the lining with sufficient holes, it should be inserted in the wooden carcase, and secured to the

woodwork by means of $\frac{3}{4}$ in. screws, which are driven through the holes prepared for their reception with a $\frac{1}{2}$ in. length of brass tube of about $\frac{1}{4}$ in. bore screwed up between the metal and the wood. All the screws must be driven from the inside of the body by means of a long spindled turnscrew, which should be inserted through the various apertures in the body. The lantern body being completed, the next proceeding will be to make the hood, which is shown complete in Fig. 15. As will be understood by reference to Figs. 16 to 19, this hood is made in three portions, which are so planned that by means of sundry bends they may be fitted and riveted together to form a hood with a projecting rim, which fits into the top of the lining. Fig. 16 is a plan of the top cover of the hood, which is cut from a sheet of iron, measuring 16 in. by $8\frac{1}{2}$ in., the dotted lines representing the position of the folds. The space between the end of the metal and the first dotted line will be 1 in., with $1\frac{1}{2}$ in. between the other two dotted lines. The central portion, which forms the bent hood, should be wired on either side by turning down $\frac{3}{8}$ in. of the metal over a couple of strips of iron wire. Fig. 17 indicates clearly the curved form to which the cover should be bent when ready; the circular curve at the front may be secured by bending this part round a piece of 1 in. gas-tubing, or similar suitable substitute, the metal being closed as much as possible, and then bent outwards again; the straight bends which are made in alternate directions along the dotted lines in order to make the double fold, which forms the projecting ledge, will be an easy matter. It will, of course, require some care to form good curves, and make straight and even bends along the dotted lines, but it is absolutely necessary that this should be done if the hood is to present a good appearance. When the cover has been prepared, the two sides, each of which will measure $8\frac{1}{2}$ in. by 7 in., must be cut from a sheet of metal of sufficient size to the form of Fig. 18. The measurements between the three dotted lines will be the same as before, that is to say—from the lower end of the metal to the first line at A A 1 in., and from this to the second line, and from the second to the third line, $1\frac{1}{2}$ in. each, the remaining space being 3 in. wide. When ready, each of these sides must be bent as shown in Fig. 19, in the same manner as the ends of the cover, previously described. The three portions may now be fitted together in the position they are intended to occupy when finished, and if found to be correctly adjusted, three small rivet holes should be punched through each corner in the position indicated in Figs. 15 and 16, the metal being secured together by means of small copper rivets, which are pushed through the four thicknesses of iron and riveted on the other side. The four corners of the under rim which lap over in either direction must also be provided with two rivet holes apiece to enable them to be firmly secured together with small copper rivets. It will thus be seen that the hood is put together entirely with rivets, no solder being used for any part of it. The hood must not be allowed to curl over too much at the front of the lantern, otherwise it will interfere with the subsequent working of the rolling curtain.

When the hood has been finished, it should be placed in the hands of a japanner to be japanned. The japan used should be black, and it will be found an improvement to have a neat gold line run round the edges, but this, of course, is simply a matter of taste. Unless the reader is conversant with the process of japanning, it will be found the most economical plan to put the job out to be done by a professional, as it is a very awkward task for a beginner. It would occupy too much space to enter fully into the details involved, but should our readers prefer to make an attempt, the following course should be adopted:—Grind up sufficient ivory-black with turpentine, and then mix it with some ordinary shellac varnish, and apply smoothly to the surface of the metal by means of a soft brush. About three or four coats should be sufficient, the metal being slightly warmed previous to the application of the first coat, after which each subsequent coat is heated to about 300° Fah. before another coat is put on. In laying on the varnish it is advisable to avoid going over the same spot a second time while the varnish is moist. An ordinary household oven will be found to answer sufficiently well for the purpose of stoving the work. In order to produce the best finish, or when a bright gloss is desired, it will be necessary to polish the surface after having applied sufficient varnish to bear the subsequent treatment. For this purpose some tripoli and oil may be applied by means of a soft rag, or a piece of cloth, and as soon as the work appears glossy it should be rubbed with the oil alone, in order to free it from the powder, and impart a still brighter lustre.

The next proceeding will be to prepare and affix a lining to each of the three doors. A piece of metal 6 in. by $4\frac{3}{4}$ in. will be required for this purpose. Having cut a piece to the size, make a centre punch mark in the middle, and then strike out a circle 1 in. in diameter, afterwards carefully cutting the metal to this size, in order that it may connect with the circular sight-hole, previously cut in the woodwork of the door. Two lines should next be drawn, parallel with the $4\frac{3}{4}$ in. sides, as indicated in Fig. 20, the first at $\frac{1}{4}$ of an in. from the edge of the metal, and the other at $\frac{1}{2}$ an inch distance from the first. Four small holes should also be punched on either side within the $\frac{1}{2}$ in. space, in order to serve as a means of securing the lining to the door. Thus prepared, a couple of sharp bends are made at right angles on either side along the scribed lines, by hammering the metal over a hatchet stake, after which it is secured to the woodwork by means of eight screws driven through the holes previously punched in the metal. The method of hingeing the doors has already been described in the previous paper, but as no form of fastening was mentioned, it may be stated that a small brass or china turn-button, or an ordinary flush ring catch, will form the most suitable fastening. If a spring catch is used, it must be let into a slight recess prepared for its reception in the left-hand side of each of the doors, the small plate belonging to each catch being let into the opposite door stile, flush with the surface of the wood. These catches, which should be the smallest size made, must not exceed 1 in. in length, otherwise they will present a clumsy appearance when attached to the doors. Any ironmonger will supply these at about 8d. each. If a button is employed instead of a catch, it should be rather less than 1 in. in length, and it must be attached to the door stile by means of a small brass screw with a lacquered head.

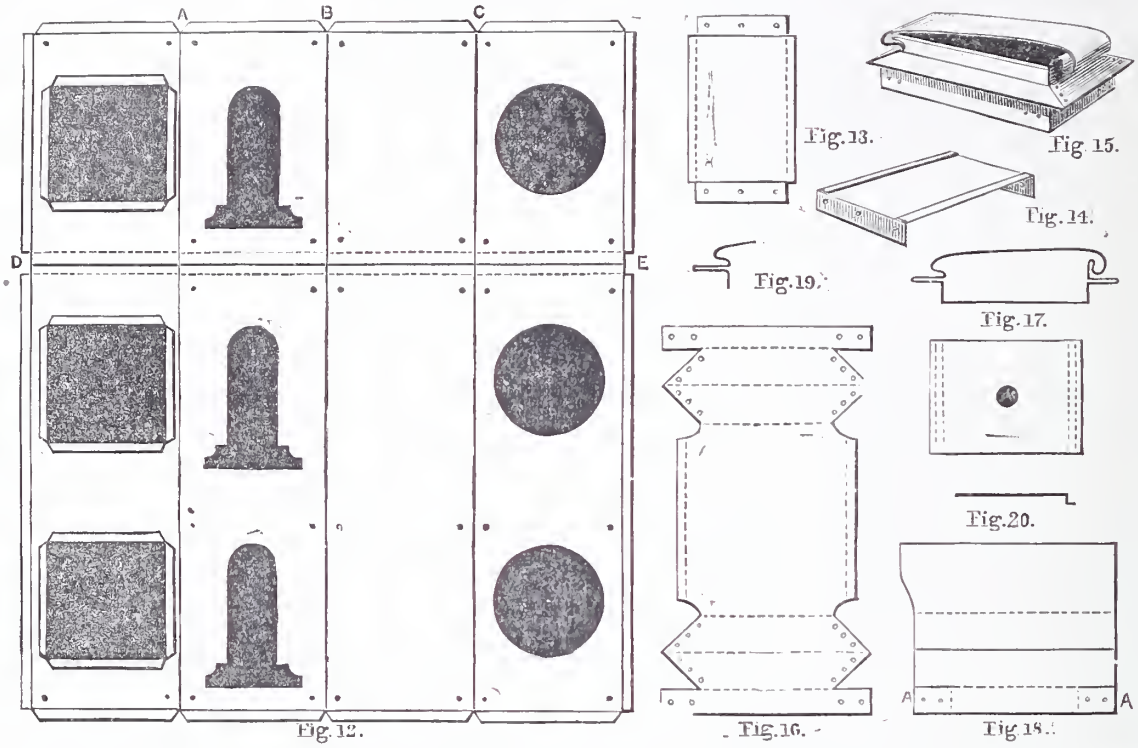


Fig. 12.—Plan of Metal Lining. Fig. 13.—Plan of Jet Shelf. Fig. 14.—Jet Shelf ready for fixing. Fig. 15.—Lantern Hood. Fig. 16.—Plan of Cover of Hood. Fig. 17.—Section of Cover. Fig. 18.—Plan of Side Wing of Hood. Fig. 19.—Section of Side Wing. Fig. 20.—Plan and Section of Door Lining.

A LAMP-STAND IN WOOD.

BY C. MAYNARD WALKER.

HE revival in recent years of the use of rought-iron work in domestic utensils of arious kinds has naturally familiarised the e to application of scroll-work of every hape and form to articles which hitherto ad been associated with pedestal or vase-hape forms, such as lamps for the table or oor—which, judging from the displays in he shop windows of art metal workers, ust be very fashionable and popular. Now roll-work in metal is not within the range the average worker, but in wood almost nyone who can use the simplest tools can ake, with proper instructions, a very editable show. The object of the present rticle is to submit a design for a table mp-stand in woodwork cut out with a roll or fret saw. Fig. 5 is from a photo f one made by the writer of ½ in. pine roughout, and finished in dead black, aving all the appearance of ironwork, nd sufficiently strong for the purpose; the tand measured over all 10 in. high by 9½ in. at the base, being triangular. Fig. 1 is a full-size pattern of the uprights, of which three will be required; the method of construction will not need a lengthened description. I will merely state briefly the manner in which I went to work: viz., having cut out three of Fig. 1, I made a triangle for the base by cutting out (for economy of material) three of Fig. 3, with a corresponding centre, as shown in Fig. 2, into which each arm was fitted, as also another triangle of the same shape, but about ½ an inch wider all round. This shape is easily obtained, without the necessity of another illustration, by running a thick pencil round the piece cut out from Fig. 3, with the addition of three segments of circles on the outside centre between the arms; these two triangles were built up, one on the other. A further triangular piece, Fig. 4, was cut and fluted with a round file, and slotted at the ends to the thickness and depth of the uprights, or standards, which were glued in and pinned as shown; the uprights were also pinned and glued to the triangular base—a small hole drilled and common pins used—the whole being very rigid without the addition of the top ring, which was then also pinned and glued. This ring should be made of two pieces of wood glued together, so as to cross the grain and prevent cleavage, and externally, to be 5¾ in. in diameter; a turned knob in the centre of base may be used or not as a finial to that part. The work was smoothed up in the ordinary way with sand-paper, and one coat given of a flat black paint, and was so far complete. In this form it may now be used as a lamp

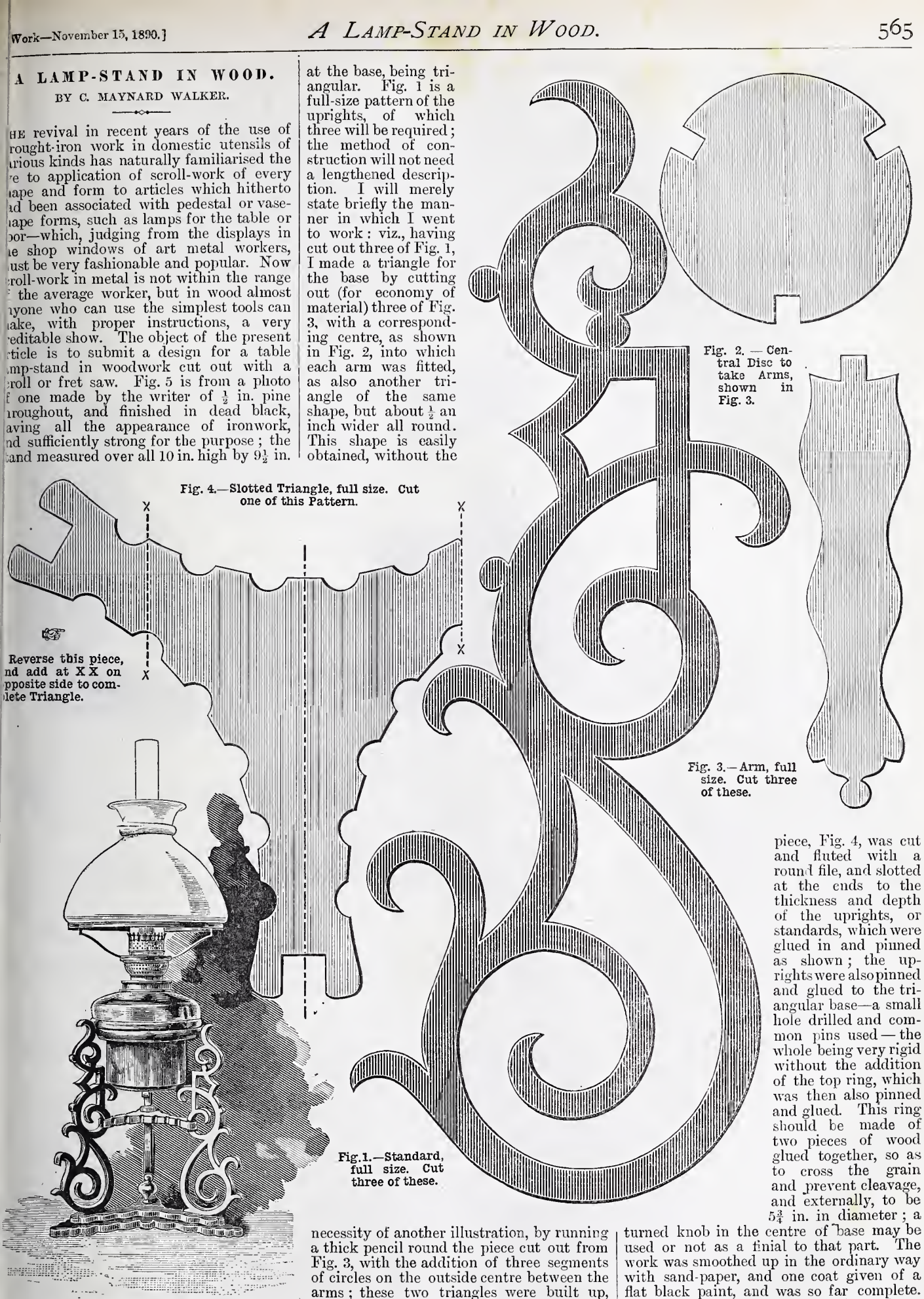


Fig. 2. — Central Disc to take Arms, shown in Fig. 3.

Fig. 3.—Arm, full size. Cut three of these.

Fig. 4.—Slotted Triangle, full size. Cut one of this Pattern.

Fig. 1.—Standard, full size. Cut three of these.

Fig. 5.—Lamp and Stand complete.

stand, as shown in Fig. 5. It will depend, of course, upon what kind of lamp container is adopted as to the internal diameter of the ring for holding same. In the case under description the one used was a lamp known in the trade as a "10 line kosmos," with a glass "well-hole container" of a peacock-blue tint, with opal shade complete; and the container, moreover, was of a bold shape, measuring 5 in. wide at the bulge by $4\frac{1}{2}$ in. deep, the shoulder of which rested upon the ring with an inside diameter of $4\frac{7}{8}$ in. This kind of lamp is very cheap, efficient, and serviceable, costing about 2s., and may be ordered through any lamp dealer in town or country. If this kind be adopted, the complete lamp and stand will be about 23 in. high, and present a bold and attractive appearance at a very low cost—plus labour. It will be seen that the stand would answer equally well as a flower or plant stand for table decoration by the simple addition, in place of the lamp, of a water-tight zinc vessel fitted into the circular space; but for whichever purpose it is employed, I am sure the worker will feel amply repaid for his labour in the possession of a novel piece of furniture.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

90.—Philip's Portable Adjustable Sundial.

I have much pleasure in directing attention to a pretty and handy new and instructive model known as Philip's Portable Sundial, adjustable for all latitudes, and fitted with compass, designed for use in schools and all educational establishments, as well as in private families. The sole manufacturers are Messrs. George Philip and Son, 32, Fleet Street, London, E.C. Its price is 3s. net. Its form and use may be gathered from Fig. 1, which shows the model placed on the case or box in which it is kept when not in use, and which serves as a suitable pedestal for it when being worked. In order to use it, the base of the sundial is fitted into the top of the case as shown, and the case itself, which is a perfect cube, must be placed on a flat surface, so that the small leaden plummet shown at the back hangs directly over a metal pin below it, projecting upwards from the stand. The lower end of the brass meridian must then be fitted into the wooden support so that the needle or central wire joining the two sides of the meridian is placed exactly against the graduated scale on the side of the support representing the latitude for which the sundial is to be adjusted, namely, for London, 51°; for New York, 41°, etc. By means of the compass the position of the whole must then be so fixed that the needle points due north. In order to arrive at the exact time, the difference between solar and civil time must be taken into consideration; and, to aid the operator in doing this, a table is supplied on the side of the stand. Moreover, the cubic stand is a complete exponent of the decimal system of reckoning measurement and weight, for it measures one cubic décimètre, which contains one litre, which, if filled with water, weighs one kilogramme, one-thousandth part of which weighs one gram and measures one cubic centimètre.

91.—Booth Brothers' Blowing and Ventilating Fan.

Messrs. Booth Brothers wish me to submit to the readers of WORK an illustration of their Blowing and Ventilating Fan, to which reference was made some little time ago by a correspondent in "Shop." Its principle and mode of action will be readily understood from Fig. 2. I should have liked to be in a position to give the size and further particulars, but as these have not been supplied to me, and I have not seen the machine, I can only leave readers who desire to have them to obtain particulars from Messrs. Booth Brothers, Upper Stephen Street, Dublin. Its price is 12s. 6d. It is worked by hand, and it is said that the blast can be conducted to any reasonable distance by means of glazed earthenware pipes.

93.—Booth Brothers' Bench Clips for Wood-carvers, etc.

A handy clip for holding down wood to the bench has been recently introduced by Messrs. Booth Brothers, and is illustrated in Fig. 3. The clip or holdfast itself is a piece of iron about $2\frac{3}{4}$ in. long and 1 in. wide, indented with notches at the thin end and turned downward at the upper end with a tooth-like projection on each side, the better to grip the wood placed under it and to be fixed on the bench without chance of moving. It is also slotted in the centre to admit of the passage of a screw, eyed on the top, that it may be twisted into the bench by a piece of wire or French nail passed through the eye and having a piece of metal, hexagonal in form, under the eye, so that better pressure may be obtained on the plate when the screw is turned

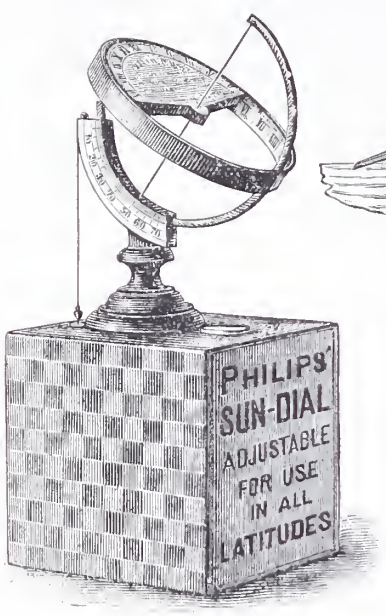


Fig. 1.

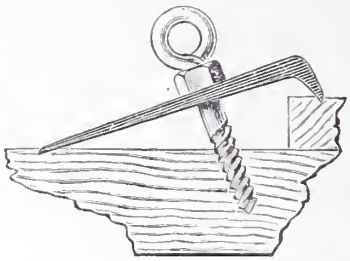


Fig. 3.

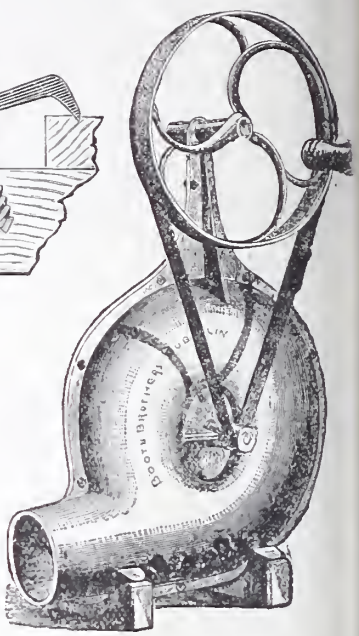


Fig. 2.

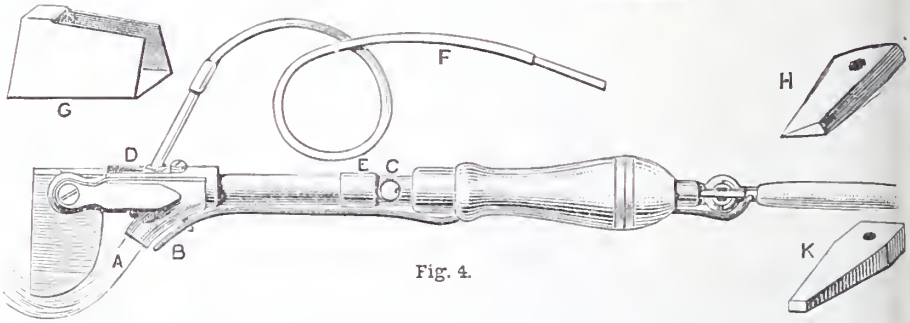


Fig. 4.

Fig. 1.—Philip's Adjustable Sundial. Fig. 2.—Booth Brothers' Blower and Ventilating Fan. Fig. 3.—Booth Brothers' Bench Clip for Wood-carvers, etc. Fig. 4.—M'Culloch's Patent Improved Soldering Bolt—G, Rest and Heater; H, Pointed Bit; K, Flat-tipped Bit.

92.—Booth Brothers' Measuring Rod.

Our friend Opifex suggests to me that no truly satisfactory answer has been as yet given to appeals of correspondents for "a rule for prompt and accurate measurement to $\frac{1}{16}$ in. of openings and spaces, etc., from 2 to 10 feet." Such a rule is certainly to be found in one which he has been kind enough to send me, and which consists of two sliding rods 2 ft. 7 in. long by $\frac{3}{8}$ in. by $\frac{3}{16}$ in., connected at each end by brass runners, an arrangement which allows the rods to slide freely one on the other, but at the same time preserves the rigidity of the rule. The rods are marked in feet and inches on the four sides, and the rule will accurately and promptly measure any opening from 2 ft. 7 in. to 5 feet, and the measurement may be read at two points on each side of the rule. It is made of boxwood, is well finished, and costs 5s. This rule, and a larger size measuring up to 10 feet, can be obtained from Messrs. Booth Brothers.

into the bench. I am not aware of the price charged per pair, but the cost may easily be ascertained by any reader on application to Messrs. Booth Brothers.

94.—M'Culloch's Patent Improved Soldering Bolt.

M'Culloch's Patent Improved Soldering Bolt is asserted by its inventor and maker, Mr. Francis M'Culloch, 47, Hopehill Road, Glasgow, to be the cheapest and most practical soldering bolt in the market, being simple, light, and durable, heated by gas, and so constructed that it is capable of doing any kind of work that is done by plumbers, tinsmiths, coppersmiths, brass-founders, wire-workers, glass-stainers, packing-case makers, opticians, etc. The form and arrangement of the bolt are shown in Fig. 4. In order to make use of it, a rubber tube is used to connect the bolt to a gaspipe, or to any ordinary gas bracket, from which the burner has been

removed. After allowing the air to pass out of the rubber tube, light the gas at the points A and B. Should it ignite at the air-holes at C, shut and reopen tap at handle, when the touch will instantly relight at the nozzle; then place in heater until required. The gas will heat the bolt ready for use in four minutes, while there is no danger of its becoming overheated. When not in constant use the gas can be shut off by the tap attached to the handle, a touch light or bye-pass B being conducted to the nozzle A, which will instantly ignite the heating flame when required. A blowpipe F can be attached when excessive heat is required for such work as is done by brass-founders, coppersmiths, plumbers, etc. It is attached by screwing the small tube into the socket D, and a cover E is then slid over the air-holes at C. The blowpipe in no way interferes with the ordinary use of the soldering bolt. By the simple adjustment of a screw, a copper bit of any shape, as shown in the illustration of the bolt, and at H and K, can be fixed in position to suit any kind of soldering work. The heating flame is regulated to pass under the points of the copper bits, and can be used in this way without tarnishing or doing any injury to the work. In such cases as glass-stainers' work, the flame can be toned down so as not to touch the glass and still keep up a sufficient heat for soldering. It is said that the cost of the gas consumed will not exceed 1d. per day. The price of the bolt with blowpipe and heater, and one bit, is 8s. 6d.; extra bits, 1s. each.

95.—ARNOLD'S BLOWPIPE.

Mr. A. W. Arnold, Gas Fitter, Hartshorne Street, Bilston, Staffordshire, has sent a small blowpipe of his own make, and writes as follows:—"Seeing several inquiries in 'Ours' lately respecting blowpipes, I beg to forward for your acceptance, and, if you think fit, for notice in the 'Guide to Good Things,' a sample of a small blowpipe, of which I have made several for use among my friends and fellow-workmen. Although small, it is very handy for soldering composition, lead, or brass of sizes up to 2 in. lead, and also for brazing small work, such as jewellery, etc. By unscrewing the outside tube and removing the jet, I have brazed up to ½ brass tube with the aid of a small foot blower. If any of your readers care to try one, I can supply them at 1s. 8d., post free, or a size larger, ½ in. brass, for 2s. 1d., also post free. The price would be more, but I make them in my spare time, and therefore can afford to sell them cheaply." I handed this blowpipe to Mr. R. Alexander, requesting him to test it. This he did, and he writes:—"The blowpipe you gave me to test I found a very useful little tool, capable of doing all that its maker claims. I brazed a new bow to a key *without* a foot blower, only by blowing with the mouth in the ordinary way. I can strongly recommend them, and say that they are very cheap indeed."

96.—POLLITT'S NEW SOLDERING TOOL.

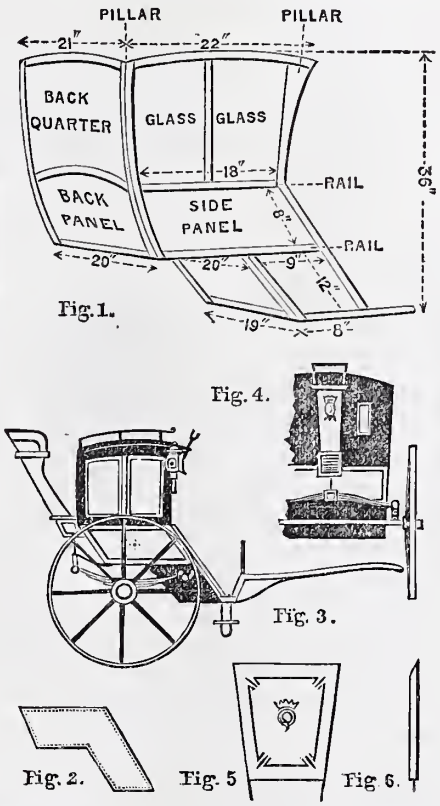
As I am dealing with bolts for soldering and blowpipes, I may as well finish up all tools of this kind at present before me by mentioning a new soldering tool submitted by Mr. John Pollitt, Central Cycle Works, Lower Mosley Street, Manchester. He writes:—"I have sent you a sample of a new soldering tool which I am making. You will at once see the advantage which this possesses over the ordinary tool. The copper cap is taken off and tinned. When once tinned it always remains clean, as it is never put in the fire. The iron is put in the fire, and can be heated as much as desired. The sheath is then replaced and held in position by a pin. Thus there is no danger of burning copper, and no retinning or cleaning of copper." The end of the iron is about 2¾ in. long, and 1⅛ in. broad, tipped with a pyramidal point. Over this is placed a copper cap of the same shape, which is held in place by a pin as stated. Except for amateurs who go in for cheapness, the ordinary copper bit is preferable. The pin, which has an eye ⅞ in. in diameter, to facilitate insertion and withdrawal, is much in the way of the operator. The price will not be more than 2s. 6d. THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Model Hansom.—AMATEUR CARPENTER.—In making a four-wheel vehicle there is only the draught to be taken into consideration; but in making two-wheel vehicles, the wheels, springs, and axle have to be so adjusted as to make the vehicle balance; and in case of a hansom it should be just a little "heavy on" at the shafts so that the counter balance is regulated when the fare is inside the hansom, or, in the case of an ordinary hansom, when the driver mounts the box or seat behind. Fig. 3 shows the most modern and approved of hansoms running, either for public or private use. First of all make a large drawing—full size of the model, as you will want to work to it—of the side, including the wheel, spring, shafts, etc.; a circle will do for the wheel, as it is the body you want in detail. The wheels are made of wood, and will be 2 ft. high over all; felloes, 1 in. by 1½ in.; nave, 3 in. by 3½ in.; spokes, 1 in. by ¾ in. The axle will be 1 in. thick, springs of spring steel 1 lap 1 in. wide, ¼ in. thick. The framework of the body is made of good dry ash or any hard wood. It must be remembered that the way of making a model hansom would not be the same as making a real one, as, for instance, when we nail our panels on to the framework in the model, we shall pin a moulding all round, whereas, in the ordinary coach-built hansom, the framework would be grooved out and the panel



Model Hansom. Fig. 1.—Framework. Fig. 2.—Panel Side. Fig. 3.—Side View of Hansom. Fig. 4.—Back View. Figs. 5, 6.—Door Front and Side View.

fitted into it, the outside of the framework of course being the moulding. We therefore commence by making the sides. Get two front pillars 3 ft. long, 3 in. wide, at the top curved down to 1¼ in.; two side pillars 2 in. wide, 1 in. thick, 2 ft. long; four side rails 18 in. long, 1½ in. by 1 in. thick; two top rails 22 in. long, 1½ in. by 1 in. thick; two bottom rails or rockers 14 in. long, 1½ in. by 1 in. thick. The front arch is 2 in. wide, ¾ in. thick, 21 in. long; the footboard, which fits between and comes flush with the top of the rockers or bottom rail, is 15 in. long, 5 in. wide, and 1 in. thick; this will make the footboard the narrowest part of the hansom on account of the shafts, which will be 30 in. long, 1¼ in. thick, tapering down to the points. The back has a curved top arch rail 21 in. long, 1½ in. by 1 in.; middle and bottom rail of the same thickness; underneath, for the well, a bottom rail 19 in. long, 1¼ in. by 1 in., and two small pillars, 1 ft. long, 1½ in. by 1 in.; there is also a rail fastened at the top of these two small pillars which the seat is fastened upon, also the back panel near the axle or underneath panel; two small pillars will also be required to stand 9 in. high from the footboard to fasten the shafts to; this pillar must fit into the shaft and an angle plate fit upon the shaft, and the bar between the pillars, besides a stay underneath the rocker and the shaft. A pillar, 2 in. wide by 1 in. thick, fits between the head rail and the middle rail to divide the windows, whilst a roof stick 1 in. by ½ in. thick is placed in the centre to support the roof and in a line with the front and back arch. In ordinary coach-building the bottom part would be made first, but we tenon and mortice our pieces and fit together as shown in Fig. 1. When the two sides are made, we fit the back, which should be 21 in. at the top to 19 in. at the bottom. The widest side of the pillars and rails must be placed at the sides. When the framework is all finished, we finish the roof off with a piece of whitewood or baywood 21 in. by 22 in., ¼ in. thick; to get this convex, wet one side, then place the other to the fire, then fasten on the roof by pinning it with coachmaker's pins. Next get a stiff piece of brown paper and cut the pattern of the side panel out; then cut a baywood or whitewood panel to the same size as the pattern, no thicker than ¼ in., as Fig. 2; pin it on the frame only round the edges; also cut out the back panel; this panel will be convex just a little, but the pins will draw it in position. There is now the top quarter to be put in all in one piece, and to be nicely jointed to the back panel, or it can have two small windows in if required. After these panels have been pinned, get some canvas and cut out the required quantity and glue it to the inside of the panels, letting the edges overlap the frame, or before you put the panel in its place you can rub some glue to the frame and panel, then pin it in its place; the canvas prevents the sun from splitting the panel, but the glue which is used in the canvas must be weak or you will not be able to spread the canvas on evenly. We now fix a board for the seat by nailing it at the inside on the top of the seat bar, and the other end is nailed or screwed to the back bottom rail. Next pin the back bottom panel in, then the bottom which is fastened to the bottom rail and the footboard. We next fix the box and seat at the back; this will require the box screwing to the back rail by means of strap, bolts, and screws; next fit a panel at the front near the shafts, and also a small dash. We now fix the springs. The body should now be turned upside down, standing upon a cushion to prevent the ground from marking it, whilst we fix the springs, axle, and wheels; the back spring should be fixed upon a stay in shape of an **U**, a small block of wood, then a couple of clips and clams and nuts, then the side springs with india-rubber robins in iron rings or shackles. We now come to an important part, and that is, setting the axle; if set in the centre it should be right, but the hansom can be made "light on" or "heavy on" by not being in the centre. Revolve the wheels round, and try the measurement from the back of the wheel; when it is alike at both sides, then the axle can be fastened to the springs with clips and with a spring block of wood between. We take the wheels off, up end it, and fasten ash or oak heading ¾ in. by ¼ in. thick all round the panel at the sides and front, as shown in Fig. 3. Next make the knee boot or flap-door; make a frame first, then panel it; the hansom must have a couple of steps, on the sides of which the hinge of the door is fastened with a bolt, as Fig. 5. It should now be glazed; small strips of wood should be pinned in the inside of the framework, then filled up with putty, then the glass put in and strips of wood embedded in putty, pinned down. After it has been cleaned off it is ready for painting, and if you take my advice let a coach painter paint it for you, as he will finish it off better; or, if you paint it, keep the black parts as shown in Figs. 3 and 4; the light parts are painted in any colour. The mouldings are blacked and fine lined; the wheels, shafts, and front (except the dash), together with the door panels and box, are painted in any colour you choose; the inside at top is painted white, the ironwork must be blacked, the inside must be blacked, and the footboard. The inside is now ready for upholstering; a small pair of lamps must be fitted to this goat hansom.—W. P.

Spectacles.—CONCAVE.—You should endeavour to obtain some spectacles from a reliable London optician. By paying a deposit you could doubtless have several pairs on trial, and these should be tested on various sizes of print, until you get a pair most generally suitable. It would be impossible for me to say the exact number you require, as this can only be ascertained by personal trial. I may add, however, that you will in all probability require two pairs of spectacles—one pair for ordinary use, and another pair for reading or writing. You should write and state your wants to Mr. Browning, 63, Strand, London, or to Mr. A. A. Wood, 74, Cheapside, London. Either of the above gentlemen make spectacles to suit all sights and *pockets*. Mr. Wood will send you a pamphlet on defective vision free of charge, and Mr. Browning publishes a booklet on "The Eyes, and How to Preserve Them," price 6d. The latter work is very useful to persons about to buy spectacles.—C. A. P.

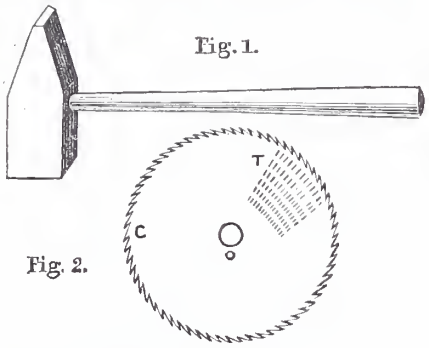
Varnish.—SOUTH STAFFORDSHIRE.—I cannot advise you to attempt the work you propose, as I fear that when the varnish has been removed and the job stained and revarnished, you will wish you had left it in its present condition. However, if you wish to try, the only available methods are to remove the varnish by a solvent or by mechanical means, such as scraping and papering; the latter is to be preferred for a piece of fretwork. If at all possible, take the job to pieces, or you will find it extremely difficult to remove the varnish from corners.—D. D

Taking out a Patent.—G. E. B. (*Accrington*) wishes to know how long he will have to wait for a patent to be granted after making application for it. According to the Official *Circular of Information*, the patent, if unopposed, is sealed about ten weeks after the acceptance of the complete specification." From the time that the acceptance of the complete specification has been advertised in the *Illustrated Official Journal*, two months are allowed for notices of opposition to be lodged.—C. C. C.

Patentee's Agent.—A. W. W. (*Baltinglass*) will have received the information he asks for if the address he gives is sufficient; if not, he will do well to write again to the Editor of WORK.—C. C. C.

Model Electric Lights.—C. H. (*Old Charlton*).—The first of the articles in this series appeared in WORK, No. 76.—ED.

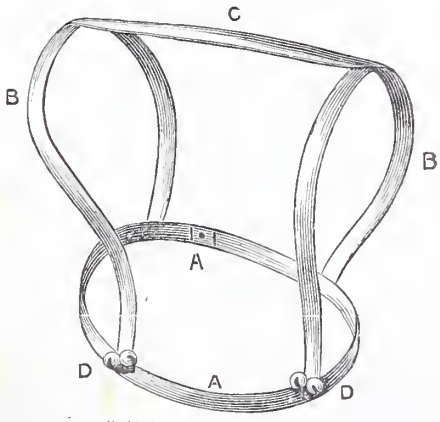
Circular Saw Hammering.—SAWYER.—You should have asked for information in reference to your circular saw before you commenced hammering on it. Perhaps before you hammered it the saw was tight in the centre, or what we term centre-bound; or may be it was rim-bound, and by hammering at random, and in places where it should not have been touched with the hammer, caused the saw to twist or buckle; and I have no doubt that it is beyond the skill of anyone to get it true, except one who has learned the whole art of saw hammering. Therefore my advice to you is to send it to Moses Eadon & Sons, President Works, Sheffield; or to Messrs. Weatman & Smith,



Saw and Hammer—T, where Saw is twisted.

Russell Works, Sheffield, or any good saw maker, and get it hammered by a man who knows the whole art of saw hammering, and if your saw is stout enough to allow one gauge to be ground off, have it ground at the same time. Had your saw been twisted in working, the following would be the way to proceed:—We will suppose the rough sketch circle C, Fig 2, to be a circular saw twisted at T: you should place the saw buckle side down on an anvil, the face of which should be a little convex, and hammer with a cross-faced hammer (Fig. 1), as indicated by marks in the circle. I acknowledge that I do not know the whole art of saw hammering, but can give a deal of information in reference to hammering saws—circular saws especially.—A. R.

Child's Reins.—SADDLER.—The body, braces, and belt form the essential part of this toy. The waist-belt only, with a ring at the back, is a device to which children apply reins. The shop-made braces and reins have an attractive finish, and if well designed are harmless. Bells attached have the merit of letting people know the team is coming. The sketch will show how made, and the method of attaching reins, so as not to be harmful. A A is the belt, with shoulder straps (B, B) attached to the belt direct, by being sewn there, but better if sewn



Child's Reins and Braces.

to "dees" at the top edge of the belt; the two back dees (D, D) take the reins, which are best attached by light spring swivels that take these dees easily, for attaching or detaching the reins. The breast strap C joins the shoulder straps together in front; a similar strap high up is often used behind. The only buckle needed is for the waist-belt, and this the players should be cautioned must not be tightly buckled. Children, the same as men, vary in size, so that the body braces should be made to suit the child using them. The waist-belt should never be below the pit of the stomach, or the pull of the belt from the reins presses injuriously on the cartilages of the short ribs.—J. C. K.

Sewn Heel.—M. M.—You must start to sew your seat round at A (Fig. 1) with a stout thread (the welt thread is generally used), and when you get round to B, go on sewing the welt in, as at C. Then the rough edges must be pared off tolerably close to the stitches, more especially the stitches on the insole side. Then put a shank in the waist (a piece of leather, pegged in and skived) as at D. Then dip your heelawl in water, and put it under each stitch that lays on the upper side, as at B. Then put your sole on, and round it up, leaving about ⅜ in. on all round. Then skive off the sharp edge right round the top, cutting away about one-third of the substance, and about as far in, towards the centre, as the stitches will come; then peg on your split lift, get the pegs as near the centre as possible, and do not let the lift come to the edge of the sole, but only let it just cover the seat stitches—this leaves the sole free to be beaten or paned up over the stitches when finished. Now do the same with the first, second, and third whole lifts, paring them up each time to the shape of the split lift; and to keep them firm while sewing, put in two long lasting

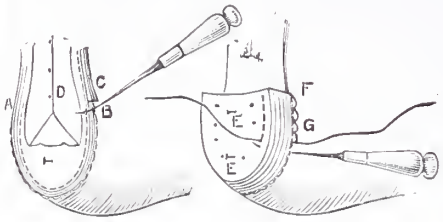
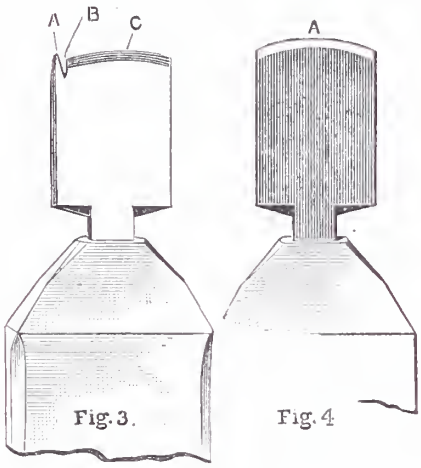


Fig. 1 Fig. 2



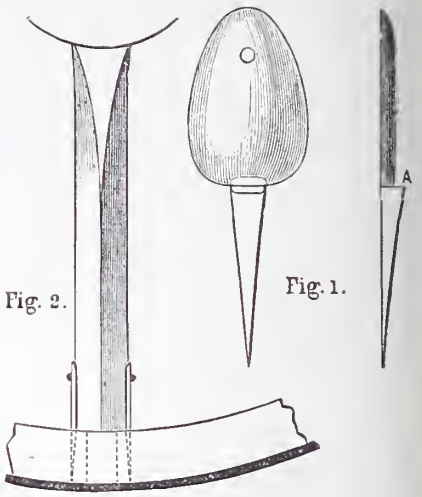
Boot-mending Tools.

tacks, as E E (Fig. 2). Then with a little stouter thread than what you have just used, start sewing the whole down at F (Fig. 2). Make the hole first (with the heelawl) right through the sole and lifts, and as you take each stitch, take up one of the seat stitches, as at G, only of course pull them in a deal more solid, as this chain of stitch is merely done, at G, as an illustration. When done, rub the stitches down with a piece of bone, and hammer the heel and stitches well on top, then pare the sole down all round to cover the stitches; pare it smoothly round, and finish off as other portions of the boot. With regard to the forepost iron, the best thing you can do is to buy a stock already in the handle, as Fig. 3, about 6d., unless it is an old iron you want to recut. In either case the guard must be as A (Fig. 3), the crease as B, and the face as C: this is done with very fine kit files. The face and guard can be cut with a three-cornered file; the face must be oval both ways, as Figs. 3 and 4, and the top of the guard must be about a ¼ in. above the face, and in a line level to it, as A (Fig. 4). A fine thin crease file will cut the crease B (Fig. 3); this wants to be about $\frac{1}{16}$ in. deep. Then oil a piece of soft sole leather, put some powdered emery on it, and polish it till it has a smooth even face.—M. G.

Telephone.—J. M. T. (*Bylands, Australia*).—I cannot tell you how to make a telephone such as you mention—that is, if the instructions upon the cutting which you send are not sufficient. It is quite possible to make a very efficient instrument from such. An electrical telephone is far superior to the mechanical telephone.—W. D.

Ivory—B. S. S. (*Richmond Hill*).—Your want in this respect shall be met as soon as possible.

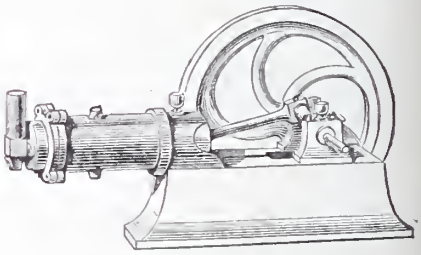
Repairing Broken Spoke in Wheel.—W. M. (*Kildare*).—When you say that you have a broken spoke in the wheel, I presume that it is broken off at the tenon which fits into the felloe. If this be so, you can hold the spoke fast in its place, and prevent it from rattling by having two spoke clips made as Fig. 1; these are of wrought iron, and have a hole through the spoon. The spoon is concave, to fit the convex of the spoke. In driving the clip down into the felloe, bore a hole with a gimlet to start it in driving; then drive the clip down tight by hitting it at its strongest part (marked A), and not on the top of the spoon. These clips are best knocked in by holding a dull cold chisel, the point being at A, and driving the chisel with a hammer. When both clips are driven home, bore a hole through the spoke, so that you can push a round iron rivet through. If the rivet be too long, cut off leaving, and rivet both ends



Spoke Repairs Tools.

firmly. Nails and screw will not do instead of a rivet. The clips when in (Fig. 2) should be painted to match the spoke. These clips will make a good job, and will last a long time. But if the hoop should ever come loose, or other spokes break—more than two—then, of course, you would have new spokes put in.—W. P.

Gas Engine.—H. B. E. (*South Wigston*).—I herewith send illustration of the "Seal" gas engine; the dimensions are as follows:—Length, 22 in.; height, 12 in.; length of crank shaft, 10 in.; weight, about 60 lbs. This engine is sold as a half-man-power engine, but it will develop about three-quarter-man-power when working at its full power.



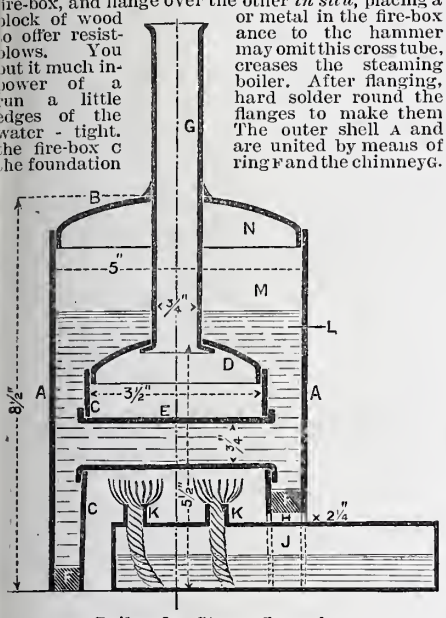
"Seal" Gas Engine.

The illustration shows engine with one fly-wheel, but they have two fly-wheels, one on each side of the engine. The price of this engine is £6 10s., including gas bag and water cistern; if engine is fitted with a governor the price is £1 more. This engine has sufficient power to drive a 3-in. lathe or fret machine.—S.

Dining Table.—AMBIGITUR.—I have given a sketch of a table which would suit you, by altering the dimensions, in No. 64, Vol. II., page 194. If you do not require an extending article you need only leave that part out. Mahogany is the best wood to use; but you could veneer a less expensive material. There are some good instructions and hints in the paper on "Joints," in No. 82, Vol. II. There is an Index to WORK, Vol. I., price 1d.—J. S.

A Canvas Canoe.—W. J. M. (*West Cowes*).—The difference in the dimensions of a canoe to carry two would be as follows: Length, the same, 14 ft.; depth amidships, 10 in., and breadth amidships, 30 in., instead of 2 ft. 2 in.; sheer or rise at bow and stern, the same; the well-hole 4 ft. long—that is, about 2 ft. each side of the centre of the canoe. The seantlings given for the framework of this canoe will be the same as the other. I made a canoe to carry two of these dimensions, and have been upset in the surf with three of us in it, no harm resulting beyond a wetting.—J. B. F.

Model Steam Launch.—HOBBY.—As you express no preference for any particular type of boiler, I have drawn one of the vertical class in preference to the horizontal, as being efficient, more easily made, and occupying less floor space. In the figure A is the cylindrical part of the shell. This may be rolled round and riveted from copper or brass sheet of about 18 or 19 gauge. But by purchasing a piece of brass tube of that gauge 8 in. in length, the trouble of riveting would be saved. B is the crown sheet. This may be hammered from sheet metal, but is more easily made as a casting; say $\frac{1}{16}$ in. thick. It may be riveted within A, but is equally safe if brazed with a blowpipe, provided it is done perfectly and without burning the brass or copper. C, the fire-box sheet, is properly made like the frustrum of a cone, in order to allow the bubbles of steam to become disengaged and to roll upwards as they are formed. But if this is too troublesome, make it parallel, in which case a piece of brass or copper tubing will do for the shell. The crown D will preferably be a casting. The cross tube E is in practice made tapering, and inclined across the fire-box. You had better make it parallel of copper tube: flange one end before thrusting it through the fire-box, and flange over the other *in situ*, placing a block of wood or metal in the fire-box to offer resistance to the hammer blows. You may omit this cross tube, but it much increases the steaming power of a boiler. After flanging, run a little hard solder round the edges of the flanges to make them water-tight. The outer shell A and the fire-box C are united by means of the foundation ring F and the chimney G.



Boiler for Steam Launch.

For a tiny boiler a brass casting will be best for the ring, and it must be arched upwards over the opening H, through which the lamp J is thrust. The ring must be riveted through or brazed to shell and fire box. The chimney G, of copper tube, is flanged at its lower end, and passes through holes in the fire-box and shell crowns. The fit must be close, and a little hard solder run round each joint to make it water-tight. An oblong tin casing J, with, say, two openings K, K for wicks, is a suitable lamp for burning methylated spirit. The spirit can be poured through one of the wick openings, or a special larger screwed plug inserted at the outer end of the casing. You should screw in a little brass tap at L, about ¼ in. or ⅜ in. above the crown of the boiler, and the water should not be allowed to sink below this, or the fire-box crown will become burnt. A similar tap should be screwed in at M, and the water should never rise beyond this, or the steam space will be encroached upon. A safety valve should be screwed in at N, and the steam pipe and tap may be brought either from the crown of the boiler or from one side, according to convenience. You can fill the boiler either through the hole into which the safety valve is screwed, or through a hole specially made for the purpose in the crown, and closed when not wanted with a screwed plug.—J.

Oil in Top of Machine Table.—J. B. L. (*New Kent Road*).—You will find it a difficult task to entirely remove this. You may to a great extent kill it by repeated applications of benzoline spirit or oxalic acid (1 oz. to ½ pint of hot water); in either case it would be best if these could be used before the final cleaning off; then fill in with a "filling," coloured to match, and mixed with benzoline or turps. There may, after all, be a dark stain left by the oil. If this still looks unsightly, it will be necessary to stain the other parts to match by the aid of stained polish. Unless you have had some experience in polishing, it would be best, in the long run, to pass the job on to a practical man. If, as I surmise from your letter, the stain only penetrates the centre, would it not be better to cut this out, say, a ¼ in. deep, and inlay in black or other dark wood a star or some similar pattern; so cutting out the defective parts, taking the precaution, before gluing, of killing all oil that may remain by benzoline, as before suggested. I need hardly remind you that benzoline must be used with caution, by keeping it at a distance from naked lights or fire.—W. J. M.

Gun Carriage.—H. A. T. (*Bermondsey*).—As you have not mentioned any particular kind of gun-carriage, whether field or stationary, I send you four rough sketches of same. Figs. 1 and 2 are simple and easy of construction, the sides being held together in position by a couple of slots. In Fig. 3 you will observe a slipper suspended by a chain underriage to fasten when travel- a mountainous is the model mostly patron- makers, and when cast in iron or brass the ends are generally curved round to allow a better and more artistic finish, as Fig. 5. Fig. 4 A is the front, and Fig. 4 B the back, of gun carriage.—W. P.

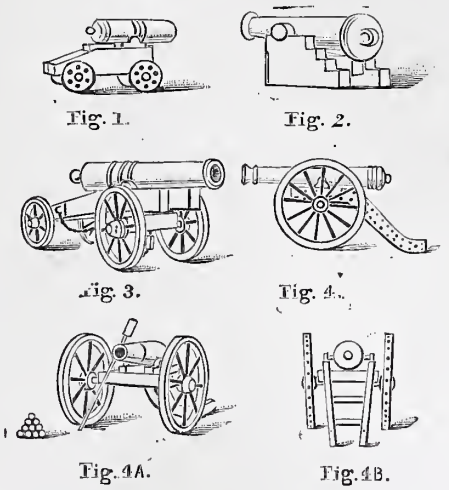
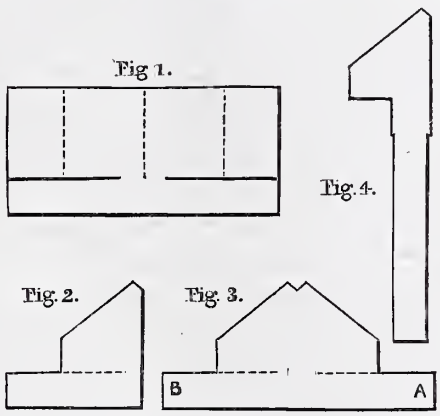


Fig. 5. Gun Carriage.

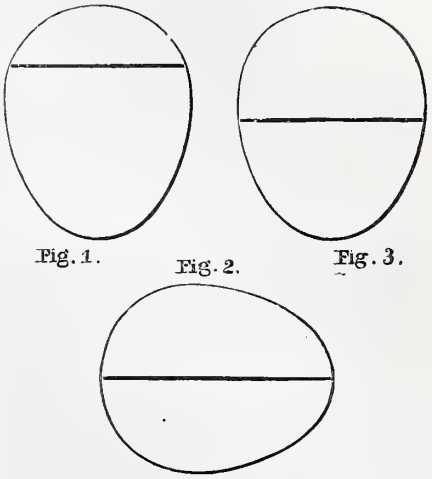
neath the car- to the wheel ling along district. Fig. 4 of a carriage ised by model

Ruling Covers.—P. C. B. (*Newcastle-on-Tyne*).—I am pleased to be able to give the desired information to the querist. There is nothing to hinder him from making the pens which he wants. He will want a set of at least three pens—fine, narrow, and broad points. They are all made in the same manner, the only difference being the points and the mode of holding the pen when in use. However—to make them. The description will be of a single one. Get a piece of lateen brass, such as paper rulers make their ruling pens with, 4¼ in. by 2 in.—the size is not important, but what I have given will do. Make two cuts with a pair of scissors in the position indicated by the heavy lines in Fig. 1—the figures are about half-size. Make three folds in it according to the dotted lines in the same figure—*i.e.*, fold it in two first, and then the ends into the centre like a three-fold football card. When this is done, take the scissors again and cut it the shape of Fig. 2; the small cut is at the back fold, and forms the point of the pen. Now open it out like Fig. 3, and get a penholder and lay it down upon A, and roll this strip of brass round it, stopping in the centre; bring over the strip B, and roll it round the holder also; a little pin should now be passed through, which will make it fast to the holder. The pen must now be pressed into shape with the pliers; the folds must be pressed very tight together. The pen should not be dipped in the ink pot; to feed it a little ink is lifted upon the point of a knife or piece of eard and passed into the flap-looking part of the pen. To use it the flap part is uppermost. For the broad point, all that is necessary is to rub away a part of the side of the point and use the pen side to the paper with the flap outwards; lines any breadth may thus be made, and it is not necessary to go over the work twice, I hope this will do for our friend.—G. C.



Ruling Covers.

Mounting Emu Eggs.—BERTIE (*Stapleford*) asks for some ideas for mounting emu eggs. I think it will be best for him to decide in the first place as to which article he would prefer, and to design something himself. Then if he will send a copy or tracing of his sketch to the Editor I will tell him the easiest way to carry it out. If he does not care to do this, well, I will make him a simple sketch of any article that he prefers, and will give him the simplest and most complete directions that I am able to. Here are a few hints to set him thinking:—1st. Are the eggs to be left as they are—*i.e.*, uncut—and, as a necessary consequence, treated as ornaments and nothing else? or, 2nd, can they be cut, so that some use can be made of their interior space? Regarding the first, I cannot call to mind at present any way of using them but as parts of candlesticks for the mantel or overmantel, or as the centre of a make-believe vase. For these, nothing but two mounts are required, and they can be screwed together. So these are easy enough to obtain ideas for, simple or otherwise, just as your taste lays. For the second—that is, where we can cut the egg—there are a good number of things to be suggested. If cut like Fig. 1, it can be formed into an inkstand with a jointed lid, or two, as a pair of flower vases, or as cases for the drawing-room table, for the ladies to keep their odds and ends in, or as a sugar basket, or tankard, or cup; or two might be mounted in a frame for preserves, with a jam spoon, suppose we say with a gold-miner's shovel for the bowl and with an emu for the handle, or they could be made into spill-holders for the smoking-room. If cut like Fig. 2, then we should get another shape box, or perhaps use one half as an ash-tray. If one were cut like Fig. 3, then it could be mounted as a pair of salt-cellars. So much for the articles; now for the principles, on which I should ponder a little before beginning my sketch. In the first place, we want to find out the simplest way to make it useful in the highest degree. Then, when that is decided on, there is the ornamental part of the design to be considered, and your guiding motives should be simplicity and suitability. For example, a bird's claw for the base is more in harmony with the egg than is the claw of a lion or an ox, but it does not follow that you need a foot taken from the animal kingdom at all; a scroll or plain ball may be better. Then for the top or handle of a lid, I should certainly like a model of an emu, but some simple ornament may do just as well. If you really mean to make an interesting piece of work of it, you might look up the habits of the bird, and then see if some notion cannot be obtained from its natural surroundings. Again, it is possible that something connected with the sender of the egg may be able to be introduced in an ornamental manner; but all depends on the amount of interest you feel able to take, so I will leave you to think of other things yourself. All the details as far as concerns the usefulness of the article should be worked out very clearly—I mean as to the sort of well you will have to hold the ink, or the means you will take to retain the liquid in the case of a tankard or flower vase being selected. I trust that these hints will set you to work, and you will see from this reply that until I know more of your ideas I cannot even attempt to enter on the mechanical details. When you write again, please give the fullest details of your capabilities that you can, so that my answer may be made in a manner suited to your abilities, for we "Shop" workers are all willing to help wherever we can, particularly when the questioner takes a little trouble to let us know the materials we have to work on and to work with.—H. S. G.



Emu Egg Mounting.

Easy Boot Making.—BOOTLAST.—I am supposed to gather from your letter that you feel quite competent, as far as taking the plaster casts. To detail the taking of plaster casts, I am afraid, would take

up too much room in "Shop." But suffice to say, you not only need the casts of the foot (which must be taken with sectional parts that you may be able to release the foot), but you want a model of the foot from the cast, which is the foot, in plaster. Plaster casts are taken by shoemakers—that, so to speak, the customer leaves his foot behind that the shoemaker may adapt a last of wood to the requirements of that foot. This, for an amateur, I think, is too far advanced; nevertheless, I am not one to discourage anyone who seeks, or tries to gain, knowledge. So if you have made the casts of your foot, you must now oil them, and, in plaster, cast a foot from them; but it is not necessary, as you have your own foot to guide you. Only wood or iron is used in last making; any compo would not stand the tacks or strain of the pincers in lasting the uppers over them. Your best plan is to take an old shoe that you have done with, determine its length in inches, buy a penny shoemaker's tape measure at the leather seller's, and find out the exact size of the shoe, and buy a last that size (or length); or another way is to stand on a sheet of paper on a smooth surface, and draw a pencil right round the foot, being very particular to hold it quite perpendicular

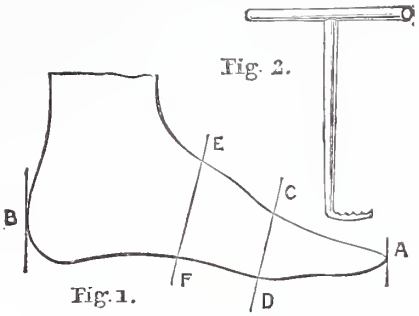


Fig. 1.

Last and Hook.

at the toe and heel, then, with the tape measure, see what this draws; and, say it was size six (that is, from A to B, Fig. 1), you must buy a last, size eight, and as near the shape toe that you require as you can, then place it on the sketch of the foot to see if its lines of construction are similar to it. Its girth measurements can be taken in inches round the great toe joint and round the instep, as shown in Fig. 1, from C to C again, passing under D, and the same at E and F for the instep. When you have bought the last, if it needs it, rasp it, till it just fits in the shoe; it can be taken out again with a lasthook, cost 6d. (Fig. 2); then try on the old shoe again, and chalk-mark it where it in any way hurts the foot; put the last in again, and with a fine awl prick through these marks into the lasts, then you can put pieces of wet leather on the lasts at these points, and make the proper room for your corns. These pieces of leather should be pegged on with wooden pegs, making a hole first with a peg-awl (cost: pegs, ½d.; awl and handle, 1d.). You can cut through these and skive the leather down to the last, leaving a nice smooth bump; compo would not do, or the process you name, as you would only get the shape and size of the foot, and when it was shaped up to the form of a boot, it would be too small. Really, you want the last as big as the measure—in fact, a sixth of an inch larger at the joint—if you want them easy. I think by following the above you cannot fail to get a last to suit you and at a small cost.—W. G.

Making Elbow.—IRONWORKER.—I am glad to be able to give you some information on the subject. It seems to me that your chief difficulty is in joining the pipes at the mitre or angle; as you have not been in the trade before I will give you the simplest way of making an elbow. Directions for marking out an elbow of any angle have already appeared in "Shop," No. 45, page 717; but you appear to have missed it, as you say you have taken in WORK from the commencement. But you must not suppose that workmen as a rule take the trouble to mark out elbows like that. I can myself, through constant practice, strike out an elbow by freehand drawing after drawing three lines on my piece of stuff. For example, say I want a 3 in. stove pipe elbow about 11 in. long each way, I cut a piece of stuff off a 2 ft. wide sheet 10 in.; I draw a line right down the centre, and another across it, about 11 in. from one end (Fig. 1). Set off from A to B, a distance equal to the diameter of the pipe, in this case, 3 in.; from the point of intersection of the two lines C a curve is drawn to B B, and, as I said before, by practice it is possible to draw this curve with almost geometrical precision. The setting of the lines A A and B B 3 in. apart, or whatever the diameter of the pipe may be, forms a right angle, and the nearer these lines are to one another the flatter the curve and the more open or obtuse the elbow. With regard to joining the two pieces, the easiest way for you will be what we call a Scotch elbow. Fig. 2 shows how this is put together; the piece with the long seam is flanged out a little in the throat about 3 in.; the flange may be about $\frac{3}{16}$ in. in the middle and go off to nothing each side. This flange is then hooked in the other piece of pipe, and the throat of that must be cut down so as to allow enough to turn over at B; this is knocked over with a small hammer, and the elbow is complete. It is of course not so good a job as a seamed elbow, but it has the advantage of being able to be made out of common iron, while a seamed elbow must be made of charcoal iron or soft steel. Instructions for making these will appear in due course.—R. A.

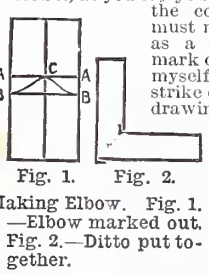


Fig. 1. Fig. 2.

Making Elbow. Fig. 1.—Elbow marked out. Fig. 2.—Ditto put together.

Turning Back Hands of Watch.—J. G. (*Glasgow*).—(1) The reason why the hands of a watch can be turned back without causing injury, is that the arbor which carries the hands can be moved backwards and forwards independently of the remainder of the works of the watch. The pinion or spindle of the centre wheel carries the hands, but if the spindle were perfectly fast to the centre wheel it would be impossible to move the hands one way or the other, because the centre wheel only moves when the watch is going, being geared with other wheels. Hence it was found necessary to adopt some plan by which the hands could be moved independently of the watch. The system is very simple. The pinion or spindle of the centre wheel was drilled through with a nice straight hole, and then an arbor fitted in with a square for the key at one end and a pivot at the other end, on which to fit the hands. This arbor is fitted tight enough to go round with the centre wheel, and yet loose enough to be moved with the key. Take a crude illustration of the system. You are no doubt perfectly familiar with the ordinary penny blacklead pencil, with a tin tube at the end containing a bit of indiarubber. Knock out the indiarubber at the end and force the tube into the centre of the pencil. The end of the pencil will project at each side, just as the square arbor projects through the hole made in the centre pinion. The tin tube and the pencil are tightly enough fixed together to form one piece for ordinary purposes, and yet if the tube were fixed in the centre of a wheel, and the pencil had a square at one end, you would be able to move it round without moving the wheel if the wheel were stationary, as in a watch—that is to say, stationary to the extent of only travelling round very slowly. Hence it is that when you move the hands of a watch you do no injury. There is another system for moving hands, but the principle is the same as the one I have already described, and therefore I need not enter into any further details. You will easily see what is meant, particularly if you follow out the idea of the pencil and the tube. It would be impossible to turn either backward or forward the whole movement. Each wheel of a watch is calculated to go round at a certain fixed rate. The fourth wheel, which carries the seconds hand, goes round once every minute. The centre wheel, which carries the minutes hand, goes round once every hour. You cannot alter this arrangement without smashing the works of the watch. The loose arbor, however, obviates this difficulty. (2) The drawing which you send is that of a bevel gauge. It is a tool which enables you to obtain the angle of any article you may be making. Take another crude illustration. Open the blade of your penknife half way. Then lay your knife on its back with the blade uppermost. Your blade is at a certain angle. Now suppose you want some fixed standard by which you could open the blade again to the same angle after the knife had been once closed. You could get the angle with the gauge in your possession. Lay the back of your knife on the body of the gauge, and then let the loose point drop against the blade, and then screw the point tight. You will thus get the exact angle at which the blade was open. The gauge can be used for a variety of purposes in connection with turning and filing.—HERR SPRING.

III.—QUESTION SUBMITTED TO CORRESPONDENTS.

Chiffonnier.—DUSTY POOL writes:—"Would some kind reader give me a detailed design for the above? I would prefer something neat, and not too elaborate, as I intend making it myself. I have looked over back numbers, but cannot find one to suit."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. W. (*Thornhill*); ONE IN GREAT NEED; J. W. (*Burnley*); HIGH PEAK; ENGINEER; STOCKTON; H. P. (*Plaistow*); LETTERS; A. T. A. (*Lerwick*); F. P. (*Manchester*); R. H. H. (*Shutter Oak*); J. B. (*Berkshire*); P. J. C. (*Balbriggan*); CALIGRAPH; J. W. L. (*Hull*); JACK OF ALL TRADES; W. B. (*Paisley*); R. F. (*Newton Heath*); CHOCOLATE; FITZHUGH; R. B. (*Bradford*); ZOETROPE; G. W. B. (*Lancaster*); H. H. (*Ashbourne*); X. Y. (*Rochdale*); SPECTACLE; W. S (*Dover*); G. E. E. (*Leeds*); "N."; J. H. B. (*Pendleton*); J. M. (*Manchester*); LOCO; NO NAME (*Sheffield*); L. J. (*Huntingdon*); W. B. (*York*); SIGN BOARD; APPRENTICE MECHANIC; E. C. (*Norwood*); O. A. B. (*Redhill*); SUBSCRIBER; ARMATURE; BIRMINGHAM; CHIPS; G. N (*Maidstone*); COUNTRY AMATEUR; J. W. (*Homerton*); W. D. (*Bath*); LITHO; J. C. (*Glasgow*); W. H. (*Hinckley*); M. S. A. (*Wigan*); L. C. B. (*Birmingham*); INQUISITAS; W. C. (*Birmingham*); A. R. (*Scorrier*); A. A. (*Peterboro'*); E. P. (*Warrington*); T. L. (*Holloway*); HUGH; R. K. (*Grays*); C. A. B. (*Kilburn*); P. H. Z. (*Hammersmith*); INDUSTRIA; J. P. (*Stratford*); J. W. B. (*Southport*); F. C. (*Cardiff*); S. J. (*Kensington*); COMPO; W. H. A. (*Canterbury*); D. H. J. (*Balham*); J. C. B. (*Glasgow*); TINKER; JACK; A. H. W. (*Brighton*); PAUL JONES; H. V. (*London, E.C.*); PETRO; T. W. T. (*Birmingham*); BALL VALVE; W. S. (*Stockport*); F. C. (*Bournemouth*); NOVICE; W. W. (*Inverness*); C. McC. (*Bangor*); NOSAM; APPRENTICE (*Burnley*); AMATEUR; WORKER BEE; AM. ASTRO.; JAY (*Dee*); R. N. B. (*Teignmouth*); M. & H. (*West Kensington*); RAT TRAP; J. H. E. & Co. (*London, W.*); J. F. M. (*Edinburgh*); J. C. (*Aberdeen*); A BLACKSMITH; E. B. M. (*Tunbridge Wells*); C. B. (*Derby*); NEMO.

"WORK" EXHIBITION.

NOTICE.

THE extension of time for receipt of application forms having now expired, the Secretary begs to inform the applicants for space that he cannot undertake to forward Labels, etc., for a few days, owing to pressure of work, but will do so as early as possible. They need not take the trouble to write for at least seven days, when anyone still without reply should then inform the Secretary.

JNO. W. HARLAND, Secy.

La Belle Sauvage, E.C.,
15th Nov., 1890.

Trade Note.

THE largest public electric light installation in the United Kingdom was opened recently in the city of Bath. Mr. Massingham, the contractor, has entered into an engagement with the town council to supply light to the street for seven years, at a yearly rent of £2,100. Besides this, there are about 3,000 incandescent lights fitted up for shopkeepers and private residents. The light is furnished on the Thomson-Houston system. An area of twenty-eight miles can be lighted from one centre. The underground cables have been laid through about fifty streets, about forty miles of cables having been used. The arc lamps are placed about a hundred yards apart. As far as possible, the mains have been put beneath pavements, usually at the depth of a foot or so. They are insulated by a thick covering of bituminised rubber, placed within a bitumen bar, the bitumen being manipulated in a liquid form. The insulated wire is protected from mechanical injury in "an iron" casing, and rendered completely waterproof. Altogether, when the central station is in full strength, it will be able to give out light enough for three hundred arc lamps and thirty thousand incandescent lights. The engine and dynamo room is fitted with four thirty-five horse-power vertical compound engines, each of which drives a fifty-arc light dynamo, as well as with one one hundred and fifty horse-power engine of the same type, driving by means of a rope belting a Mordey alternator, capable of supplying four thousand lamps, each of ten candle-power. Two additional one hundred and fifty horse-power engines, with alternators, were to be put down ere this. A boiler house, which has been fitted up, will take eight of Babcock & Wilcox's tubular boilers, each of one hundred and fifty horse-power, working at one hundred and fifty pounds pressure per square inch.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Bell's Patent Enamelled Adhesive Waterproof Advertising Paper Letters and Figures in all colours and sizes. Best and cheapest. Liberal terms to agents. Sample sheets, gratis. Factory, 17, Arthur Street, W.C., London. [14 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [2 R

Fretwork, Carving, Brass, Leather, and Poker Work.—Speciality in ornamented ivorine for painting. Illustrated Catalogues of tools, 800 Illustrations, 6d.—HARGER BROS., Settle, Yorks. [7 R

Engineering for Amateurs.—FLEMING, 63, Stirling Street, Glasgow. [9 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [1 S

Elliptical Chuck, as page 468, WORK.—If sufficient demand exists, BRITANNIA Co., Colchester, will supply parts, either rough or machined, at a moderate price. [11 R

On Hard Soldering.—A useful work issued by CHARLES E. ROSE, Jeweller, Bolton. With sample of solder, 1s. 6d. [12 R

Patent Foot-Power Circular Saw.—Will do double the work of other makes, nearly new, £13, soon saves its cost.—BRITANNIA Co., Colchester.

Machinery and Tools.—Largest stock in London. BRITANNIA Co., 100, Houndsditch. Cash or hire purchase.

Gas and Steam Engines.—Engineers', Amateurs'. Builders' Tools, Stocks, Dies, Forges, etc.; catalogue of new, 6d., or list second hand, 2d.—BRITANNIA Co., Colchester.

Best Book on Lathe.—Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA Co., Colchester.

PROOF OF THEIR EXCELLENCE.

rom the Rev. A. CAY, Northborough Rectory, Market Deeping, April 10th, 1889.—find them a nice, efficient preparation."

rom the Rev. J. ALLEN JONES, St. Asaph, April 15th, 1887.—"I find them excellent."

rom the Rev. CHAS. RUTTER HARRIS, Skilgate Rectory, Wiveliscombe.—"They razer's Sulphur Tablets') have been very useful in a nasty case of 'blackheads,' and wo other cases of 'scorbutic ailments' and a case of eczema."

rom the Rev. W. GOODBER, Langley Vicarage, Bishop's Stortford.—"Kindly inform of the cost of six dozen packets to take myself and give away occasionally in my ish. I have already taken them and believe they have done me good."

rom the Rev. Prof. HALES, M.A., 2, Minford Gardens, W., June 21st, 1889.—hank you for packet of Sulphur Tablets. I will certainly recommend them."

rom the Rev. ALEX. GUNN, of Watten Free Church, Caithness, N.B., April 4th, 1890. 'An old soldier in my neighbourhood has had rheumatism, often very painful, in his shoulder for four or five years. The shoulder was always cold, and so stiff that he ld never lift his hand higher than his face. I gave him some of your 'Sulphur Tablets.' e pain, coldness, and stiffness are all gone, and to his great surprise he can wave his arm ove his head. This happened more than a month ago, and the shoulder continues as ll as when he was a boy. It appears to me such an astonishing cure that I cannot help ting you know it."

From the Rev. H. J. DYER, West End Villa, Rickmansworth, 7th March, 1890.—Some months ago you kindly sent me two packets of Frazer's Sulphur Tablets for distribution among the poor of this town. I am very happy to tell you that I have found em to be worthy of the highest praise, for in several cases of skin disease eruptions they ve been most beneficial—both for children and adults—while as a gentle laxative they rpass anything I have ever tried. The trouble is I am beset with applications for ther supplies—those who have been benefited sending their friends to be cured. I ould be very glad to have some more of the Tablets. Can you supply them at a reduced rate for gratuitous distribution among the poor? I shall be very glad if you can?"

A Medical Man's Opinion.—"Your 'Sulphur Tablets' are a decided improvement on rs. Squeers' mode of administration. Besides being useful in habitual constipation, in gouty diathesis, and in hæmorrhoids, they produce a beneficial effect in Chronic Lepra d Psoriasis, and in Eczema.—M.R.C.S. Eng., and L.S.A., September 8th, 1890.

From STANLEY PHILIPS, Esq., F.R.C.S., Upper Long Ditton, Surrey, July 24th, 1890. "They are excellent for taking away spots on the face, and keeping the skin free from l sores and pimples."

From the BRITISH VICE-CONSUL at Honfleur, France, January 30th, 1890.—"They e all that can be desired."—FRANK LETHBRIDGE.

Mr. ERNEST F. TOZER, 20, Mill Street, Guernsey, thinks "Frazer's Sulphur Tablets" a first-rate blood purifier."

"I have found great benefit from Frazer's Sulphur Tablets, especially for constipation."—Mr. W. J. HILLIARD, 32, Holden Street, Shaftesbury Park, S.W.

Sergeant G. PASHLEY, K Division, Isle of Dogs Police Station, Poplar, E., says, referring to a friend: "He informs me that he had an eruption break out at the back of the neck, which was completely routed by Frazer's Sulphur Tablets."

Mr. WILLIAM GREGORY, Knightsbridge Arms, West Ferry Road, Millwall, E., says:—"Since taking Frazer's Sulphur Tablets I have entirely lost some rheumatic pain I have had for upwards of two years. I am delighted with them."

"Brookwood, Dulverton, July 3rd, 1889.

"DEAR SIRS,—About a fortnight ago you kindly sent me a packet of your 'Sulphur Tablets.' I gave six of them to the mother of a little girl, Beatrice Baker, who for several months has been afflicted with breaking out in her hands and sores. I called on Mrs. Baker yesterday, and she says the Tablets have done the child a deal of good. She came in from school while I was there, and I was surprised to see how the sore places had nearly healed—only the marks were left. The child is about nine years of age, and her mother is extremely grateful to you for the Tablets. You can make use of this if you wish.

"Yours sincerely, E. BURROWS."

DO I NEED THEM?

If you have Rheumatism, Yes! They will kill the decomposed and poisonous exces of uric acid in the blood, causing the disease.

If you have Constipation, Yes! They are a gentle, safe, and simple laxative. as suitable for children (in smaller doses) as for adults.

If you have Hæmorrhoids, Yes! They relieve the congestion of venous blood at the affected parts and afford relief.

If you have Ulcers, Scrofula, Scurvy, or other Impurities of the Blood, Yes! They neutralise the blood poisons causing the diseases, and expel them out of the system.

If you have Skin Disease or Eruption, Yes! They have a specific curative effect on all such, as they open the pores from internally, and free them from obstruction and disease taint. They likewise "scotch" where they do not kill the disease principle from the blood which causes Eczema and other diseases.

TEST THEM FREE OF CHARGE.

Wishing to have "Frazer's Sulphur Tablets" judged on their merits, we will send samples, gratis and post-free, on brief written application being made for same. Name "Work."

"Frazer's Sulphur Tablets" are put up in packets, price 1s. 1½d. (post free, 1s. 3d.), and are for sale by chemists and medicine vendors. Every Tablet stamped "Frazer's Sulphur Tablet." Beware of fraudulent imitations.

Sole Proprietors, FRAZER & CO., 11, Ludgate Square, London, E.C.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

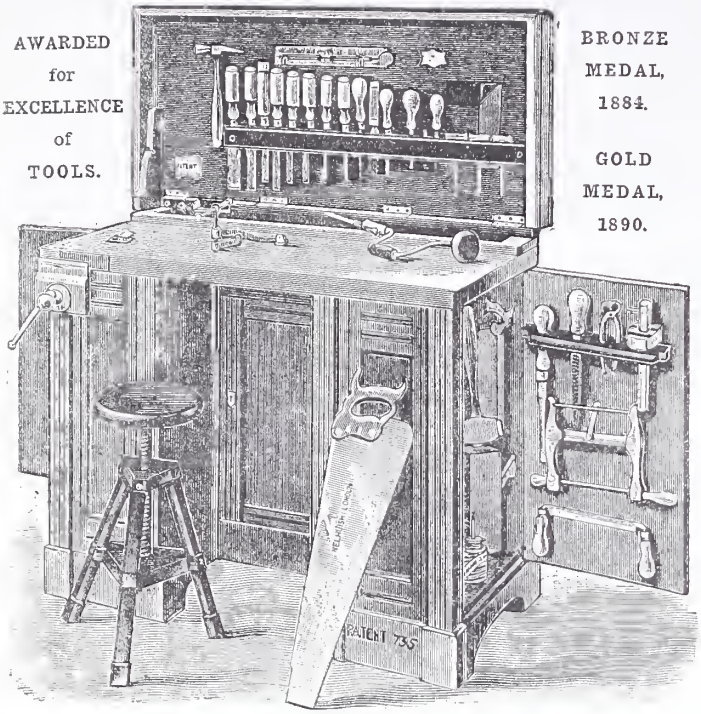
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,
84, 85, 87, Fetter Lane, LONDON.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

60th Thousand, price 1s.; post free, 1s. 3d.

CASSELL'S SHILLING COOKERY. This new and valuable Work contains 364 pages, crown 8vo, bound in limp cloth.

"This is the largest and most comprehensive work on the subject of cookery ever yet published at the price."—*Christian Age.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

TOOLS TOOLS
MOSELEY & SON.
323. HIGH. HOLBORN.
200 PAGE CATALOGUE
BY POST 6D
ORDERS OF 10/- CARRIAGE PAID

ESTABLISHED 1851.

BIRKBECK BANK
Southampton Buildings, Chancery Lane, London

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

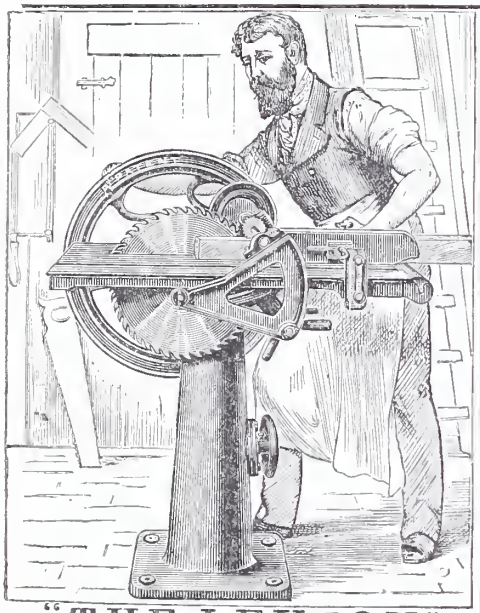
TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balance when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application.

FRANCIS RAVENSCROFT, Manager.



"THE LEYTON"
New Patent Circular Saw Bench for Hand Power.
Cuts Tenons, Mitres, Grooves, Rebates, and Saws Wood 3 inches thick with ease.
LEWIS & LEWIS, *Engineers, Cambridge Heath, London, N.E.*

SANDOW'S famous Trainer, Attica, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

STERN'S PUMILINE LINIMENT

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

CASSELL'S CLASSIFIED CATALOGUE, containing particulars of upwards of ONE THOUSAND VOLUMES published by Messrs. CASSELL & COMPANY, ranging in price from

THREEPENCE TO FIFTY GUINEAS,

will be sent on request *post free to any address.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

A COMPLETE NOVEL by FLORENCE WARDEN, Author of "The House on the Marsh," &c., entitled, "Missing—a Young Girl," Fully Illustrated, appears in

CASSELL'S
ILLUSTRATED ALMANAC AND COMPANION FOR 1891
NOW READY, price 6d.

This year's issue consists of *96 pages,* and contains particulars with Portraits of the Champions of the Year in various Sports and Pastimes, together with a record of their achievements.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

SERIAL ISSUE in Monthly Parts, price 6d., of the

POPULAR SCIENTIFIC WORKS
By LOUIS FIGUIER,
With *Several Thousand Illustrations.*

The Series will commence with "The World before the Deluge," Revised by the late H. W. BRISTOWE, Director of the Geological Survey of England, the Text newly Edited and Revised by Dr. ROBERT BROWN, F.L.S., &c.

PART 1 ready NOV. 26th.

"Admirable works of popularised science."—*Daily Telegraph.*

*** *Prospectuses at all Booksellers'.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers.*

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores; or by Post from the **MANAGER, SALT REGAL WORKS, LIVERPOOL.**

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 88.] SATURDAY, NOVEMBER 22, 1890. [PRICE ONE PENNY.

A CHEAP AND SIMPLE ELECTRICAL INDUCTION MACHINE.

BY G. W. LUMMIS PATTERSON.

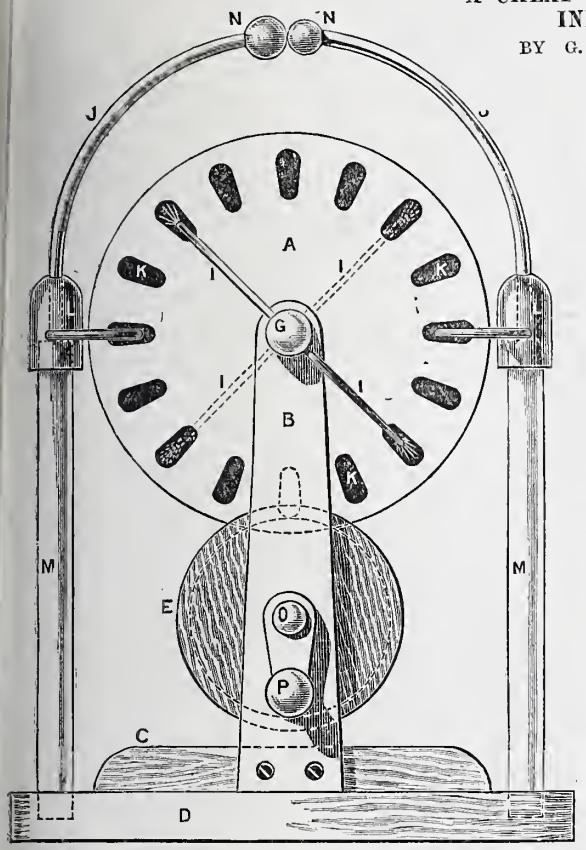


Fig. 1.—Cheap and Simple Electrical Induction Machine: front view.

THE construction and action of this machine is based on the fact (discovered in 1753 by John Canton) that when an electrified body is brought near an insulated conductor it causes an electrical separation to take place on that conductor. This action is called electrical induction. An experiment to illustrate this action can be made by rubbing a glass or ebonite rod with a silk or cotton handkerchief, and bringing it near to an insulated conductor, such as a metal pencil-case suspended by a silk thread. The ends of the conductor will then be found to attract such light bodies as feathers, chaff, or bits of paper; and if small balls of elder-pith or cork be hung to the ends, they will be repelled. It will be found that the middle portion of the conductor gives no sign of electrification, and that the electricity on the opposite ends are of different signs, that nearest the excited glass rod being negative, and that on the opposite end positive. It will thus be seen that a positively charged body induces negative electricity on the end of the conductor nearest to it, and positive electricity on the farthest end of the conductor. If the glass rod be taken away, all signs of electricity on the conductor will cease, while the glass rod will have lost some of its electricity. The quantity of the two charges induced on the conductor depends on the amount of charge on the rod (a highly charged rod

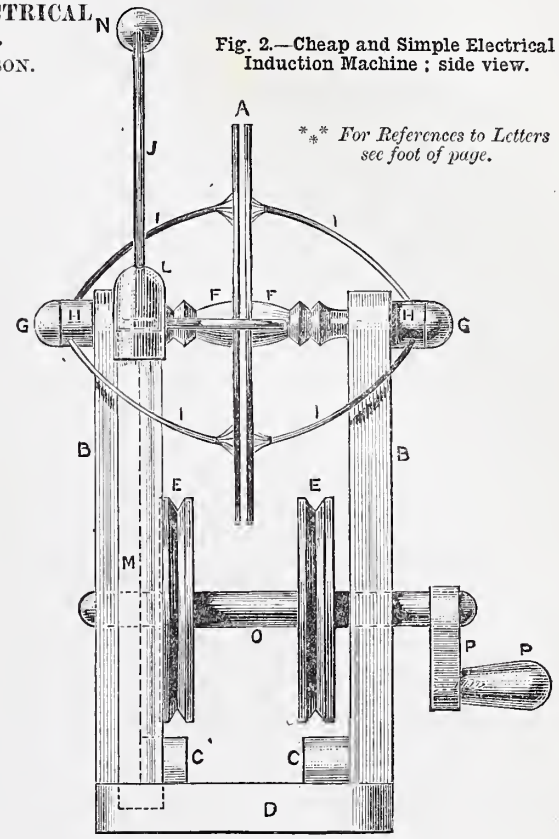


Fig. 2.—Cheap and Simple Electrical Induction Machine; side view.

*** *For References to Letters see foot of page.*

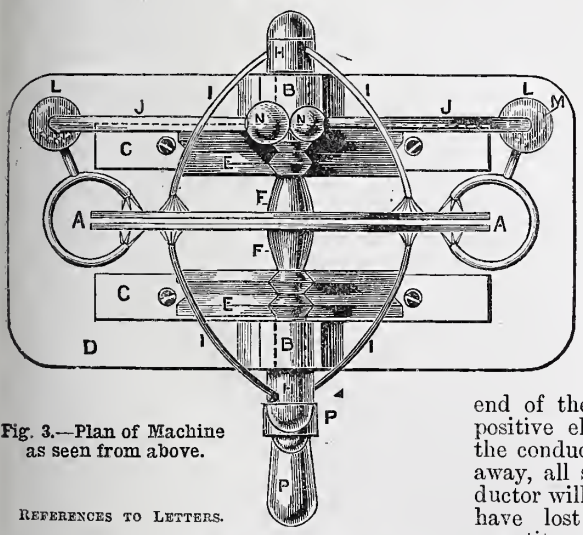


Fig. 3.—Plan of Machine as seen from above.

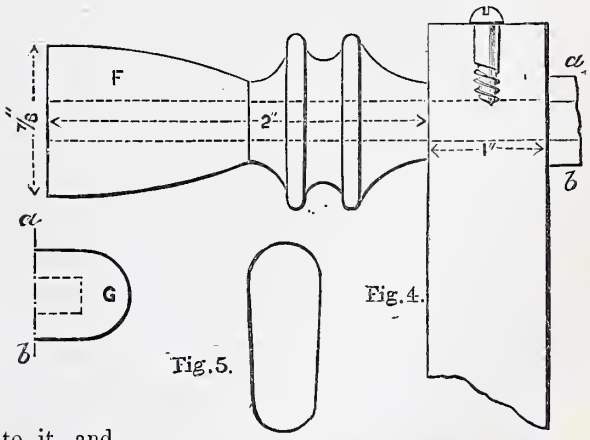


Fig. 4.—Mahogany Bosses: full size—G, Continuation of Fig. 4 at *a b*. Fig. 5.—Sector (full size).

REFERENCES TO LETTERS.

A, Double Glass Plate; B, B, Supports; C, C, Slips screwed to Base; D, Base of Machine; E, E, Pulleys; F, F, Mahogany Bosses; G, G, Mahogany or Ebonite Brush-holders; H, H, Brass Tubes carrying Brushes; I, I, Brushes; J, J, Conductors;

REFERENCES TO LETTERS—*continued.*

K, K, Tinfoil Sectors; L, L, Mahogany or Ebonite Comb-holders; M, Collecting-comb Insulators; N, N, Brass Balls at Ends of Conductors; O, Spindle for Pulleys; P, Crank Handle.

producing a greater inductive effect than a less highly charged one), upon the distance of the rod from the conductor, and upon the substance through which the charge acts. For instance, if a sheet of glass be introduced between the glass rod and the conductor it will be found that a greater amount of electricity is induced in the conductor. All these phenomena must be considered in the construction of an inductive electrical machine. If the glass plates of the machine be very thick, or if the glass be of bad quality, or if they be placed at a greater distance than $\frac{1}{8}$ in. apart, the electrical effect will be very much diminished, if not altogether stopped.

Description of the Machine.—This machine consists of two circular plates of thin window-glass, varnished with shellac varnish, and mounted upon a fixed metallic spindle in such a way that they can be rotated in opposite directions at a small distance apart. To each plate is attached sixteen sectors of tinfoil or thin brass at regular distances apart, and to the centres of each plate is cemented a hollow mahogany or ebonite boss, upon which is turned a small pulley. These are driven round by larger pulleys (fixed on to a spindle revolving in the lower part of the framework) by means of cords, one of which is crossed to get the necessary difference of rotation. Two curved metal rods, having small wire brushes soldered on to the ends, are fitted on to the ends of the fixed spindle. These brushes are capable of revolving round the spindle, and are best placed at about 45° from the horizontal diameter of the plates. These brushes momentarily touch two sectors on the same diameter of each plate as it revolves. Glass insulating rods, to which collecting combs and conductors are fitted, are fixed into the base of the machine. The points of these combs are directed towards and along the horizontal diameter of the plates. To the combs are fitted two brass or copper rods, terminating in balls, whose distance apart can be varied at will.

Action of the Machine.—The action of the machine may be briefly described as follows:—The glass plates, revolving at a high speed in opposite directions, are electrified by friction with the air, or some similar cause. This gives an initial charge to the sectors—some positively, and others negatively. If while the front plate is revolving from left to right the sector on the back plate, situated at about 45° from the horizontal diameter, and on the left of the plates, be charged positively, opposite to this sector there will be a sector on the front plate going from left to right. As it passes under the wire brush the positively electrified sector opposite, and on the back plate, causes an electrical separation to take place on it, attracting negative electricity, and repelling positive electricity through the brush and metallic rod to the opposite sector on the same diameter. As all the sectors on the top of the front plate pass this brush they receive a negative electric charge, and as they go over from left to right they influence the sectors on the back plate as they pass under the brush at the back, and cause them to receive a positive electric charge. The same action will necessarily take place on the bottom portions of the plates. As a result of these actions, positive electricity is brought over to the left side of both plates, while negative electricity is brought over to the right. If the front rod and brushes are revolved so that they are placed on the same diameter as the brushes on the back, and the brushes on the back are revolved so that they are on the same diameter as the front brushes were, the effects are reversed—that is, instead of positive electricity being brought over to the left, it is brought over to the right, and negative electricity to the left. The combs collect the electricity from each side of the plates, and conduct it to the external circuit through the brass balls. This machine is analogous to a shunt dynamo, in that it excites itself best when the external circuit is open, for if the combs and conductors be removed the machine still continues working, and begins to glow all over with brush discharges.

Construction of Machine.—To construct this machine two mahogany bosses are required of the shape and size shown in drawing (F, Fig. 4). They have $\frac{3}{16}$ in. or $\frac{1}{4}$ in. holes through their centres, and must be turned very true. Two circular plates of thin window-glass—8 in. diameter—are required. These should be of even thickness throughout, for if one side of a plate is thicker it will also be heavier, and when revolved at a high speed the heavier side will tend to fly off, causing vibration and most probably breakage of the plate. Before purchasing the plates it is best to get a few samples of glass, and test each by rubbing with silk and bringing near to bits of paper or any light substance, and selecting the glass which appears to be excited the easiest, and which attracts the paper the strongest. These plates usually have holes bored through their centres, but as glass boring is a difficult operation to inexperienced persons, I would recommend that they be mounted on the following method, by following which no holes are required:—On a sheet of paper or thin cardboard describe a circle having the same diameter as the plates. A smaller circle is described from the same centre, having the same diameter as the bosses. A glass plate is put on to the paper so that the edges of plate coincide with the outside circle, and the face of one of the bosses being covered with glue or similar cement, it is placed on to the plate so that the edges coincide with the outside of the smaller circle. It should then be gently pressed, and the cement removed with a wet sponge. The plate should then be removed, and put aside until dry. The same operation is gone through with the second plate. On to the centre of the back of one of the plates (A) a cardboard washer about $\frac{1}{16}$ inch thick should be glued, to keep the plates the necessary distance apart. While the plates are drying the base (D) and supports (B) should be constructed. These are made of 1 in. mahogany or pine. The dimensions of the base are 12 in. by 6 in. The supports (B) are 2 in. at base, tapering to 1 in. at top by 10 in. in length. They are to be glued and screwed on to two slips (C) of mahogany or pine—1 in. by 1 in. by 8 in.—which are screwed on to the base (D). The holes for the boss (F) and pulley spindles should be quite parallel, and are best done by clamping the supports together and drilling them. The large pulleys (E) are of mahogany or pine, $4\frac{1}{2}$ in. diameter and $\frac{1}{2}$ in. in thickness. After being roughly turned to size, they should be glued the correct distance apart on to the spindle (O), which is $\frac{1}{2}$ in. square by 7 in. in length, of mahogany or other hard wood, and put between lathe centres and turned to correct size. The spindle is turned circular for 1 in. from one end and 2 in. from the other end. To this end a crank and handle is fitted, as shown (Figs. 1, 2, and 3, P). One of the supports should be permanently fixed with screws, and glued on to the base; the other should be loose, to allow of adjusting the plates. If the glass plates have holes bored in centres, a $\frac{3}{16}$ in. or $\frac{1}{4}$ in. spindle will have to be passed through the plates and supports; if the plates are mounted in the manner I recommend, two short spindles should be used. One should be fitted into each support, and should project about one inch on the outside of support, and about two inches on the inside of support, and they should be a tight fit. On to the projecting ends of the spindles a brush-holder (G) of mahogany or ebonite should be fitted. These are to carry the neutralising rods and brushes (I), which are of $\frac{1}{8}$ in. brass or copper wire, soldered into short pieces of brass tube (H), so as to revolve stiffly. On to the ends of the rods are soldered small brushes made of very thin copper, or brass foil or wire. The collecting-comb insulators (M) are of $\frac{1}{2}$ in. glass tube. On to one end of each tube a brass, ebonite, or mahogany comb-holder (L) is fitted, and the other end of the tubes should be cemented into holes bored in the base. The combs (I) are of $\frac{1}{8}$ in. brass or copper wire, shaped as in drawing, with common pins soldered on to the ends. Holes are drilled in the comb-holders (L), into which the combs fit tightly. The conductors (J), which are of $\frac{3}{16}$ in. brass or copper rod, should fit into holes drilled into the top of comb-holders (L). They should make electrical connection with the comb-holder, and should terminate in brass balls (N)—one about $\frac{3}{4}$ in., the other about $\frac{1}{2}$ in., diameter. The base, supports, and pulleys being put together, the glass plates should now be varnished with thin shellac varnish, which is made by dissolving orange or button shellac in methylated spirit. The plates before being varnished must be heated before a fire, which is best done by holding the plate on a bit of thick wire, and revolving it by gently striking it with the finger, or, if the frame of the machine is not polished, the plate may be mounted and driven round by means of the handle. The plate must not be allowed to get very hot; it should be just hot enough to allow the back of the finger being placed against it. It should then be removed from the fire, and if it has been heated on a bit of wire it should be mounted in the frame. A large camel-hair brush should then be dipped into the thin shellac varnish and applied to the plate, which should be rapidly revolved by means of the handle and pulleys. Both plates should be varnished until they appear of a pale yellow colour. If the varnish has a milky appearance while being applied it shows that the plate is not hot enough, and therefore it should be heated again. I would advise that a few trials be made on a piece of glass until the necessary experience and skill are gained, it being a difficult matter to varnish properly. After the plates are varnished the tinfoil sectors should be fixed on to them at regular distances apart. This is done by means of a template, which can be made by taking the card used for fixing the bosses on to the plates, and drawing a circle $\frac{3}{8}$ in. inside the outside circle, and another about 1 in. from the second. The second circle is divided into sixteen parts, and the sectors are drawn full size, as shown (Fig. 1). The sectors are made by cutting a card into shapes shown full size in Fig. 5. A strip of thin tinfoil, rather larger than the full-size sector, is folded up into sixteen folds, and the shape being placed on to the tinfoil, the required number of sectors are cut out

once by cutting round the shape with rp scissors. The plates are then put on the template, and the sectors are stuck with gum or other cement, as shown g. 1). The plates on drying should be shed to get rid of any gum which may nain, and they can then be mounted on the frame, which should be polished or nished. The plates should be adjusted il quite parallel by moving the loose port about until the right position is nd, when the support should be fixed o the base with brass screws. The plates uld revolve about $\frac{1}{16}$ in. apart. One or Leyden jars should be connected to the nbs to get the best effect from the chine. These are made of thin glass s, or large test tubes coated outside and ide with thin tinfoil or bronze powder nented on to the glass with gum. The tallic coating should reach to about in. of the top of jars. A large cork, cover of mahogany soaked in melted affin wax, should be fitted on to the top the jar, and a $\frac{1}{8}$ in. brass rod, terminat- in a brass ball, should be passed through til the end of the rod touches the bottom the jar. If one jar is used it must be ulated from the earth by means of a ge glass plate; if two jars are used they ed not be insulated, but both the outer atings should be connected by a strip of foil, and the inside coatings connected to separate conductors. It is best to var- h the tops of the jars in the same manner the plates were varnished, to prevent any s of electricity. The frame should be her varnished or polished, and should be e from sharp corners or points. In start- g the machine, it is best to keep the nductors apart until the machine excites elf. The conductors can then be brought gether until the spark passes.

PARAFFIN LAMPS.

BY THOMASO.

TTERN FOR BASE OF STAND—HANDLE—SLIDING PIECE—SET-SCREWS—MAKING STAND—RESERVOIR—TUBE FOR BOTTOM SLIDING PIECE—FINISHING OFF ENDS—FINISHING OF LAMP—LACQUERING AND FINISHING BASE.

E will start on the pattern for the base the stand. From Fig. 5 and the sec- n Fig. 6 all dimensions can be got. The easurements of Fig. 5 are taken before velling the edges, and the section is taken A B, Fig. 5. I made my pattern of pine, tting it out first as shown by the dotted es on the section, and then gluing and iling on the flanges of the shape, also own by the dotted lines. The two uld then be bevelled off at one operation. e semicircular part of the flange I cut t with a fret saw, and bevelled with a arp penknife. If you have a fret-sawing achine with a tilting table, there is no fficulty; but do not bevel the outside til it is in position. The ring X in Figs. and 6 I cut out of a piece of $\frac{1}{8}$ in. walnut, ch as is sold for fretwork, and then unded it with a penknife and file very ngerly. The centre-piece C (Figs. 5 and 6) as also bevelled with a knife, and glued on ter the hole underneath it had been made d bevelled. Be sure and see that the ttern stands flat and does not "wobble," you will have trouble with the casting. f course, I am going on the assumption at you are in the same position as myself viz., latheless.

The next pattern will be for the handle, own full size at Fig. 7. I cut my pattern out of a solid piece of beech, but an easier way, and one which I have since adopted in other patterns of a fragile nature, is by gluing two pieces of fretwood (say $\frac{1}{8}$ in. walnut) together, the grain of one piece being at right angles to that of the other. Trace the outline of the handle on the piece of wood thus prepared, and saw it to shape with a fret saw. Small pieces of soft wood can then be glued on each side to form the round part at the bottom, and the whole finished off.

The next pattern is for the sliding piece S (Fig. 1, p. 480), shown full size in Figs. 8 and 9. It might be made of pine, with the grain running in the direction of its greatest length. The radius of the curved part is, of course, half the diameter of the shade, whatever that may be, plus the thickness of the brass rim supporting the shade ($\frac{1}{16}$ in.). As illustrated, it is for a $7\frac{1}{4}$ in. shade. Better have it a little larger than otherwise.

One more pattern is required (Fig. 10). This is simply five pieces of wood "skewered," and secured with a touch of glue. Numbers 1 to 5 give the respective shapes of the pieces, and the numbers correspond. Divided where indicated by the arrows, you get the two set-screws, the lower sliding piece T (Fig. 1, p. 480), and two other pieces for a nut and a washer.

Smooth all the patterns, and give them two or three coats of varnish made with methylated spirit and orange shellac crushed up fine. This will take a day or two to dissolve, and must be stirred frequently. Go over the patterns with fine sand-paper after varnishing.

The price charged me for a casting of the pattern of the base (weighing 3 lbs.) was $7\frac{1}{2}$d. The remainder of the castings (brass) cost about 6d. It saves trouble, when the castings are small and various, to take a rough sketch of each with you when you go to get them. The founder can then see at once what the pattern is like.

Having got the castings, you can start on the stand. Take the $\frac{9}{16}$ in. square brass wire, which is for the upright, and cut it 17 in. long. It is best to get it a little longer than you actually want, as the ends are generally mangled in the cutting. Straighten it carefully, using a mallet. A hammer can be used if something is kept between it and the brass to prevent indenting. File $\frac{3}{4}$ in. of each end round, and cut a $\frac{1}{4}$ in. screw-thread on them. A screw-plate will be wanted for the set-screws, $\frac{5}{32}$ in. being about the size for them. Drill and tap the iron base to fit the upright. Drill and tap the square piece cast on the "skewer," to form the nut Z (Fig. 6), and file up, bevel, drill, and slightly countersink the octagonal piece for the washer W (Fig. 6). Drill and tap the handle to fit the other end of the upright, and then file it up. It being screwed on the upright will render this easier. If the end of the upright should project through the handle, file it even. File up the top sliding piece, and drill and square the hole with a square file, where indicated by the dotted lines in Fig. 8, to fit the upright easily, and drill and tap the hole for the set-screw where shown. If you have to get the screw-threads cut for you have them done before finishing up the metal, and let the man drill the necessary holes for the screws. Now take the $\frac{1}{2}$ in. by $\frac{1}{16}$ in. flat wire, and bend it with your fingers into a ring large enough to take the rim of the shade easily, and rivet (copper rivets) or screw the ends to the sliding piece as shown. If you taper the holes for the rivets slightly, you will be able to file the ends off flush. Before riveting, see that the ring touches all round when laid on a flat surface, or the shade will chatter with every movement in the room.

The reservoir is the next thing to be made. Two pieces of the sheet brass shaped like Fig. 11 are required. The diagram shows the radii of the circles. The distance of the centres of the circles one from another must be got in this manner:—Temporarily fit the stand together (a bed-key is just the thing for tightening the nut under the base), and put the shade in position. Then measure from the centre of the upright to the centre of the opening in the top of the shade. This is the distance required. It is important that the chimney should come in the centre of the shade, because if it touches, one or the other will most likely crack. The piece for the bottom is to be $\frac{1}{8}$ in. smaller all round than the top. Lay the bottom on the top, and mark round it with a sharp point. This mark is for a guide in soldering the sides on. The larger of the two holes in the top must be large enough for the screw collar of the burner to need a little coaxing to get it in. Allow it to project through about $\frac{1}{16}$ in., and then solder it. Before soldering, see that when the burner is screwed in the milled head of the winder comes to the side, so that it can be conveniently turned by the right hand. The other hole in the top (which must come exactly over that in the bottom) is to take the tube holding the bottom sliding piece. The tube can be bought at the metal warehouse or made out of the sheet brass, about 4 in. long. When in position it should project through the bottom about $\frac{1}{8}$ in., and about 1 in. above the top. Solder the joint (a lap one) very carefully, as you will not be able to get at it if it should leak. The part of the join which shows above the top of the cistern should alone be filed even. Drill and square the hole in the bottom sliding piece, file it up roughly, slip it in the top of the tube until it (the tube) is about $\frac{1}{16}$ in. above it, and then solder it, using a very hot iron. Keep the iron on the solder until the brass is thoroughly hot, and the solder keeps melted for a second or two after taking the iron away, and you will get a strong join. The join in the tube will most likely want re-soldering after this. With a centre-punch dint the tube in three or four places round the sliding piece, in the same manner as the brass ferrules are fastened on tool handles. This will securely hold the sliding piece in case the solder has not united the parts properly. File the top of the tube level, and fit the set-screw on the side opposite to the join in the tube. These set-screws (Fig. 10) should be notched round the edge with a file after the thread is cut—that is, if they are not turned and milled. You can now cut the holes in the top and bottom of the cistern the right size for the tube. In cutting holes in sheet metal I always use a fine fret saw, to prevent the metal buckling. The piece to form the sides is 3 in. wide. The length you get by measuring round the bottom piece of the cistern with a strip of paper, allowing $\frac{1}{2}$ in. or so extra. See that the edges are straight and square, then mark the middle; bend it to something near the shape, and putting it upon the under side of the top piece, with the centre mark in the middle of what will be the front of the lamp, solder it to the line you marked, leaving about 3 in. of each end unsoldered for the present. Be careful that the sides are at right angles to the top, as they are rather apt to get a twist.

Most people tin brass before soldering. I am not one of the "most people." With a

hot iron and killed acid I never have any difficulty in making a strong job of any brass-work of a reasonable size.

Put the tube carrying the bottom sliding piece in position, and then just slip the bottom of the cistern in place, and try it on the stand. See that the upright *is* upright—the T square will tell you—and that the shade-holder, when fastened in position, does not overhang one side of the iron base more than the other. It can be regulated by filing a little off the side of the square hole in the sliding piece opposite to the set-screw; but do not do this until you are sure that the fault does not lay with the upright. It may have got a twist.

Having got all even, secure the tube with a couple of dots of solder on the outside, just to hold it in position while it is being properly soldered (you can scrape them off after), and then solder it in firmly, the ends of the sides being left unsoldered rendering it easier. If the end of the bit is curved with a hammer while hot, it will also assist.

The ends can now be finished. Trim them down, an equal amount off each, until the two edges will meet in the centre of the back of the reservoir, at right angles to the top. Finish soldering them, and then solder the join inside, making the solder flow about half an inch on each side of it. Cut a piece of the sheet brass, 3 in. by ½ in., coat it thickly on one side with solder, put some killed acid on it and the join, lay the soldered side down on the join, and press a hot soldering iron on it—the hotter the better. The solder between will melt, and the join be as strong as if it was lapped. Solder carefully down the sides of the strip, fill up the crack outside with solder, and go over every doubtful place, especially where there appears to be only a thin film of solder, and then solder the bottom in, about ⅛ in. from the edge. The bottom should slip in easily and fit well. If force has to be used to get it in, the reservoir will get bent out of shape. The end of the tube will, or should, project slightly beyond it. Cut a piece of the sheet brass; in the middle cut a square hole to fit the upright; slip it on, screw the cistern in position, and solder the piece over the bottom of the tube. This will take a good deal of the strain off the set-screw, and prevent it marking the upright to a great extent. It is best to file a little off the sides of the square holes where the set-screws are, and then insert a thin piece of sheet metal, bent as shown in Figs. 8 and 9. These pieces cannot come out unless the parts are taken right off the upright, and they prevent the screw marking it. There is no need to screw up the set-screws as if they were never going to be undone again. A very little force is sufficient.

The lamp can now be finished off. Polish up the reservoir first with emery-cloth or fine sand-paper, and then with (say) Bath brick, being careful to rub in one direction, and not with a circular scrubbing motion. This is all the cistern wants, as the paraffin will keep the brass bright if it is rubbed with the duster after filling. Fine-file the upright in the direction of its length, polish with fine emery-cloth, and burnish. As it comes from the shop it is fairly smooth, though dirty. Scraping with a steel scraper previous to burnishing is a safer and quicker method for amateurs than filing. The upright should be finished before it is finally screwed into the base, care being taken that the vice does not mark it. Burnish the handle, top sliding piece, and outside of set-screws. Polish the shade-holder, and burnish the edges. The varnish I have mentioned for the patterns makes very good lacquer. With a camel-hair brush varnish the shade-holder, top sliding piece, set-screw heads, handle, and the little washer at the bottom of the upright. This being only a rough sort of lacquering, I held the pieces over the top of the lamp, moving them about until the steamy look had gone off. The result was quite satisfactory. Before lacquering, see that the articles are free from dirt and finger-marks.

The base I finished by mixing some powder colour (dark Quaker green looks well) with gold size and painting it over. When dry I gave it two or three coats of the spirit varnish and stood it with the back to the fire, to harden the varnish until it was as hot as I could bear standing on my hand. The result was equal to Japan, and what is of more importance, paraffin does not affect it. Avoid Brunswick black; paraffin will bring it all off wherever it touches. An ornamentation in the way of lines, etc., should be put on before the last coat of varnish.

When the base is cold, quickly painting the edges with the varnish (liquid glue would be better), and stand the whole concern on a piece of green baize (I used black cloth). When the varnish or glue is hard, cut the baize round with a sharp knife, and the lamp is finished.

When taking the chimney off, take hold of it by the thicker part down by the burner, or it might break off short at the neck. When carrying the lamp about, take hold of the upright just under the handle, the latter only being intended to prevent your hand slipping, and to give a finished appearance. The lamp would not hang any even anything signify; but unless you had a full thread cut on the top of the upright and in the handle, it would scarcely be safe to swing it. And as the handle, as I have just said, is rather ornamental than useful, except as a means to prevent slipping, it is open to the maker to substitute a knob for the handle shown, if he thinks it to be preferable.

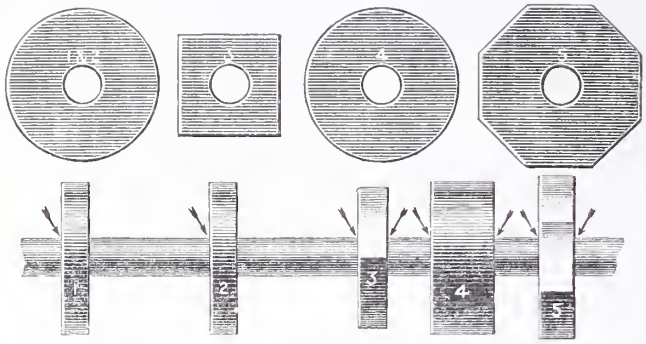


Fig. 10.—Pattern for Set-screws, etc. (full size)

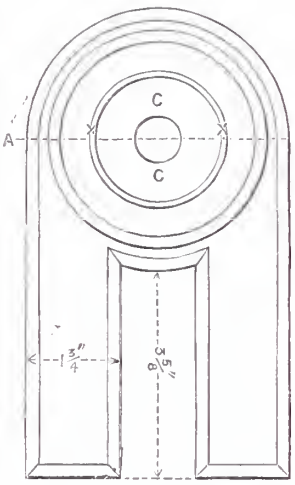


Fig. 5.—Plan of Base.

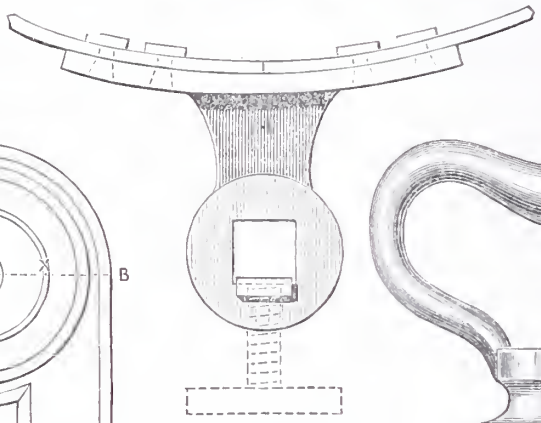


Fig. 8.—Top Sliding Piece (full size).

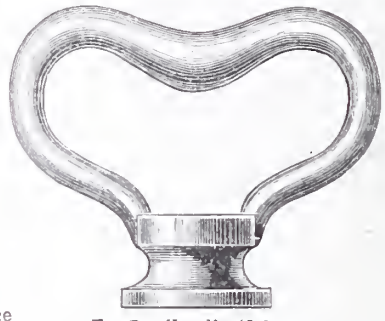


Fig. 7.—Handle (full size).

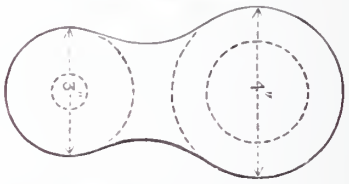


Fig. 11—Top and Bottom of Cistern.

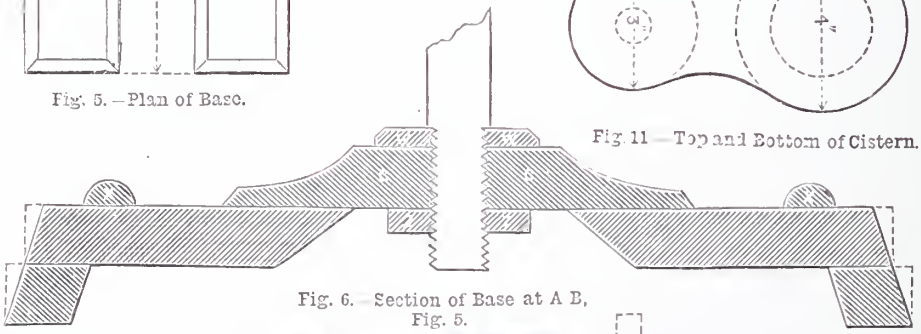


Fig. 6.—Section of Base at A B, Fig. 5.

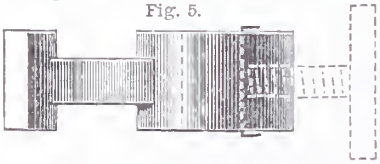


Fig. 9.—Top Sliding Piece, side view (full size).

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

Wax Extractors—The Solar Extractor—Gerster's Extractor.

Wax extractors follow honey extractors in a natural sequence, although, perhaps, not as indispensable to the welfare of an apiary. A good deal of extracting can be done with very simple apparatus; for instance, I was satisfied for a long time with an extractor

hich was made thus: An ordinary milk rainer, with fine wire netting for the ottom, was bought for eightpence. It is most eight inches across, and has sloping les a couple of inches high. A saucepan as then borrowed in the kitchen into hich the lower part of the strainer would , and be supported by the rim round the lge. Water was put in the saucepan, the rainer over, the combs in the strainer, nd the saucepan cover fitted the top of the rainer.

The whole was then put on the range, here the water was brought to the boil; the eam rose through the strainer, and melted e wax, which passed through to the water nderneath, leaving any dirt or refuse in the rainer. When all the wax was extracted, e water was poured into a basin, and the wax, when cool, was found in a cake on top.

This is very simple and inexpensive, and is on the same principle as the Gerster Extractor, except that, in the latter, the wax is not brought into contact with boiling water.

The Solar Extractor takes the palm for the quality of the wax extracted by it. It can be used only in the summer when the sun is hot, but then it works of itself, and costs nothing.

It is a well-known physical fact that glass is a trap for heat—that is, it lets it in, but will not let it out again. To be more exact, it permits of the passage of luminous rays of heat, but not of opaque. The direct rays of the sun are luminous, but those which are radiated from a comparatively dull substance are opaque. For instance, in a greenhouse, we find the heat very much more oppressive than in the hottest place outside.

This principle is utilised in the Solar Extractor. It consists of a box formed with a sloping top like a desk, which top is glazed with a double thickness of glass as is seen in Fig. 5. The dimensions may vary considerably, but those I have given in Fig. 1 will make a very useful and practicable size, viz., length, 20 in.; breadth, 12 in.; height at back, 12 in.; at front, 6 in. It should be made of very sound and dry stuff, preferably yellow pine, and it would be well to dovetail it together at the corners. The bottom should be grooved and tongued at the joint, or else made of one piece of wood. It would be a great improvement to line the whole structure with tin, which would ensure its being tight. The top consists of a frame of 2 in. × 1 in. stuff morticed together at the corners, and rebated to take the glass, the rebate being $\frac{3}{4}$ in. × $\frac{1}{4}$ in. The glass is to be placed in a bedding of soft putty—a very thin coat—then a strip $\frac{3}{8}$ in. × $\frac{1}{4}$ in. is to be tacked to the frame close up to the glass; the other glass is then to be put in a similar bedding of putty, and another strip tacked on over all. The object is to have the glass air-tight in the frame, and this can easily be secured by a judicious use of putty or white lead. The frame may now be attached to the box by means of a couple of hinges at the back, and two hooks in front will keep it down close.

A tin shelf is now to be made, the length of the inside, and approaching within an inch or so of the front. Three sides of this shelf, or rather tray, are to be turned up an inch, and the corners to get a touch of solder. Supports are now to be affixed to the inside to support the tray. If the box is lined with tin, these supports would take the form of pieces of tin soldered against the ends, and turned up at right angles, like L iron. If, however, the extractor is not lined, strips of wood tacked against the ends would do. The tray is to slope slightly forward so that the wax will run into the receptacle placed in front for it. The strips which support it will be placed about half-way up the ends. Over the tray there is a sieve of tinned wire netting, bound with tin, on which the combs to be converted into wax are placed. This sieve is a quarter of an inch from the tray, supported with strips of tin standing edgeways across it. I also have the tinned edges turned up for a quarter of an inch, so as to catch the comb and prevent it from slipping off.

The box to catch the wax underneath is as long as will fit between the tray supports, and may be as wide as the extractor, or any less width. It is made of tin with a wired top, and is, of course, water and wax-tight. Care should be taken that the fluid wax will all flow into the receptacle placed for it, and not flow over its ends where it is not wanted.

A convenient stand for this extractor is shown in Figs. 2, 3, 4. To make Fig. 2, get two pieces of wood 2 ft. long by 2 in. square, and halve them together in the middle. Now get another piece 15 in. long by 3 in. square, and round the upper end for a distance of about 3 in. to $1\frac{1}{2}$ in. diameter; then cut the lower part to fit over the junction of the cross pieces, and affix it to them with one long spike driven from underneath, and some smaller nails at the sides, having it at right angles to the cross pieces. Fig. 3 may next be taken in hand; it may be any convenient size, and about 3 in. thick. The most important item in its construction is the boring of the hole, which is $1\frac{1}{2}$ in. diameter, and should be exactly at right angles to the upper surface. It is countersunk on top, so that the washer and screw (Fig. 4) will be flush, or, if anything,

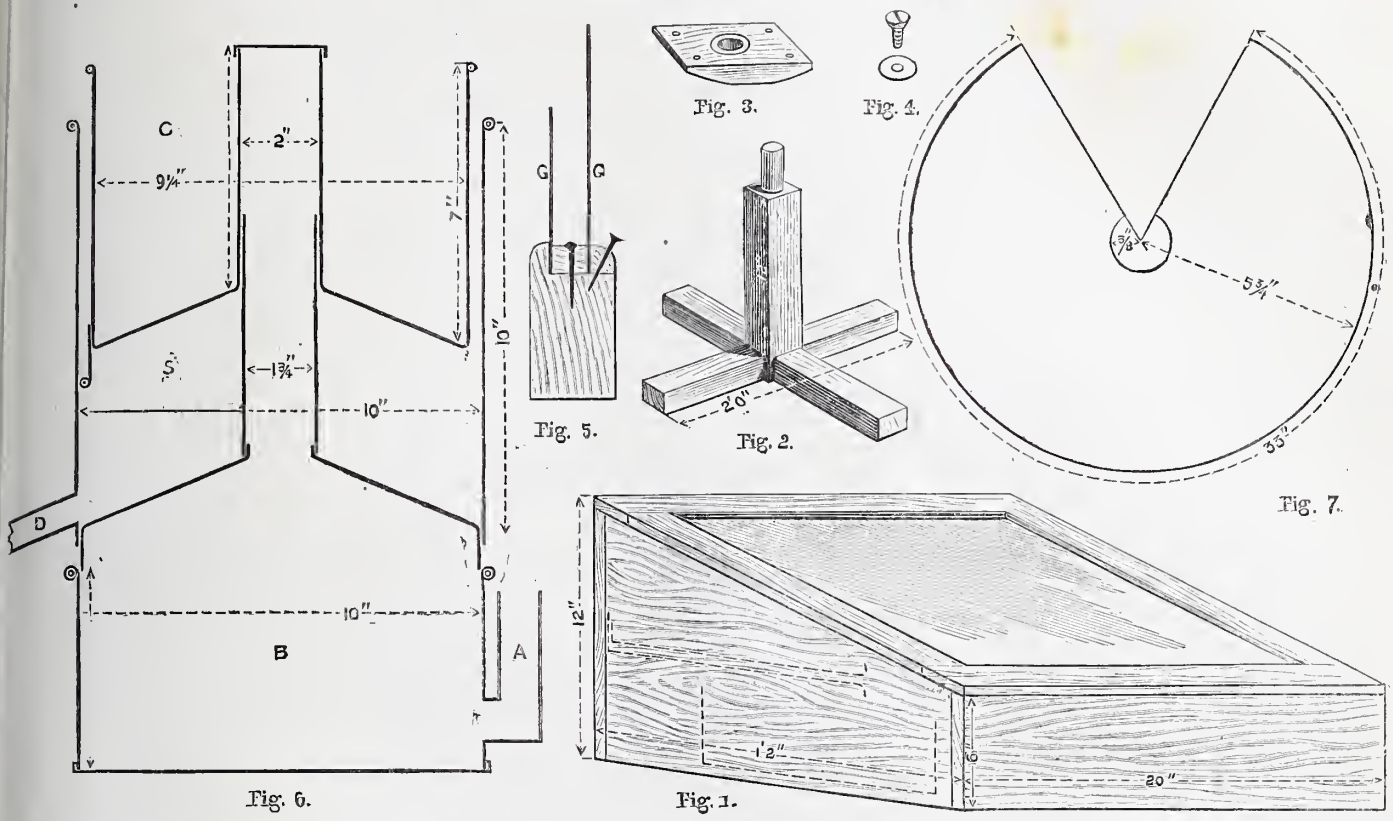


Fig. 1.—Solar Extractor. Fig. 2.—Foot of Stand for Solar Extractor. Fig. 3.—Revolving Top, fitting on Foot of Stand. Fig. 4.—Washer and Screw to secure Top of Stand to Foot. Fig. 5.—Mode of glazing Top of Solar Extractor—G, Glass. Fig. 6.—Section of the Gerster Extractor—B, Boiler; S, Steamer; C, Comb Basket; A, D, Pipes. Fig. 7.—Mode of cutting Cylindrical Top of Boiler.

somewhat lower than the surface of the wood. When the entire stand is together, the extractor can be attached to it by means of four screws passing upwards into the bottom. The object of the revolving part is, I need scarcely say, to enable the glass top to be turned, so as to catch the direct rays of the sun.

I now turn to the Gerster Extractor, of which a section is given in Fig. 6.

It consists of four parts: 1, the boiler; 2, the steamer; 3, the comb basket; 4, the cover, or lid. Of all tin work I dislike most the making of covers. It is hard to dish them to a nice curve without special tools and blocks; and, consequently, I usually buy a saucepan cover for a few pence at the ironmonger's, and make the other parts of any piece of apparatus to suit the cover. Supposing, then, that the cover is 10 in. across, the boiler and steamer will be the same size.

The former can first be taken in hand. It would be advisable to make it of copper, as it would be then far more lasting. If, however, tin is used, on no account should acid be employed as a flux for the solder, as it would soon eat its way through the plates.

The boiler may vary much in height, but 5 in., shown in Fig. 6, will suit very well. The pipe A requires a word of explanation. Its object is to allow the height of the water in the boiler to be seen without taking off the steamer, which would be an awkward thing to do often.

This pipe would be about an inch in diameter, and have a cork or metal cap to cover the top. Instead of it a U-shaped piece of tin could be soldered over the hole in the boiler, and would be equally efficacious.

The steamer is of the same external diameter as the boiler. The bottom is in the form of a cone, of which a pattern is given in Fig. 7, and a rim of doubled tin is affixed to the lower edge, small enough to fit into the boiler. It is made just in the same manner as an ordinary vegetable steamer, which will be a good guide in its manufacture. The apex of the coned bottom has a hole cut out of it, the edge is slightly turned up, and a $1\frac{3}{4}$ in. tin tube, 6 in. long, is soldered firmly to it. Another tube, D, is soldered into the side, as low down as possible, so that it will drain out all the contents of the steamer.

The comb basket is made of perforated tin, one hundred holes to the inch, which can be procured from Messrs. Abbott, 9, Merchants' Quay, Dublin, at one shilling a sheet, measuring 20 in. × 14 in. The cylindrical part, $9\frac{1}{4}$ in. diameter and 7 in. high, can first be made.

It may be necessary to give a rule for cutting out the material for making hollow cylinders such as this: Multiply the diameter by $3\frac{1}{7}$, and add what is required to make the joint. If a plain overlapping joint is used, add the amount of lap; but if a hooked joint, such as I recommend, is used, three times the length of the turned over parts should be added, usually about $\frac{3}{4}$ in.

In the present case, a strip of perforated tin, $29\frac{5}{8}$ in. × $7\frac{5}{8}$ in., will form the cylinder, the extra width being $\frac{3}{8}$ in. for the wiring on top, and $\frac{1}{4}$ in. to make the joint at the bottom.

The conical bottom of the basket has the same slope as that of the steamer; the same pattern will do for both, except that the radius of the basket pattern may be $\frac{3}{8}$ in. less. A perforated tin tube, similar to that in steamer, but $\frac{1}{4}$ in. larger, is fixed in the centre of the comb basket; but, while the tube in steamer is open at both ends, that in the basket is closed on top with a piece of plain tin—the cover of a coffee canister does capitally.

Three legs made of doubled tin are soldered, equidistant from each other, to the lower edges of the comb basket, so as to keep the bottom an inch from that of the steamer. In Fig. 6 I have drawn the three parts separated from each other, but they would fit down into place in actual use.

To use this extractor, water is placed in the boiler, which is then placed on the range or on a fire; the combs are smashed up and put in the comb basket, which is put into place, and the cover fits over all, and keeps in the steam. Presently, when the water begins to boil, the steam passes up through the centre tube of the steamer, hits against the closed top of the basket tube, and is disseminated through the combs, which it soon reduces to a fluid state. The wax and condensed steam run through the tube D into a vessel placed for their reception, while the dirt and refuse remain in the comb basket.

The basket can be cleaned by a liberal application of hot water in which washing soda has been dissolved, and the point of a brush will take out any stubborn pieces of dirt.

I may here say that all pieces of apparatus should be kept scrupulously clean; honey, like paint, can most easily be got rid of when fresh.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

CASTING FROM NATURE IN PLASTER OF PARIS.

WASTE MOULDING FROM NATURE—MOULDING THE FACE AND OTHER PARTS OF THE HUMAN FIGURE—TAKING A MASK AFTER DEATH—CASTING ANIMALS, LEAVES, FRUIT, ETC.

MOULDING from nature is a branch of the art exceedingly useful to the modeller and carver. It gives him an absolute *fac-simile* of nature's handiwork, always fruitful in suggestions, and invaluable for reference: whilst to others who are no artists it offers an interesting and pleasing pursuit. There are many persons who have no turn for modelling or carving, but who would like to know how to take a successful cast of the face or even of the hand of a friend.

Both these things, and particularly the latter, may be easily done by anyone who has learnt from our former articles how plaster should be mixed, and moulds formed and chipped off. The difficulties, if such they may be called, of moulding from the living face, lie chiefly in providing for breathing during the operation, and in dealing with the hair. In casting the mask of a woman or a boy, the latter difficulty scarcely presents itself, and the novice should therefore first try his hand on one of these. There is another difficulty, perhaps, but this rests rather with the person moulded from than with the moulder, and that is that he or she may find it hard to keep perfectly still; this, however, has to be done, for any movement of the muscles of the face during the setting of the plaster will probably ruin the whole business.

The person to be moulded from—the subject, as we may call him—should either lie upon his back, or be so seated in reclining position that the head can b thrown well backwards on a cushio Means must be taken to prevent the liqu plaster going beyond the limits of the mas which cannot well extend further than the roots of the hair, the front of the ea and a little way beneath the chin. Mould have different ways of doing this; an ea one is by twisting towels round the fac and well tucking them in close to the ski Whatever hair comes within the boundar as the eyebrows and eyelashes must nee do, has to be plastered down with soap; f any loose hair will become embedded in t mould, and when that is removed will ve likely be pulled out. Soap is better for th purpose than the grease used by so moulders, as the latter is liable to soften the natural heat of the plaster evolv during setting. These preparations shou be carefully attended to, but they need n be tedious, unless the subject is a man wi a hairy face. The soaping down of bear moustache, and whiskers, so that straggling hair shall be left, must needs ta time; and the flattening down of the masses will so change the appearance of th face that the cast from such a subject w rarely seem quite satisfactory. The ey and mouth have, of course, to be kept clos during the operation, and breathing has be provided for through the nostrils. Quil or reeds are often placed in them, but expe moulders prefer to keep air passages op by the use of the spatula alone. A ve little olive oil should be rubbed over th skin.

It is well to mix the inner mould wit slightly warm water; this is not only f the comfort of the subject, but because th application of cold plaster to the face likely to cause such an involuntary moti of the muscles as might injure the work.

From the moment that the first spot plaster is applied till the mould is thorough set, which may be ten minutes more or les the subject must not stir any one of h facial muscles; after it is set till its remov he will remain motionless of necessity, ar will probably grow somewhat impatient, f the sensation of being cased in plaster scarcely an agreeable one.

For the sake of making the operation short as possible, some moulders, instead making an inner and outer mould, form th mould in one thickness only. This is point for the exercise of private judgment but if all things are, as they should b properly prepared beforehand, very litt time need be lost in making a partin between the two layers, and the convenien and safety of the inner coloured mould wi not fail to be appreciated when the time f chipping out comes. For his own part th writer would always prefer to make th orthodox division in the mould.

The operator will, of course, have take due care to include in his mask no mor than will "leave" easily. In mouldin from flesh he can, indeed, go farther tha when dealing with a hard, rigid substanc like marble, because flesh will yield. Bu he must remember that bone and cartilag will not give way so readily. For instanc should he extend his mould to behind th ears, he will find those members sufficien to prevent it from leaving. He must b careful on this point, as any error in thi direction would cause much discomfort t his subject, and probably oblige him t break his mould.

Otherwise, nothing will be likely to inter fere with the easy removal of the mould

unless it may be that certain small hairs will become embedded in it, and this it will scarcely be possible altogether to avoid. These may cause some trifling delay, as they will have either to give way or to be pulled up; and this may cause some slight pain to the subject. Though the mould when removed will look clean, the proper washing with soap and water ought not to be neglected, for without it mould and cast will not part so well.

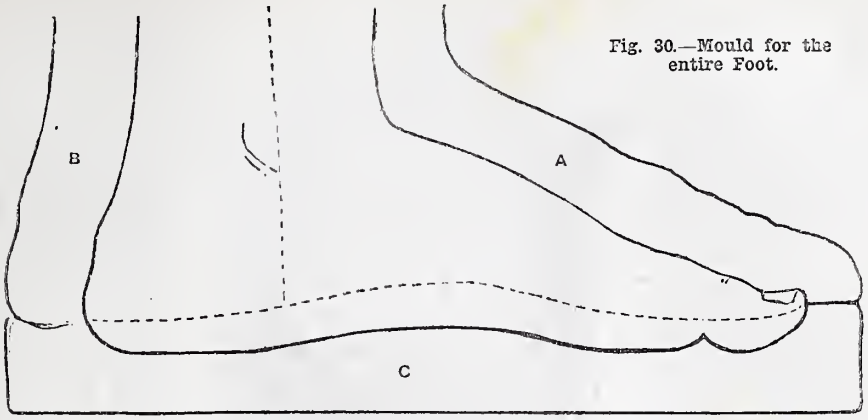


Fig. 30.—Mould for the entire Foot.

In a mask cast from nature the eyes, of course, appear closed. Anyone who has the skill can, of course, with some little labour, show the eyes, and if he chooses build up the remainder of the head and bust in plaster. Yet a bust so treated is rarely satisfactory; it looks what it is—a makeshift. If he can model well enough to do this, he will be wiser to model the entire bust in the regular manner in clay, using his mask as an authority; and in any case the best line to take with the mask is to mount it on a board covered with velvet, and keep it as it is.

Casts are occasionally taken from all parts of the human figure. From arms and legs the moulding is very simple, and the result generally satisfactory. There is more difficulty in moulding the "torso" (that is in plain English the trunk), since in the act of breathing the chest is constantly expanding and contracting. That energetic, and, if a man's own opinion be sufficient to establish his claim to genius, that highly gifted painter, Benjamin Robert Haydon, being greatly charmed with the finely developed torso of a negro model, made an attempt to mould it. He did this without taking the necessities of respiration into account. The result was that the plaster setting, the chest was unable to expand, and the fellow was all but suffocated. It was only by breaking the mould to pieces that Haydon restored to him the use of his lungs. Some more cautious moulder must have done the work with greater success, for the writer had for some years a cast of this man in his modelling room, complete in every part except the head.

The hand is an easy and interesting member to cast. Individuality and character are to be seen in it: the hands of an intimate friend often seem almost as well known to us as his face. Hence a cast of the hand is frequently a really valuable memento. As such, more than one side is rarely required to be seen, and the work of moulding is then particularly simple.

The hand may be laid, palm downwards, on a towel, the towel being so tucked beneath it as to fill up all hollows; or perhaps we may proceed with even less trouble by providing a soft pillow on which to lay the hand, for the pillow will so accommodate itself as to fill up all spaces. A towel can be rolled round the wrist at the point to which it is intended to carry the mould. The subject will take the moulding of a hand far more patiently than that of his face, and the operator can therefore proceed more leisurely.

When the mould is set, the whole hand, mould and all, can be turned over, and any little tongues of plaster which may have run beneath, pared away; the mould can then be eased where necessary so as to release the fingers.

If the hand is wanted in the round, so as to show both sides of it, the labour is greater, because the mould must be made in two pieces. The first half of the mould can be made on a pillow as before, the hand then turned over, and the mould trimmed where necessary, including the boring of key-holes along its edges. The second half can then be formed upon it, just as in casting from a clay model in the round. Or perhaps a better way, because it permits of dividing the hand more equally, is to bury one half of the hand in sand, to mould the exposed half, and then to proceed as before. When rubbing oil over a hand or foot previous to moulding, it is well to be particular in applying it round the nails.

The mould for a foot of which only the upper part is to be shown needs to be made in two portions, a front and a heel, the two meeting at the projection of the ankle. A towel can be arranged to prevent the plaster from the first made part of the mould going too far, though an expert moulder will make the division with his spatula merely. But sometimes a cast of the entire foot, in a standing attitude, and in the forms it assumes when weight is thrown upon it, may be wanted for practical purposes. There are some persons, curious in the matter of their boots, who make a point of placing a cast from one of their feet in the hands of their bootmaker; and it must be owned that they show wisdom in so doing. To make such a cast it is well to knock together a shallow wooden tray, of length and breadth sufficient to receive the foot, and into this to pour plaster to a depth of three-quarters of an inch. On this, as soon as it is set, to place the foot, and to pour on more plaster, so as to encase all the sole and so much above as will leave with it. The edges of this have to be trimmed and key-holed, and upon it the two-part mould for the upper portions of the foot formed as before. In Fig. 30, such a mould is seen in section; A being the part enclosing the front, B that enclosing the heel, and C, that enclosing the sole. The tray will be taken to pieces before chipping out the cast.

Taking a mask after death is not a cheerful but still not a difficult task. The rigid features can no longer ruin the work by any involuntary movement, there is no occasion for undue haste when the subject can feel no impatience, and for the breathing which has ceased there is no more need to make provision. It is well to stop the nostrils with plugs of oiled cotton-wool, which can be pulled out afterwards. In other matters the process is the same as casting a mask from the life, but, except as regards dealing with the hair, without its difficulties.

If a posthumous bust is required, a mask taken after death is a most valuable aid to the modeller. The soft parts—the features—may, and probably will, have changed much, but the great landmarks of form will remain unchanged, so that from them the exact proportions can be faithfully reproduced, and photographs will enable him to restore what is altered or lost. Where no bust is needed the mask will form a melancholy but most precious memento of the lost one.

Among the lower living creatures, birds and furry animals are for obvious reasons not well suited to the purposes of the plaster moulder; but fishes, snakes, lizards, frogs, and all such like naked beings, suit him admirably. With these there is no difficulty beyond the mere trouble of packing, and this, so far as the writer's experience goes, is most readily done with sand. On this the creature can best be arranged for moulding in a single piece, should that be all that is required; or if the entire animal is wanted in the round, one half can be buried in the sand, the exposed part moulded first, and the other afterwards. The animals most easily dealt with are fishes and snakes; more skill and patience being needed to mould reptiles with feet.

Casts from such objects are much appreciated by those interested in natural history; and are of very great service to persons engaged in the decorative arts, wood and stone carvers more particularly. To these art workmen casts from vegetable forms are also of service—from leaves especially.

We may almost venture to say that no one has ever been able fully to appreciate the beauty which lies in those common leaves which grow around us who has not cast them or seen them cast in plaster. Looking at leaves in our ordinary careless manner, we take little heed of their curious serrations, of

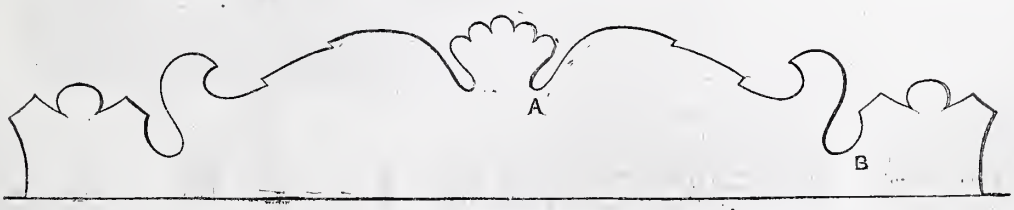


Fig. 31.—Elastic Moulding.

their intricate veinings and markings, of their delicate curvatures. Their colour and partial transparency do something towards hiding these things from us. But when we see them emerging from the mould in the new, pure, white plaster, their marvellous workmanship forces itself upon our notice. The absolute fidelity with which this opaque and brilliant material reproduces all, even the most minute detail, delights and astonishes us—or if it does not, we must indeed be dead to all sense of admiration.

The way to reproduce a leaf in its beauty is not to press it down flat, or to lay it on a board, so that the weight of the plaster poured upon it will flatten it; we must preserve its natural curves. If we lay it upon the table we shall see that it is anything but flat, and that it rests only on three or four points. What we have to do is to pack sand under it as it lies, so as to give it a solid bed; we may then pour on our plaster. A leaf needs no oiling, and will, after the completion of the mould, readily come away, though a little easing is sure to be needed at the edges where the plaster may have overlapped them, especially if they are deeply serrated. Probably the bed of sand will have extended beyond the leaf on all sides, and some of it will adhere to the mould; it is not desirable to scrape this off; if left, it will, after the cast has been made, be seen to form a roughened background to the leaf, which will decidedly add to its effect, and set off its delicate modelling.

Groups and arrangements of leaves, admirable for decorative purposes, may be formed by the moulder if he has taste and judgment; and by judicious packing he will find little difficulty in casting fruits, berries, etc., in the same way.

CLOCK CLEANING AND REPAIRING.

BY A PRACTICAL HAND.

This paper, let me say, is on my favourite work, for before I went to the trade, at the age of twelve, I made a wooden clock, with wire pinions and thick tin 'scape wheel, a piece of steel legging spring for pallets, wooden rod pendulum, and bell-pull ornament for ball. It went well for years; but think of the time! Still, it was a labour of love; and when I look back at the age of forty-nine, I think of it as giving me the most genuine pleasure of all my work.

We read of Robert Ferguson, the Scotch philosopher, in his youthful days as a shepherd, making a wooden clock, and also a watch, after seeing one a friend allowed him to examine. He made the spring of whalebone, and spiral or hairspring of the same material. This watch went, so the book says, but I think only when it was carried.

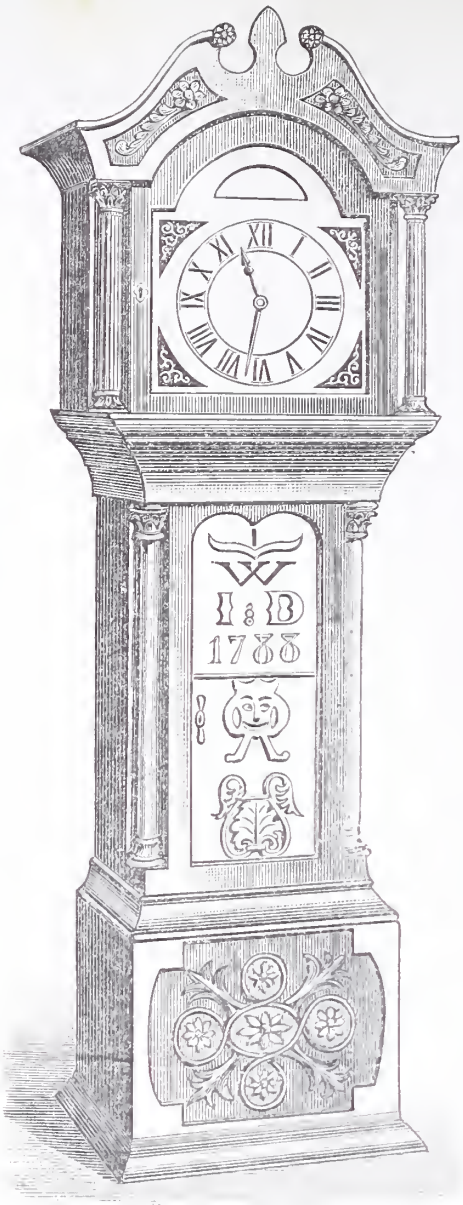


Fig. 1.—Grandfather's Chiming Clock, 18th Century.

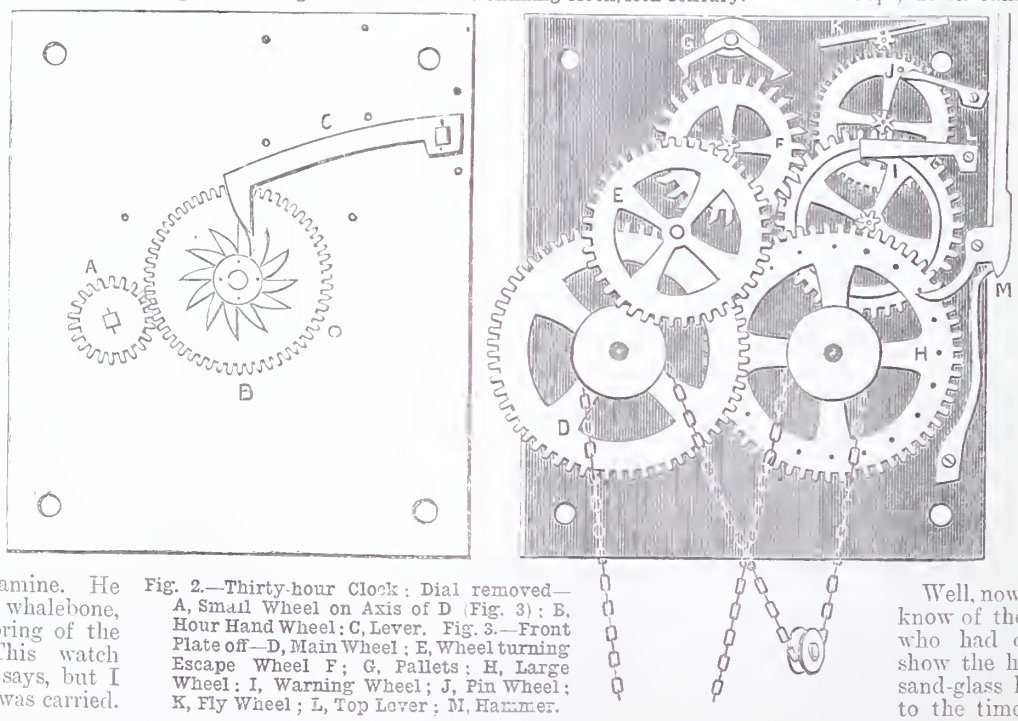


Fig. 2.—Thirty-hour Clock: Dial removed—A, Small Wheel on Axis of D (Fig. 3); B, Hour Hand Wheel: C, Lever. Fig. 3.—Front Plate off—D, Main Wheel; E, Wheel turning Escape Wheel F; G, Pallets; H, Large Wheel; I, Warning Wheel; J, Pin Wheel; K, Fly Wheel; L, Top Lever; M, Hammer.

Knowing what a difficult thing the escapement alone is to make, by those serving seven years in the good old days, the statement will not be believed by those who understand a watch; exaggerations in such cases are often made.

I next constructed a clepsydra or water-clock, which told the hours and quarters only with one hand. I made a tin cylinder eight inches in diameter with divisions inside—twelve equal, placed on the slope, and a small perforated hole same size and place in each—cemented on the end, and placed water in one compartment, and secured the hole I inserted water at. Then on the axis at one side I fixed a small reel, wound on my cord, attached a weight rather heavier than the water, and set the odd hand at the hour, and so the water commenced to slowly pass into the next compartment. It went all right, except timekeeping, doing it under the hour. But overcome that I must; so I cut from the weight layers of lead until it went as near time as an old verge might do, a *few minutes* either way. It was a novelty for one thirteen years old; but winter came; alas! it ceased to work. We did not know of glycerine in those days, else it might have been overcome. To wind it up, I had to turn the whole affair, to coil up the cord on spool, reset hand, and off again.

When I began work in earnest as an apprentice, I constructed an original alarum to waken myself—at six in those days—to go to work. On the case of clock in my room I placed a pin to nearly touch the chain holding weight driving this clock; I marked chain at this pin at ten o'clock, and saw where it was at 5.45 a.m. Now I attached a cord and hook over a pulley on the side of wall a little from the clock, and further on near my bed I fixed a wooden frame with two eyelet pins, and the other end of cord with a wire to go between the eyelets of those two pins, and from this sliding pin I attached by wire loop a noisy canister of large size. Now, to set it, I passed pin through one loop, then put wire loop of canister on, and passed through the other loop. At ten I hooked on the pin part on clock chain, and when 5.45 came it was drawn tight and out of loop; down came noisy canister and aroused me at once. Rather clumsy, but effective, for a boy of fifteen. If a little sooner or later to bed than ten, I hooked on to chain a little higher or lower; it was easily reckoned. Next was a chiming clock; but I must leave the description for the end of these papers, when I will also describe a mysterious clock, transparent dial, and an electric alarum which I made, as they will no doubt interest many readers.

Well, now to business. We all know of the good King Alfred, who had candles marked to show the hours by night, and sand-glass hours by day, down to the time when clocks went

without pendulums, having an escape wheel on the top, with teeth like the old verge, and pallets same; and instead of balance rim, a hairspring had two weights so placed at angles on small arms that one was at rest when the other was raised ready to again receive its impulse—timekeeping very indifferent: one may be seen in motion now at South Kensington. But when Galileo invented the pendulum, from observing a swinging chandelier in the cathedral, clocks then began to be of use as accurate timekeepers, and sundials went into the realms of antiquity. Every form and style of clock imaginable have been constructed since that grand invention, even to those which will run one hundred days by once winding; they are partly after the plan of the common roasting-jack, several revolutions both ways occur before two teeth of the 'scape wheel pass onward. The clock nearest perpetual motion is in a church in the south of England: the large weight in one week goes down the interior portion of the steeple, and when nearly at the bottom it rests upon a lever which turns on a water tap, passing water into a small turbine water-wheel. This winds up the clock, and when nearly at the top by a connecting rod turns the tap back and waits another week. I know of nothing nearer perpetual motion (of any service) than that. The electric clock I would like to tell you of, but I must not take up further space.

Grandfather's Clock.—I will now give directions for cleaning and repairing a grandfather's clock, with a sketch of one in my possession, date 1788, ancient carving on the head, door, pedestal, etc., which is very much admired in this latter part of the nineteenth century: a 30-hour grandfather's clock, with dial removed (see Fig. 2); with front plate off (see Fig. 3).

In Fig. 2, A is the small wheel fixed on to the axis of largest wheel, upon which the chain acts; this turns B once round in twelve hours, carrying one hand. On this wheel is riveted the pointed toothed wheel which lifts the lever C, setting free the striking part of the clock (see Fig. 3), and causes it to give warning to soon strike the hour. This is done by lifting L out of its resting-place on the rim of wheel I, and allows the wheel J to nearly revolve once round. In putting together this is the only difficulty an amateur has to contend with, by not refitting so as to give sufficient warning, or when doing so partly raising the hammer, thereby causing it to strike first blow in a hurry. This is a tell-tale that an amateur has been at work.

The refixing of the chain will be a little difficult, but not so if you will jot down on a piece of paper how it passes over and under (see Fig. 3). One part from weight pulley goes over large wheel left-hand side and down to small lead circle; the other coil of chain passes from pulley to left side of large striking part wheel (this has a ratchet upon it), and passes over and down to small lead circle; you will see now it will wind all up that is required by one outside coil right-hand side. The pull of the weight is equal on both going and striking parts. I have heard it argued by men who ought to have known better that each received full weight. It is easily proved not to be so by attaching the weight by hook to a single chain, as the ticking is twice as vigorous.

The main wheel D turns E, which turns F the escape wheel, giving impulse to pallets G, whose crutch is moving the pendulum. I once remember an old country woman who had come five miles to get pendulum made right, for it was the only part that would not go; scarcely credible, but it is nevertheless true, not more than four years ago either.

Next we have the chain turning large wheel H, which turns warning wheel I, and this turns J, the pin wheel, which has a pin fixed so that it rests upon the lever; when warning is complete, this wheel turns fly wheel K, which completes the lot, except at the back of plate, where there is a wheel with twelve indents set at various distances to allow the arm of the lever inside to be held up until the number is struck. This wheel is turned slowly by a small wheel which is fixed upon axle of wheel H; it cannot be seen until count wheel is taken off. This small wheel is often liable to be lost, as it is only put on to the square end of large wheel axle, and in drawing this wheel out in taking asunder, the small wheel drops unnoticed by the beginner.

Having all to pieces, dip them overhead in paraffin oil to soften coagulated oil and dirt; this it does thoroughly; then wipe all dry, and thoroughly brush bright with larger brush and chalk or prepared powder. Then see all teeth are clear and pivot holes round and not too large; if so, fill in with brass, clinch both sides, and use your drill: not too large—it is easier to make larger, but not smaller, remember. Should the pallet face be worn hollow, place it in vice or piece of iron with a hole in it so that you can tap it gently with a light hammer and so move $\frac{1}{8}$th of an inch or so, and it will then be as good as ever, and have a larger swing in the pendulum. It may have already been moved by some clock jobber; in that case you must with a fine file level each face and *slightly* bring the two faces near; best to lay the pallet on a clean sheet of paper and mark or trace its shape. Now see when filed what it is short, and so make it right; it may save you further trouble.

Should the spring part top of pendulum be broken, which is very often the case, unscrew the brass square from rod, file the pin, and take out spring; replace with verge watch-spring, you will get plenty broad enough.

Should 'scape wheel teeth be worn, which no doubt they will, dress each one up neatly level and all *alike*, then smoothly burnish them with a piece of steel; if the pinion is much worn, best knock off the wheel and get one same size; do not tinker it. The other going part wheels wear very little, so will be all right. In striking part, the fly wheel, the top one, its pinion will be worn, as it does so much more work than the rest. Get a new one; the rest will be fairly good. A grandfather's clock being so well made, the parts I mention are about all that wear to any extent. After cleaning and repairing all well, take the back plate and place the three going wheels and pallet, then put on front plate, and by pressure of your thumb try if your repairing has affected the escapement. It will tick very rapid and easy if all right; if not, and it has a tooth where it stops, touch up with file. Now replace the whole clock, which is quite easy, except striking part—you have the going part in; place large wheel of striking side H next I, J, K, then the three levers; hammer, lowest hole, next front lever, above it stop lever, which drops into rim I. So place them that the hammer is at rest—that is, it has just passed over a pin—when the top pin is holding I secure, and the pin wheel J has about $\frac{3}{4}$ths or $\frac{2}{3}$rds of a revolution to make next time warning is given. To be clear and explicit, the pin in J must be that distance from the sloping lever end that rises to meet, this is where all amateurs fail. You cannot if you take notice as above.

Sometimes it may be put accidentally all right by an amateur; if after all you should get it wrong, so that it gives almost no warning, or the hammer is left ready for a blow, move the pinion out of the hole and pass next wheel on a tooth or two and try till all is right; now pin up and replace the small wheel and count wheel with the spring at the back, also small wheel and large hour wheel at front; run the chain over as I mentioned before and rejoin the link you open, or the weight falling sometime may alarm you. Oil all pivot-holes and a drop on the pallets; replace face (unless it wants relacquering or silvering), and fix on its only hand. To the original grandfather's clock the only thing now is the beat and the bell. Listen to the beat; if it goes unequal—heavy and light—raise up either side of the works a little until it sounds right; now let down again and bend the wire crutch at the back that moves the pendulum *towards the side held up* until you hear it equal; try again until right. Turn round the bell until it is at the loudest sounding part.

A NOVEL AND PRETTY FLOWER VASE.

BY JAMES SCOTT.

Anything which is capable of being so treated that beauteous effects can be obtained in our homes should be welcomed by all workmen, professional and amateur. It may seem, after a perusal of these notes, that it would be but toyish to utilise my suggestions; but I will not be my own executioner by saying it would be so, nor shall I plead for mercy in the event of their being rejected as such. I give them as useful in some cases for providing a means of decorating our rooms by an inexpensive—very much so—method. I am not entirely original in this respect, as will be seen later on.

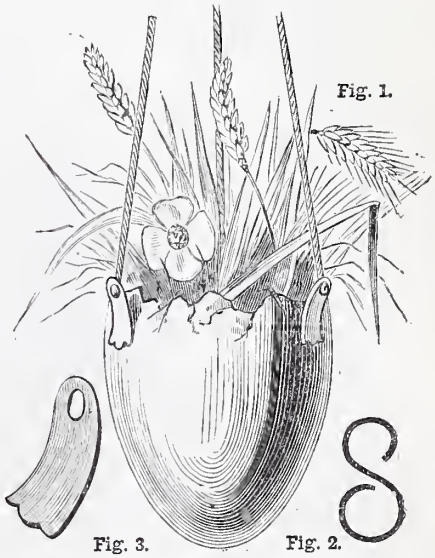


Fig. 1.—Egg-shell utilised as Flower Vase. Fig. 2.—S Hook to support Vase when hung up. Fig. 3.—Shape of Tin Lugs or Ears for Vase.

Whilst cracking an egg-shell the other day, as a preliminary operation to the delightful demolishment of its contents, I bethought me that I could utilise the wasted and seemingly useless shells. It requires very little skill to eat the food portion of an egg without entirely destroying the outer covering. A few of these shells, with jagged edges, might be thoroughly cleansed inside and outside by some simple means, and the

outside painted in a pretty enamel; whilst the inside could be filled with mould, and such humble green stuff as mustard and cress, or very small plants or flowers, grown within. A pin hole in the bottom of the shell would allow the water to escape when the mould was being fed; and I am sure it would not be thought too much trouble to hold a cloth underneath for a second or two to catch the drippings.

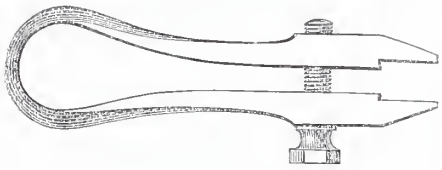
Three small chains or coloured cords could support these peculiar flower-pots. If small pieces of tin, such as are shown in Fig. 3, are cemented to the shells, they will serve as fasteners for the lower ends of the cords; and a small hook, like that in Fig. 2, can receive the top end. I frequently see genuine painted ostrich eggs, or porcelain imitations, hanging as flower vases, but the former are comparatively rare, while the latter are sometimes expensive. But were this not the case, they could not be placed so conveniently about an apartment as could the small ordinary shells.

At the sides of a mantelpiece, hanging from underneath overmantel shelves, or upon the wall between pictures, their humble effect would be appreciated. I might also suggest that a few hanging in any of the summer-houses made from the attractive designs of Mr. Yorke, lately given in WORK, would be found ornamental, and would not be likely to detract from the rustic appearance of the houses; in fact, eggs, unpainted perhaps, are an essential of pure rusticity, lying, as can often be seen, snugly in their nests. Someone may say, however, that flowers do not grow from these shells: but should this be their remark, I must remind them that summer-houses, however rustic in appearance, do not grow as such. I may also point out that the mode of treatment I have suggested will apply equally well to cocoanut shells, and to ostrich eggs when you can get them.

MEANS, MODES, AND METHODS.

THE PLIER NUT-WRENCH.

OF the endless diversity of screw-wrenches and spanners, it would seem that ingenuity had almost expended its resources. Some have come and gone, perhaps to be revived under the artificial stimulus of a patent, for many new inventions, if they can boast



Plier Nut-Wrench.

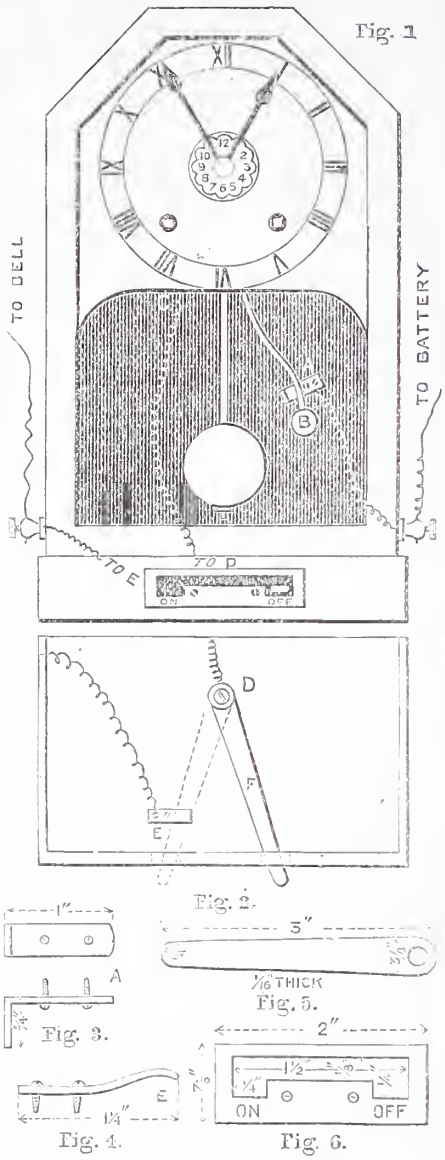
of no other merit, may claim it on the score of antiquity.

A screw-wrench for small nuts, and as a cycle fitting, has been wanted with a grip handle which shall turn end-on nuts as if by a screwdriver, and to have as few parts in making up as need be, so as to be durable and cheap. Here is one with only two parts, and a brass shoulder-collar, which will take nuts up to ¾ in. diameter—with end or side action for turning nuts on or off; or it may be used for a screwdriver, if a screwdriver blade, 1½ in. long, is handy, or awl, punch, or gimlet, all equally usable in the grip of this wrench, with its screwdriver-shaped hand-piece. The inventor is W. Witham, 22, Grove Street, Lisson Grove, N.W.—a well-known tool-smith. J. C. K.

AN ELECTRIC TIME ALARUM.

I send a sketch of an Electric Time Alarum and Switch Fitment, which I made myself, and has been working for the last six months; it is simple, and took but little time to make. It may be useful to readers of WORK who wish to be early risers.

My clock was an ordinary alarum, of which I took away the *bell* and left the other parts. Fig. 1 represents the front of the clock, showing the fitment of the alarum. Fig. 2 is a plan of the inside bottom of the clock, showing the switch



Electric Time Alarum and Fittings.

fitment. A is a piece of brass screwed to the back of the clock, in the shape of the letter L (or right angle), as in Fig. 3. B is the hammer of alarum bell, which comes in contact with A instead of bell. C is a wire connected to the works of the clock, and to D in Fig. 2. E is a piece of brass screwed to the bottom of the clock, bent as in Fig. 4. F is another piece of brass made as in Fig. 5, also screwed to bottom of clock at D, and forming a small lever. Fig. 6 is a brass plate, made as shown, and is screwed to the front of the clock, with ON and OFF stamped on it at each end; the small end of F projects about ¼ in. through it; a piece is cut out of the wood so that F works freely from ON to OFF. E is placed so that when F is brought over to ON the connection will be made. I can set it to any hour I like. J. G. B.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

97.—WINCH'S NEW FOLDING LETTER RECEPTACLE.

THIS consists of a netted bag attached to a small lath of wood about 7½ in. long on one side, and to a thin board about 10½ in. long, and as wide as the lath is long, on the other. The lath is screwed to the door or shutter, as the case may be, and the board, which is furnished with two eyes at the top for this purpose, is hung on two hooks, which are screwed into the door about ½ in. above the letter-slit. The board in this position hangs over the slit in the door, concealing it from view and preventing direct draught. When a letter, newspaper, or any small article is pushed through the slit, the board is lifted, and that which is pushed through the opening in the door falls into the net, and remains there until it be seen and taken out. The receptacle can be made to lock if required. The "Folding Letter Receptacle" is made by Messrs. A. F. Winch & Co., 166, Rochdale Road, Oldham, in two sizes, sold respectively at 2s. 4d. and 3s.

98.—MARTIN'S BINDER AND TRIMMER.

Mr. James M. Martin, St. John's Hill, Edinburgh, sends a "Binder and Trimmer" for pamphlets, periodicals, etc., which will be found of assistance to those who wish to accomplish any rough and ready kind of binding, and to reduce the edges of their periodicals, a mode of treatment I do not like myself, but which may be of use under some circumstances. It is made, apparently, in five different sizes, from 1s. 6d. to 3s. 6d., the prices rising by increments of 6d. The apparatus consists of two frames, the upper one being smaller than the other. On one side of the upper frame are three pairs of wire points which fit over three uprights of brass plate set in the lower frame in the corresponding side. The periodical is placed with its back against the uprights, opened in the middle, and the lower frame is pushed against it so that the wire points pass through the back, each pair on opposite sides of one of the uprights. Wire staples are then put through the holes and bent over, which completes the operation for a single number. Many numbers can be bound together by turning the wires over tapes or bands the same width as the brass uprights. To trim the edges of a single number, or to cut any number of numbers to the same size, each must be laid on the lower frame, and the upper frame placed in proper position upon it. The edges are then trimmed with a sharp knife, the edges of the upper frame serving as a guide for the knife during the operation. The frames are of hard wood and nicely made.

99.—THE CANTILEVER ENLARGING APPARATUS.

This is the name of a new apparatus for enlarging photographs, designed and manufactured by Mr. William Hume, Scientific Instrument Maker, 1, Lothian Street, Edinburgh. It is supplied at different prices according to size and appliances supplied with it, ranging from £4 15s. for quarter-plate, or £6 10s. with enlarging objective, upwards. Judging from the illustrations of the instrument, and the description and instructions given in Mr. Hume's price list, I should take it to be a most desirable apparatus for the purpose for which it is intended.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Geometry, etc.—G. C. B. (*Sutton*) writes:—"Dear Mr. Editor,—Yes, I daresay on opening this you will say, 'another grumbler,' and consign it to the W. P. basket. Yes; I am a grumbler with an object. In the first place, I should like to know if the articles now appearing on 'Sheet Metal Work' are in compliance with the wishes of the correspondents who asked for, and were promised, geometry for sheet metal workers. Now, you surely don't call the simple tawdle (*sic*) now appearing fit for practiable (*sic*) men; and again, your Mr. Alexander talks about rollers, wiring machines, and a host of other tools only to be found in first-class shops; why, in very few jobbing shops will you find even a jenny. And then, again, just the very things one wants to know how to make—oh, you must buy them ready-made. I refer more particulary (*sic*) to bent kettle spouts. Now it frequently happens that a kettle comes in with the spout burnt off, a straight one is put on, and everyone knows how difficult and dangerous it is to pour boiling water from; but what is to be done? no ready-made ones in stock, and the boss not inclined to buy any; he says, make some when slack; the queston (*sic*) is—how? This is only one instance; but others are met with daily in a country jobbing shop. I trust soon to see articles on practical geometry and mathematics, so that we who live in the country far from technical schools and advantages town men have, may not be left out in the cold altogether."—[Well, to begin with, after the very severe facer you have been pleased to deliver to one whom you are good and kind enough to number among your "dears," I may say at once that I did not say "another grumbler" on opening your letter, and consign it to the "W. P. basket," because I could not well do either one or the other before I had read it and mastered its contents, and when I had done this and got to the end of it, I must confess that, to my shame and everlasting disgrace, I laughed. Yes, dear G. C. B., the "simple tawdle" (by which I suppose you mean twaddle) that is now appearing in the shape of *my* Mr. Alexander's "Sheet Metal Work" is in every way calculated to meet the requirements of, and is perfectly "fit for, practiable (by which I presume you mean practical) men, and I may assure you at once that letters are received which show that many are profiting by the papers that *my* Mr. Alexander is writing, and especially in this way—namely, that when they pass from a "jobbing shop" into a "first-class shop," as most, if not all, of them who are not already in the latter are seeking to do, they will find themselves all the more at home in their new sphere of labour than they could possibly have done had Mr. Alexander done the thing which he has not done, and ought not to have done, by taking up your line of treatment, and entirely ignoring the machinery which has been introduced to facilitate operations, abridge labour, and therefore lessen cost of production in the tin-plate worker's craft. Now you clearly wish him to come down to your level by talking, or rather writing, about matters which most young apprentices would understand, and which ninety-nine out of a hundred journeymen would not care for. He, on the contrary, wishes you to come upstairs to his level; and if you will make up your mind to study his papers with care, you will certainly be able to get up half-way, if you do not reach the top landing; and I presume you have some desire to get out of the jobbing shop into the first-class shop, which is infinitely better than getting out of the frying-pan into the fire, which you have unfortunately done in this case. I am not a tin-plate worker myself, but although many people are inclined to "write me down an ass," and do so sometimes to such an extent that I voluntarily touch my ears to ascertain to see if they still remain *à la mode*, or have assumed a long and hairy form like those of Midas, yet in the matter of bent kettle spouts, it would not puzzle me to accomplish the bending of a straight spout into the form shown in Fig. 6 (page 469), by filling it with lead, and then coaxing it into the desired form with a hammer, after which the lead must be run out; and to understand that spouts like Fig. 7, which, with Fig. 6, I reproduce here to save readers the trouble of reference, are made in halves, and then brazed up. I have asked Mr. Alexander to enlighten you on this point, and you might have arrived at the information without throwing bricks at him, metaphorically speaking, by simply asking the question; but now you must wait for the enlightenments until the tea-kettle question comes to the front, when the formation of a bent spout will no longer remain a mystery to you or anybody else. But now I am brought face to face with a fact which "everybody knows," but of which I have hitherto remained miserably ignorant—namely, that it is both "difficult and dangerous to pour boiling water from" a straight spout—an operation which I have been permitting the feminine portion of my family to perform daily for many years, when manipulating the coffee-pot at the first meal of the day. How truly thankful I ought to be that they have hitherto escaped disfigurement through accident, if nothing worse, which might have arisen from pouring hot coffee from a pot with a straight spout! Well, it is never too late to learn, and thanks to you, dear G. C. B., I have added to my limited knowledge, and am better informed now than I was before I received your letter. And now I must put you to a little pain, as the surgeon said before sewing up a scalp wound in a broken head, by telling you that it is of no use to put any trust in the appearance of "articles on practical geometry and mathematics" in WORK, "so that *we* who live in the country, far from technical schools and advantages town men have, may not be left out in the cold altogether." But according to your letter, you hail from Sutton, Surrey, and, according to my notions of the geography and topography of the home counties, Sutton is only thirteen miles from London by the London, Brighton, and South Coast Railway, and therefore not so far from the metropolis as to prevent you entirely from the benefits to be derived from the technical schools that are to be found therein. Besides, I trust—you see I am going to do a little in that line now—that you may soon have a technical school at Sutton. Meanwhile, let me remind you that there is an admirable series of "Lessons on Practical Geometry" in both the "Popular Educator" and the "Technical Educator," published by Messrs. Cassell & Co., which I cordially recommend to your notice, and that, if you prefer such lessons in a collected form, you will find them in "Linear Drawing" and other volumes of Cassell's Technical Manuals. WORK is, of course, an educational journal from one point of view; but there never was, and there is not, the slightest intention of conveying elementary instruction such as you ask for in your letter, and which has been already completely and efficiently supplied in the educational works and elementary text-books to which I have referred. You might as well ask for "Lessons in Spelling," or for the beginning of all knowledge that is taken in by the eye as well as the ear—namely, the alphabet.—ED.]

Bent Kettle Spouts.

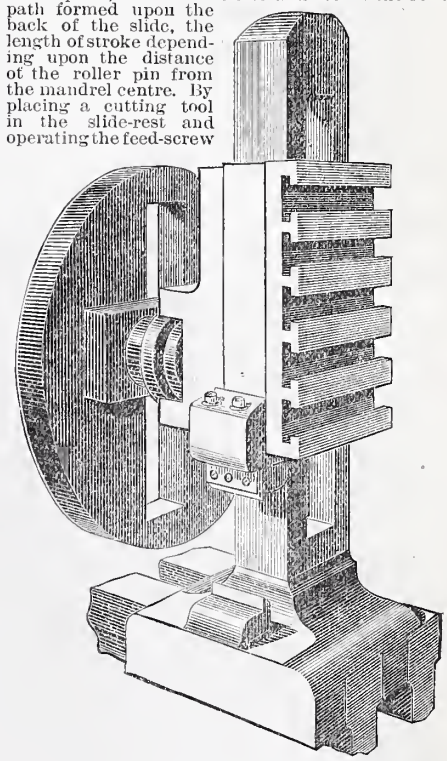
Gaiting Wheels. — WORKER BEE writes:—"With reference to my note on this subject (see 'Shop,' Section I., page 519 of WORK), the accompanying sketch was omitted from my text there. It is now presented, and will serve, I hope, to make my remarks the more understood."

Gaiting Wheels.

How to Fret a Banjo. — J. G. W. (*London, N.W.*) writes to R. H. H. (*Crewkerne*) (see page 503, Vol. II.):—"Have you read my instructions 'How to Fret a Banjo'? (Vol. II., No. 70); and if you have read them, have you given them a practical test? I did not say divide the neck of banjo into eighteen equal parts with a pair of *compasses* or *spring dividers;* the distance between the points of compasses will give the exact distance from the nut to the first fret; then divide the distance from the first fret to bridge into eighteen equal parts: that will give the distance from first to second fret, and so on with the others, dividing from each fret to bridge into eighteen parts. I say again that this is the best and easiest method to fret a banjo, and until someone can show me something better I shall continue to adopt it. Of course it requires patience and care in setting out a scale: there are no 'near enoughs' about it; it must be exact. While writing this I have tested a mandoline I have made and fretted by the method I give, and find that it is practically true, if not theoretically; so, therefore, if the method I give is suitable for fretting the short neck of a mandoline, it is perfectly clear that it will do for fretting the neck of a banjo. You give an elaborate lot of figures, giving the distances for fretting Brewster's 'grand orchestra model,' which, by the way, has a 13 in. hoop, and not, as you state, a 12½ in. Would you be surprised to hear that this maker's banjos are fretted by precisely the same method that I gave in Vol. II., No. 70? Very funny, isn't it? If you will write to the Editor for my address, I will mark off and send you one of my fretting scales to test, if you are still not satisfied."

Motto for WORK. — AN OLD SUBSCRIBER writes, in sequence to J. W. H., as follows:—"On page 501 of WORK, Vol. II., under heading 'Cork-cutting Machine,' you suggest that '*Ab uno disce omnes*' would be a good standing motto for the periodical. So it would. But will you permit me to suggest a shorter, and an equally appropriate one—viz., '*Solvitur ambulando?*' For, in all matters coming within the wide scope of WORK, the difficulties of every kind experienced by subscribers (professional as well as amateur) are removed with such admirable lucidity by the staff of WORK that it becomes a pleasure not only to those who live thereby, but also to such as, like myself, take it in hand to occupy a leisure hour."

Improved Attachment for Lathes.—F. M. R. (*London, E.C.*) writes:—"The apparatus shown in the accompanying illustration will be found a very useful adjunct to a lathe or any similar tool from which a vertical reciprocating motion can be obtained. It consists of a standard which is bolted to the bed of the lathe; upon this slides a grooved face-plate, to which is secured the work to be tooled. This face-plate is moved up and down by a roller mounted upon a pin bolted to the ordinary lathe chuck-plate, which travels to and fro in the roller path formed upon the back of the slide, the length of stroke depending upon the distance of the roller pin from the mandrel centre. By placing a cutting tool in the slide-rest and operating the feed-screw by hand or by means of self-acting motion obtained from the slide, metals may be planed, shaped, key grooves cut, and a variety of other tooling work accomplished with accuracy and rapidity. For the convenience of light metal-workers, a punch and pair of shearing blades can be added for cropping plates and roughing-out material. The grooves upon the sliding face-plate can, when desired, be replaced by a vice for holding the work, or a vice can be bolted to the grooved face-plate. The illustration is taken from an attachment fitted to a 4 in. centre lathe, which has a stroke of 3 in.; a speed can be obtained of 50 to 200 strokes per minute."



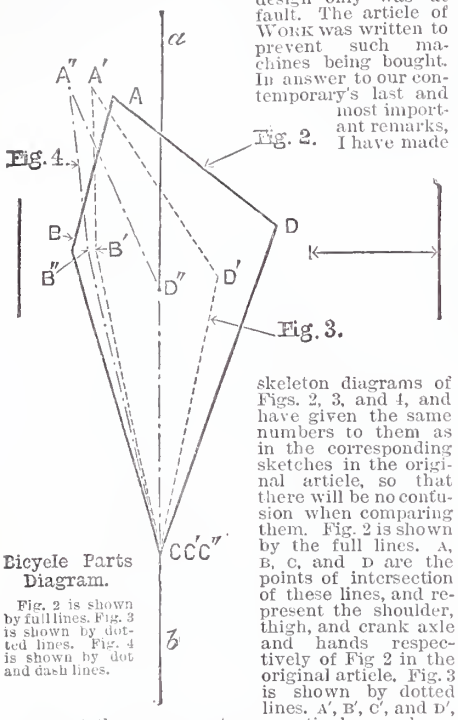
Attachment for Lathe.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Unsightly Cupboards.—CUPBOARD.—No end of resources are open to you to render your cupboards sightly instead of being an eyesore. Do away with the crimson calico, and paint the glass in some flat but genial tint. Then you might ornament the panel grounds with *fleur-de-lis* or other stencil patterns in another colour. Or you can obtain some of the imitation stained glass patterns sold largely in London. If you refer to the Index of Volume I. of WORK, you will get several hints as to decorating

in this way. A coat-of-arms or motto might be worked in.—C.

Bicycles.—THE IRISH CYCLIST.—Our contemporary, "The Irish Cyclist," criticising an article on "A Few Hints to Intending Purchasers of Cycles," Vol. II., No. 66 of WORK, remarks:—"To commence with, the author conjectures that the reason why riders put their saddles back is to secure adhesion of the driving wheel to the ground, whereas a rear-driving wheel requires no such thing, and the only reason a safety or tricycle rider puts his saddle back is that he wishes to *sit behind his pedals.*" In this sentence our contemporary jumps to a very false conclusion. It was not the author's idea to convey the impression that the *riders* put their seats back any more than that they had the handle bars placed too far forward or too high, but that the *makers* did it and did not allow sufficient adjustment to move it forward if the rider desired. I myself do not think that 20 per cent. of the riders know that they are increasing the adhesive power of the driving wheel by placing the seat further back over the centre of the wheel. I have on several occasions met men on the road who have complained that they could not sit upright on their machines on account of the seat being so far back, and yet at the extreme limit of its forward adjustment. Again, I have met them with the handles almost as high as their chests, and not capable of being lowered. In these cases the riders wanted a better designed machine, as the design only was at fault. The article of WORK was written to prevent such machines being bought. In answer to our contemporary's last and most important remarks, I have made



Bicycle Parts Diagram.

Fig. 2 is shown by full lines. Fig. 3 is shown by dotted lines. Fig. 4 is shown by dot and dash lines.

skeleton diagrams of Figs. 2, 3, and 4, and have given the same numbers to them as in the corresponding sketches in the original article, so that there will be no confusion when comparing them. Fig. 2 is shown by the full lines. A, B, C, and D are the points of intersection of these lines, and represent the shoulder, thigh, and crank axle and hands respectively of Fig 2 in the original article. Fig. 3 is shown by dotted lines. A′, B′, C′, and D′, represent the same parts respectively as above, but in the positions of Fig. 3 of the original article. Fig. 4 is shown by the dot and dash lines. A″, B″, C″, and D″ represent the same parts respectively as above, but in the positions of Fig. 4. In the diagram, Fig. 4, the handles D″ and the crank axle C″ are in a vertical line and not inclined, as shown in the original sketch; the reason will be explained later. In the diagrams I have taken the crank axle as the common centre and drawn a vertical line *a b* through it, and then marked off the relative positions of the shoulder, thigh, and hands in each sketch. Fig. 4 represented, in the author's judgment, the best relative positions of the seat (represented in diagrams by thigh), handles, and crank. The seat and crank in Fig. 3 were intended when drawn to be in the same relative position to those in Fig. 4, and when due allowance has been made for stretching forward to reach the handles, very little more is necessary for inaccurate drawing, as will be seen by the diagrams, in which, if the point D′, representing the handles, were brought to D″, the points A′ and B′ would almost coincide with A″ and B″ respectively of Fig. 4, thus producing the same "ideal" position for the safety as for the ordinary. Our contemporary continues:—"In brief, the only defect of the attitude in Fig. 2 is that the handles are too forward. Bring them back (as they would be brought back in almost every first-class machine of the time), and the rider can sit upright on his saddle." There must be some difficulty about bringing the handles in the safeties as near the body of the riders as in the ordinaries, or we should surely have had some enterprising maker to the fore with them; but up to the present no such machine has been noticed by the author. If the rake of the fork or the bend of the handles were excessive, then it could be arranged; but most probably there would be some unforeseen defect conducing to back steering. This Fig. 2, as will be seen from the diagram, is not, as our contemporary asserts, nearer the "ideal" position, Fig. 4, than Fig. 3 is, and the only defect of this figure is not, as our contemporary asserts, that the handles are too far forward, but as stated in the original article, "The principle defect of this figure is that the handles are too high." In the original Fig. 4, the handle and the centre of driving wheel, though shown slightly out of perpendicular, were intended by the author to be in a vertical line; but the block evidently got slightly twisted, which in this position makes the horizontal distance from the seat to the centre of the crank axle more nearly coincide with Fig. 2 than Fig. 3, which mistake principally called forth the remarks of our contemporary. If the author of the criticisms will now kindly follow the advice given to us and set up perpendiculars through the crank axles of the sketches they have reproduced, and measure the horizontal distances between these and a point representing the thigh bone of the riders (this measurement is preferable as the nose of the saddle is not visible and the back is not so accurately drawn), he will find that Fig. 4 is so twisted that it now more nearly coincides with Fig. 1, which he admits is a bad position, than with any of the other sketches. I think, when, even in copying four sketches, such a mistake is made, that our contemporary might allow a little more latitude in the original designs.—P. B. H.

Opal Letters.—W. H. C. (*Ilkeston*).—You will obtain these of Messrs. Nash & Hull, 202, High Holborn, London, W.C., or of the Patent Letter and Enamel Co., Limited, 144, High Holborn, London, W.C.

Self-acting Fountain.—E. E. B.—The cause of the delay in playing evidently arises from the pipe getting choked with air; possibly you have made the bend too sharp; you can always readily relieve it by blowing down the jet hole sharply; in any case it will right itself in a few minutes if let alone. With regard to the height of jet, it depends upon the bore of the tap; some are very narrow and straight; the best are the widest and conically shaped; if you do not like the 14 in., get an "oil-can nozzle," and use instead; this will give you the full height possible.—C. M. W.

Salt in Bunsen Battery.—J. M. (*Newcastle-on-Tyne*).—A solution of common salt may be used in the zinc compartment of a Bunsen battery instead of a solution of sulphuric acid. The chief disadvantages of this solution are:—(1) It increases the internal resistance of the cell, and, consequently, there is less available current in the outer circuit; but this is not very marked at first. (2) It crystallises in the pores of the porous cells, and soon bursts them above solution line unless soaked in warm water after each time of using. (3) It forms with the zinc a muddy deposit in the cell, and thus makes the battery more dirty than when used with sulphuric acid. (4) The force of the current is slightly less with this solution. The zincs should be as carefully amalgamated to use with this as with other solutions. Wash the zincs in hot soda water to free them from grease before immersing them in the acid pickle, and let this also be warm. You will then have no difficulty in getting the mercury to adhere to the zinc.—G. E. B.

Direction of Current from a Coil.—MAC.—The direction of a current from the secondary wire of an induction coil, whether a medical or a spark coil, is opposite to that circulating in the primary wire of the same coil. The following is a simple method for detecting the direction of an electric current. Dissolve a small piece of copper sulphate (bluestone) in a small quantity of water held in the bottom of a china egg cup or similar small vessel. Connect a scrap of copper foil or large copper wire to each of the terminals of the coil by means of a length of copper wire, and immerse the two scraps in the copper solution. Now pass a current through the coil and note the condition of the copper scraps. One will be corroded by the current; mark this one P, as it comes from the positive pole of the coil. The other scrap will receive a deposit of copper; mark this N, as it comes from the negative pole of the coil. The direction of the current is from positive to negative. Note how the battery was connected to the coil, and always connect it in this way again to be sure of the direction of the current.—G. E. B.

Chair Stuffing.—R. E. H. (*Llanrwst*).—Without seeing the chair, or having actual measurement, it is extremely difficult to explain in anything like a reasonable space how you are to manage. The leather, or whatever the covering is, must be set out for the buttons, and to allow for the pleats, a certain fulness must be allowed both lengthwise and across. For such a chair as you describe I should say a fulness of about ¾ in. would be somewhere near the mark. Remember that the greater the fulness the deeper the pleat can be. In case you do not understand what is meant by the extra fulness, let me say that the covering must be larger by this calculated each way by the number of buttons there would be required for plain covering. Thus, if you have three buttons in a row, allow accordingly.—D. D.

Boring Pinion Wheel.—AMATEUR FIFE.—If your wheel is 12 in. in diameter, and requires a hole of only 1¼ in., I think it should be called a wheel, and not a pinion; if it has arms, you can put it on a face-plate with a little block of wood under three of the arms; let the blocks be of such a height as to lift the rim off the face-plate by about 1 in. all round; adjust thickness of blocks till the rim stands off the plate exactly the same distance; place it as nearly as you can measure in the middle of the plate, and clamp with dogs or bolts passing through the face-plate; then put it on the lathe, and, after centring correctly, clamp it fast. If your wheel has no arms, screw three pieces of hard wood board to face-plate; turn out a recess in these, and fit wheel in, and clamp with bolts.—F. A. M.

Canoe Building.—AMATEUR CARPENTER.—You had better purchase No. 53 of WORK, containing an account of how to build a canoe and of what wood.—L. Y.

Paste for Parchment.—J. S. H. (*Stockton-on-Tees*).—The best thing you can use, as far as I know, for sticking pieces of parchment together is the "Stick-All Cement," sold wholesale by the "Ever-clean Collar Company," 100, Wood Street, London, E.C., who send out sample tins at 9d. and 1s. 3d., post free. It is the *stickiest* stuff with which I am acquainted, and I have seen it used on fractured earthenware and plaster images with excellent effect.—ED.

Alteration of Tricycle.—W. H. (*Gateshead*).—If you will send me a sketch or woodcut of your machine, showing position of cogs, framework, etc. etc., and height of wheels, I will give you full particulars and drawings for altering your tricycle.—F. C. P.

Church Chair.—W. B. (*Howden-on-Tyne*).—I submit a sketch of a match chair for the front of the pulpit. The sides are open instead of enclosed with panels, as your sketch shows the pulpit to be. If you are a joiner you will need no instructions; if not, study back numbers of WORK, or take the design to a first-class chair

Church Chair.

maker. I cannot understand whether your sketch intends to show half spindles faced on to the pulpit, or merely gothics; but you will have no difficulty in altering my design accordingly, if wrong.—J. S.

Painting Cart.—M. T. W. (*Wrableton*).—Refer to No. 65, page 209 in "Shop," Vol. II.; you will see my answer on painting a polo cart; also in No. 81, page 473 of "Shop." The secret of coach painting lies in getting the under or groundwork up preparatory to painting, and not in giving it a great number of coats of paint, which would only tend to make it rougher. As you wish to pick out the wheels with white, if to be varnished over the same day, get some dry white lead and grind in gold-size and turps, adding a little blue to it; or, if you varnish the cart the day after, mix some pure tub white lead, a little varnish and turps, also a little blue in it, to keep the varnish from turning the white yellow. In picking out, hold the liner between the thumb and finger of the right hand, using the other three fingers to guide and steady the hand. To line straight, keep your eye on the quill end of the liner, and not on the end of the liner. When the lining is quite dry wash down with clean cold water, dry with sponge and leather, and give the body and wheels a good coat of flowing best carriage varnish in a warm room; and in painting and varnishing panels the brush must be stroked down from top to bottom of the panel, and never crossways, or the varnish will show even to the under coats; and if the black panels show any grit, never mind, as black is the worst colour for showing up, and white one of the best for not showing when varnished.—W. P.

Soldering Wires.—NAUTICUS.—Although you did not see any heating apparatus, you may depend upon it that the men were soldering the wire joints by heat in the usual way, if they were soldering them at all. It is just possible that they may have made merely a closely twisted long joint, similar to a splice, coated this with a conducting cement, and then covered the whole with Chatterton's

compound, or a similar insulating substance. The flux employed for soldering wires may be either resin or the ordinary soldering fluid (chloride of zinc solution or killed spirits), the latter being easier than resin. Clean the ends of the wires with a bit of emery-cloth, twist them together to form a joint, dip the joint in the soldering flux, then rub it with the hot soldering-iron previously well tinned—that is, coated with solder. Some of this solder will come off the soldering bit, and enough of it will adhere to the joint to make it secure. Wash off the excess soldering fluid with a wet sponge or rag, dry the joint by warming it, and rub some paraffin wax on the warm joint before coating it with cotton, silk, or other insulating substance. If you have a number of joints to make on fine wire, have a small ladle of melted solder handy, and dip the prepared joint in this instead of using the heated soldering bit. The cold soldering recipes you have seen in books only apply to metallic cements for mending fractures in cast ornamental articles.—G. E. B.

Electric Light for Bicycle.—CYCLIST.—You cannot fix an electric light in your "spring back lamp as a substitute for burning oil;" but you may get made for your own use an electric light set, composed of an electric lamp set in a white enamelled reflector, and a small battery made of ebonite cells. Messrs. Cathcart and Peto, Electrical Engineers, 57B, Hatton Garden, London, E.C., inform me that they make sets suitable for the purpose. Each set measures externally 3⅜ in. by 2 in. by 4½ in., and weighs about 2 lbs. The price complete is 35s. the set.—G. E. B.

Relacquering Zinc.—MARKWELL (*Brixton*).—Zinc can be as readily relacquered as any other metal. The metal must be quite clean, and must be heated before the lacquer is applied. Any instructions previously given will apply equally to your particular job.—G. E. B.

How to Make a Landing Net.—F. J. C. (*Maidstone*).—Follow the general instructions given for netting a hammock on the front page of No. 79, Vol. II. of WORK. Get a ring of ¼ in. brass wire 15 in. in diameter, or better still, make a frame out of two pieces of whalebone bent and hinged to form a collapsible ring. Make the first chain of meshes out of stout netting twine in ½ in. meshes, long enough to take in the circumference of the ring. Then follow on with the same size mesh, in finer twine, in one direction round and round for some three or four rounds. After this, abate the number of meshes by dropping three in each alternate round at equal distances apart, and thus gradually bring the net to a taper point at the bottom. Finish off with a grummet or ring of the twine, ¼ in. in diameter, whipped with a bit of white thread. Fasten the net to the ring with two half-hitches of twine in each mesh. The net must be dressed as a fishing-line, and carefully washed and dried after each time of using, to prevent bad effects of damp.—G. E. B.

Dissolving Gold from Engraved Surface.—BLACKBIRD.—Two parts hydrochloric acid to one part of nitric acid is the right mixture to use for dissolving gold, but this will frost the surface of an engraving, and leave it dull. If you dilute the acid mixture with water, its action will be less energetic, and it will not corrode the surface so rapidly. You may dissolve off some of the gold in a solution of potassium cyanide by sending an electric current from the engraved article through the solution to another article—that is, make the engraved article an anode in an electro-gilding bath. This also will rough the surface, which must be got up afterwards by scratch-brushing and polishing the article.—G. E. B.

Emulsion.—AMMATURE.—Abney's books are the best in every respect and thoroughly reliable, and if the directions given in them are thoroughly carried out the experimenter ought to succeed. The following is a simple form: Dissolve 100 grains of hard gelatine in 3 ounces of pure water, in which 32 grains of bromide of ammonium have been previously dissolved. This is done by soaking the gelatine for a few hours in the water and bromide until it swells up and becomes soft, then put it into a water bath, and apply heat until the gelatine is quite dissolved; this must then be put into an opaque bottle—ginger-beer bottle, for instance—and 55 grains of crystal of silver nitrate added little by little, shaking up well between each addition until the whole is dissolved. Pour this out into a dish to set; when it has done so, squeeze it through some coarse canvas into cold running water, and let it wash for five hours to remove the soluble salts; gather it from the water, and place on a hair sieve to drain for some hours. It may now be replaced in the bottle, which can be set in some hot water to melt, and when melted should measure 5 ounces; if it does not, make up the quantity with water, add 5 drachms of spirit of wine, and filter through wash-leather; it is then ready for coating either plates or paper. Any smooth pure paper will do; saxe paper is perhaps as good as any. They require no preparation, being merely drawn over the surface of the melted warm emulsion, and hung up to dry, avoiding air-bubbles. All these processes must be conducted in a weak ruby light. A paper that AMMATURE may find meet his wishes is simply made by floating ready sensitised matt or albumen paper on a 10 per cent. solution of bromide of ammonium for a few minutes, and drying in the dark; this may be developed in the same manner as the ordinary bromide paper.—D.

Tuning Concertina.—J. M. (*Bayham*).—You do not say whether the concertina you want to tune is English, Anglo-German, or German, or if single-note, organ, or "celestial." If it is an English one, and wants thoroughly tuning, do not attempt it, or you will get into a muddle; it will be far better to send it to a maker who will do it properly and cheaply; about 4s. is a fair average, or, if damaged, in proportion. If only a few notes are out of tune you may proceed as follows. First find out which are the faulty notes by sounding each one with its octave, then carefully take out the six long screws and take off the top. You now have the "pan-board" and the *draw* notes exposed to view. Take the pan out by inserting the forefinger in the central hole and pulling it straight up. (Before doing this, however, note carefully the exact position of the pan in the box, so that you may be sure of replacing it in that position.) The *press* notes will now be seen on the under side of the pan, and a circular label will be found in the centre which shows the name and position of each note. Remove the offender by pushing it straight out from its groove with a blunt tool, such as a screwdriver, pressed against the clamp, and if it is too sharp, remove a small portion of the metal of the reed at the *head* by scraping with a penknife or very lightly filing it with a small file. If too flat, alter it by scraping or filing it at the tip, in either case having previously placed a piece of very thin sheet metal or parchment under the reed, to prevent its being bent or pressed down during the operation, which would prevent its speaking freely. Do not do too much filing; a mere touch, especially at the head, is quite sufficient to make a considerable alteration, and if it is filed too much the quality or, as it is called, the "voicing" of the note is likely to be altered. Before replacing, hold the note up edgeways to the light, and you ought to be able to see between the reed and the plate for two-thirds of its length. This applies to all "free reeds" (except curved or bent ones), the larger notes of course requiring more spring than the smaller ones; but it will be a pretty safe guide to give a note from the middle of the concertina a spring of about the thickness of a visiting card. You can now replace the note and the top, and proceed to try it with its octave. If it is free from "beats," or waving, it is in tune; if not, proceed as before till you get it right. The best way of trying the notes is to seat yourself on a chair, and, taking a pin that has had its point flattened out, press down the key of the octave to the note you are tuning, and insert the pin between the key and the cloth bushing, which will hold the note down, and you can then hold the lower head of the concertina tightly between the knees, while the upper one can be held firmly in position with the hands, and the thumbs are free to try the notes. If, on trying the notes previous to tuning, any are found so flat as to be discordant, it is useless to attempt to sharpen them, as the flatness is owing to a flaw in the metal itself, and it would drop out of tune again directly. These remarks apply equally to the Anglo-German, which works upon exactly the same principle as the English concertina, except that the English is known as double-action—that is, press and draw notes are both of the same pitch, while the Anglo-German has a difference of a tone or semitone between draw and press of the same key.—R. F.

Model Cutter.—H. G. (*Dulwich*).—Wait patiently for the article on this subject. Use good white pine for the hull, and yellow for mast and spars. The dimensions given in previous reply are all that are necessary.—G. J. E.

Sawing Machine.—OLD BOY.—An article will shortly appear showing how a serviceable and powerful machine may be constructed at a low cost.—ED.

Tools, etc., for Engraving on Metal.—W. B. (*Newport*).—The only firm with which I am acquainted who deal in *all tools* for engraving on copper, steel, and other engraving, is Messrs. John Sellers & Sons, Arundel Street, Sheffield. Their prices rule rather high, but the tools generally are of the highest quality, so that the extra expense at the outset is usually the most economical in the end. In answer to your second query, I do not know of any book upon engraving on metal. There are several books upon wood engraving and etching, but none, so far as I know, on metal engraving. You will, however, find articles on the subject of engraving in the various encyclopædias—notably, the "English," and which is also illustrated—but as they merely skim the surface of the subject, a learner would hardly gather much information, which is chiefly technical. You will find a short article, fully illustrated, running through Nos. 33, 38, 43, 45, and 48, in the first volume of WORK, and from which I hope you may gain some useful information.—N. M.

Hand Camera.—SAUL.—If you can manage to make an instrument of the kind designed, it should not be difficult for you to construct one of the magazine pattern. There are so many devices—and good ones, too—for effecting a change of plates in a simple manner, that it is somewhat difficult to say which is best. Perhaps one most easily made is when the plates are contained in sheaths and set one behind the other, and pressed up to register by a spring at the back. A light tight bag is attached to the upper part of the camera, the plate exposed being lifted by the finger and thumb, and placed at the back of the others, a piece of wood dividing the exposed and unexposed plates. When this is reached, it is known all the plates have been exposed. A small projection on the top edge of the sheath will assist in counting how many plates are either used or not. In an instrument of this pattern, the number of plates is only limited by the length of the receptacle. Another kind is when the plates are merely backed with opaque paper, just turned over the front edges, and placed behind each other, pressed into register by a spring; after exposure a catch is removed by means of a milled-headed button on the outside of the camera, supporting the plate by its lower edge, and the plate falls into a space below, a weak spring giving it the necessary tilt, compelling it to fall face upwards on the plates below, where it is retained in place by springs. Another simple form is where the plates are held in position like the views in a revolving stereoscope, and kept in register by a lever and button; in this form the plates are fixed in sheaths, which are attached to a small endless band, and by the turn of a button brought one after another into position, an index and pointer showing how many plates have been set for exposure. The list of cameras of this kind is very numerous; the general idea in all is to place a plate in correct position, removing it after exposure with as little trouble and expedition as possible.—E. D.

Book on Graining.—J. K. (*Watford*).—"The Plumber, Painter, and Glazier," 1s., Houston and Sons.—K.

Blisters in Paint.—PAINTER.—Some believe blisters to be caused solely from the presence of water under the paint skin; others vouch that gases and not steam are the direct cause of the nuisance. It is difficult to give an authoritative answer to your query. Are the iron cases free from *every trace* of water or greasiness before painting? If they show rust when blisters peel off, it looks very much like water; there is evidently a want of cohesion between the iron and the first coating. If this is a question of primary importance to you, I would advise you to write to Mr. E. Mathieson, Ardrossan, near Glasgow, for a copy of his book; he will probably let you have it at a greatly reduced price. It is the only real attempt to grapple with "blisters" that I know of. Try also the "Paint Preserver" of the Church Manufacturing Company, Pomeroy Street, S.E. It is a remarkable production, and worth experimenting with.—F. P.

Patches in Painted Woodwork.—ARNOLD.—The "ugly brown patches coming through the paint" after three coats of white-lead paint has been given are very easily accounted for. It is the resin in the knots discolouring the lead paint, and exuding out of the wood. On page 699, Vol. I. of WORK, paragraph commencing with, "Paint is something like," etc., you will find this matter explained. If you did use knotting—I expect not—it was very inferior in quality. Go to a decent shop, and be sure you get the right thing; do not be put off with a drop of polish, etc. Your remedy is to give the places a thin coat, or two thin coats, of "knotting composition;" then make up the white again—use raw linseed instead of *boiled* ditto—in proportions as before. Then touch up the knots twice with the paint, and give one coat all over to get once more a solid uniform appearance. Four coats are none too many, so there is not much harm done after all.—F. P.

Vandyke Brown.—VANDYKE.—The trouble you complain of when using this pigment is not common to such. I should think it is due to either being of an inferior quality or to being greasy, or else there is something wrong with the grounding paint. Get a little pigment from elsewhere. Vandyke should be purchased ready ground in water, and of the best quality only. Perhaps there is no necessity to use it so thick as you speak of; for walnut, you know, there is ivory black, burnt sienna, and vandyke, to get variety of tone with, separately or mixed, as we like. See paper on "Walnut Graining" in WORK.—LONDON DECORATOR.

Marbling.—YOKEL.—The only lithographed colour examples are such as were given with various issues of the *Journal of Decorative Art* (15, St. Anne Street, Manchester) a year or so back. *Dove marble* is of a grey colour; it may be simply imitated. Paint the ground a light leaden tint of blue; make some of a darker shade, and with a feather put in veins and markings across the block or panel; use thin black in the same manner, but rather sparingly; then put in white streaks, and soften all with a stiff softener; when dry, scumble with thin white and put in solid touches of white.—F. P.

Paint for Venetian Blinds.—J. S. W. (*Macclesfield*).—An answer bearing upon this subject will be found on page 780, Vol. I. of WORK. The laths can be easily painted in the usual manner. Let them be first thoroughly washed with soda, then coated with white-lead paint (of desired tint), and finished with a coat of enamel paint, or two coats white-lead paint, and then one coat of light copal varnish. The grey tint can be made by the addition of a little red, blue, or black pigments. A substitute for enamel would be white lead mixed with copal varnish only. New blinds require a first coating of "knotting composition."—F. P.

Cabinet and Overmantel Designs.—S. D. (*Brixton*).—There have been many of these in Vol. I. of WORK. Buy the Index to that volume for one penny, and the whole contents of the volume will be before you. Then obtain the numbers you want through your bookseller, or of Messrs. Cassell and Co., London, E.C.

Pack-saddle.—SADDLE.—The number of Captain H. R. Newburgh-Stewart's Patent, December 1, 1887,

No. 16,540, price 4d. His address is Travers' House, Windsor, Berks. A direct communication with him is the very best course.—J. C. K.

Enamel.—C. M. (*Brighton*).—I do not know what you mean by the "white enamel preparation used by makers of overmantels before ebonising." You must be confounding it with some filling you have seen used or the preparation which is used sometimes when the work is to be polished bright on cheap overmantels. If your frames are anything you want to finish well, let me recommend you to finish them by French polishing in the usual way. If, however, you do not care for this, coat them with a mixture of size and whiting.—D. D.

Recipe for Blacking.—J. W. (*Barnsbury, N.*).—The following recipe, taken from McQuhae's "Decorators' and Artisans' Handbook," may be useful to you and others who are inquiring after this sort of thing:—Four ounces of ivory black, three ounces of the coarsest soft sugar, one pint of small beer, and half an ounce of oil of vitriol. Mix them gradually cold.

Banjo Making.—J. S. (*Glasgow*).—The banjos used by professional players are lined with wood inside the hoop; there may be exceptions to the rule, but all first-class banjos that I have seen have had the hoop lined. There are various new styles of banjos with metal hoops, but no linings to them, in the market; but I have not heard of one which could be at all compared with a hoop made of German silver, edges spun over two steel wires, and lined with wood inside. A number of new notions by myself and other makers have been tried, but up to the time of writing the ordinary model still holds its own. To ensure making a banjo with a good tone, such a one as you desire, you must make a good hoop, line it with wood, fit it with a band with a recess turned in it, or notches filed in it to keep the wires of the brackets from cutting into the vellum; use the best brackets only, for if you buy brackets that as soon as you put any pressure on them the threads strip off, you never will make a banjo to your satisfaction. Use a "Roger" vellum; they are more expensive than the common ones, but the superior results attained by their use more than compensate for the difference in price. When a vellum is properly pulled down and set, it should feel almost as tight and hard as a piece of board when pressure is applied by the thumb or finger. I should certainly give preference to a vellum all white, provided it was of a uniform thickness all round. I would not have a transparent vellum on my own banjo at any price. Banjo players, like other musicians, have their little fads when ordering a banjo to be made: one would like the vellum to have a small transparent patch on it, another would like it half transparent and half white, another all white, and so on. In selecting vellums, it requires care and judgment, only to be obtained by practice and experience (at times, dearly bought); it would not do to be guided solely by the colour of a vellum, as I have seen many which have been nice and white, but which I could not conscientiously use if I wanted to do justice to my customers. I cannot tell you anything about the metal you mention (silveroide), having had no experience with it. I have just made and introduced a banjo with hoop and band made of pure aluminium, which is much lighter than the ordinary metal "jos," about five times lighter than brass, taking equal proportions in size and thickness of each metal. The tone is very good, but I prefer the G. S. hoop. The vellum must not touch the wood lining inside metal hoop, but must rest on spur over edge of the metal. There are a number of banjos imported here from America (warranted *real American* make); the hoops of which comprise an outside casing of thin metal; the bottom edge is spun over a wire, with a thick wood lining; the edge of metal casing finishes a little below the top edge of wood lining. When the vellum is pulled down tight the edge of the metal casing is very apt to cut it, or if it does not do so, the band, not being properly recessed, allows the wires of the brackets to pull into it and cut it. Do not make your banjo after this last-mentioned style, or you will not be able to get the tone you wish for.—J. G. W.

Bookbinding.—J. G. B. (*Stratford, E.*).—I have analysed your note, and have reduced it to three questions. (1) Do bookbinders use any particular form of apparatus to stamp circles on books?—Yes. (2) Is the book laid on brass circles such as printers use?—No. (3) Are such circles and gold lettering done with separate handle letters and circles?—No.—G. C.

Gold Lines.—ANXIOUS.—You want to know how to put gold lines and stamps upon velvet. This is a very difficult process: one which even the best of finishers cannot accomplish at all times in a satisfactory manner. It requires very careful manipulation. I will endeavour to describe the process, and would advise you to make experiment with waste pieces, as you are sure to spoil not a few when you begin. The same details will be necessary whether you are using lines or stamps of any design. Velvet cannot be prepared for gilding by any of the processes already described for leather work. It must not be damped in any way, and the glaire used for leather and cloth would stain it if worked over the surface. There are at least three powders used for making the gold "stick," as we say. One of them is dried white of eggs reduced to powder; another is gum sandrac; while the third is resin: both of these are powdered like the eggs. Either of these can be used, but the gum is the best; it must be reduced very fine, and it is best to be put into a bottle and a piece of fine muslin tied over it: by this means it can be dusted over the part to be gilded. When the powder has been applied the gold is cut to the required size, and lifted on the roll or stamp. The design is then firmly impressed and the superfluous gold wiped off. The tools of course must be heated. When the design is large, it is usual to work it out on paper, and laying it upon the velvet, impress it through, and afterwards go over the design, glairing it with a camel-hair pencil; and when dry, lay on the gold, re-impress the tools as directed for leather work, and when finished, rub off the superfluous gold with a clean rag. As to exactness and regularity, it would certainly be best to accustom yourself to do this without any special tools or appliances. You might, when you have dusted on the powder, draw a line, by means of the straight-edge and a pencil point, and work to the line so drawn. Slight division marks might be made the same way. You could also make lines and marks with chalk; but you must be careful, as velvet is easily marked and stained.—G. C.

Venetian Blinds.—J. J. (*Hadfield*).—Though for many years I was engaged in making Venetian blinds, I never used a paint-box for painting the laths; I have heard of a trough being used for the purpose, which I suppose J. J. means. I regard this trough as a slow, messy, and wasteful contrivance, only useful to a heavy-handed workman, who is quite unsuitable for a blind painter. Laths for blinds are best painted, held by the operator's forefinger and thumb by one of the upper holes, the lower end of the lath being stopped by two small nails driven into a clean board which is resting in an inclined position on the edge of the bench; the slope is to prevent the paint accumulating at the end of the lath. As to a punching-press to make the holes, Reynolds & Co., Acorn Works, Edward Street, Blackfriars Road, S.E.; or Hawkins, 126, London Road, Southwark, each supply a machine which is good and reasonable in price. If J. J. means the varnish used to mix with green, which was so frequently used formerly, turpentine varnish is the article; it has the power to develop the colour in a wonderful manner. This green is not so much used now, as it is poisonous, though I never heard of any mischief from its use. Without the varnish the same quantity of green would only just tint the paint, though a full colour was produced with the varnish. If J. J. means that the blinds are painted and are now to be varnished, the varnish depends on the colour. If blue or grey, the varnish should be the palest of carriage or copal varnish, though what is called maple varnish will do as well. If a stone, buff, drab, any of the reds or browns, greens, or any tints of them, oak varnish will do if of good quality. If J. J. is speaking of blinds not painted, let him stain them, if desired; give two coats of patent size diluted with one-third water, and varnish with best church oak. An article is in the Editor's hands on the subject of Venetian blinds which may help. I could have made this answer shorter if J. J. had been more explicit; but I hope it may be of use to some others, so I give this rather prolix reply, and trust that our worthy Editor may not have to use his shears; but it would be much better if querists would be more definite. Longer questions would require less bulky replies.—B. A. B.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Gypsum.—GYPSUM (*Larnaca*) writes:—"Will any reader kindly inform me how gypsum is burnt in England, and when with coal or coke, what system of oven or kiln is used? I principally want to know how to prevent the smoke from going through the kiln and making the surface of gypsum stone black."

Gear Wheels.—STOCKTON-ON-TEES writes:—"Can any reader inform me where I can buy small steel machine-cut gear wheels? This will oblige."

Cheap Lathes.—ENGINEER writes:—"Can any reader give me the names and addresses of cheap makers of lathes? I have not much money to begin with, and I want to avoid the merchant's profits. I should like to know where I can buy one direct."

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Telephone District and Section.—TELEPHONIST writes:—"In reply to INQUIRER (see page 506), you can buy telephones which are free from the claims of the National Telephone Companies, but they are not practical instruments at all. I would advise you to wait until December 9, 1890, when Bell's patent expires: this you can use both as transmitter and receiver; the carbon transmitter patent is not free until July, 1891. If you require to open a district for telephone subscribers on the exchange principle, you will have to apply to the Secretary, General Post Office, London, for a licence."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—TYRO; ZERO; R. H. W. (*London, S.E.*); J. E. S. (*London, S.W.*); J. C. (*Belfast*); F. L. (*Snettisham*); R. S. (*Norfolk*); YOUNG CHIP; R. G. (*Preston*); SUGAR BOILER; C. H. (*Whitley*); G. W. (*Brockley, S.E.*); H. R. (*Northampton*); T. E. W. (*Hull*); A. H. D. (*Birmingham*); J. M. MC (*Westport*); J. LE M. (*Guernsey*); NEMO (*Lunna*); A. A. (*Duffield*); YOKEL; H. R. (*Paddington*); HARWICH; T. J. (*Tredegar*); GRATEFUL FRIEND; INDEX; SMITH; R. O. (*Sheffield*); W. E. P. (*Manchester*); A. B. C.; T. W. V. (*Leicester*); J. D. (*Glasgow*); F. P. (*Andover*); S. H. B. (*Barnstaple*); J. W. M. (*South Shields*); J. A. W. (*Glasgow*); R. H. (*Accrington*); R. L. H. (*Glasgow*); J. H. (*Pemberton*); LEO (*Wigan*).

"WORK" EXHIBITION.

NOTICE.

WATCHES, JEWELLERY, &c.

THE Secretary hereby gives notice that on and after December 10th next until December 20th, exhibitors may forward to the Secretary, "Work" Exhibition, Messrs. Cassell & Company, Limited, La Belle Sauvage, Ludgate Hill, E.C., any small exhibits of value by registered letter (insured if above £5 in value). By this means such valuables will be safer than if sent to the Polytechnic Institution direct, and if the official label is enclosed the Secretary will guarantee that they shall be duly catalogued and exhibited.

JOHN W. HARLAND, Secy.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	.. .. ..	1s. 8d.
6 months, "	.. .. ..	3s. 3d.
12 months, "	.. .. ..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL AND COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Bell's Patent Enamelled Adhesive Waterproof Advertising Paper Letters and Figures in all colours and sizes. Best and cheapest. Liberal terms to agents. Sample sheets, gratis. Factory, 17, Arthur Street, W.C., London. [5 s

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 s

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [2 R

Complete Outfit for Making Real Photographs; printed instructions; ready for instant use. Carriage paid, 1s. 9d. Particulars of £500 prize competitions free to all purchasers. No fees.—"Work" Dept., PHOTO NOVELTY CO., Alvaston, Derby. [13 s

Picture Moulds.—15 to 25 per cent. positively saved. Send for wholesale list now.—DENTS, Importers, Tamworth. [16 s

Machinery and Tools.—Largest stock in London. BRITANNIA CO., 100, Houndsditch. Cash or hire purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks, Dies, Forges, etc.; catalogue of new, 6d., or list second hand, 2d.—BRITANNIA CO., Colchester.

Best Book on Lathe.—Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA CO., Colchester.

Tools! Tools!! New list, stamp. All kinds for amateur use. Low prices.—STIFFIN & CO., 324, Essex Road, London, N. [1 s

Solo Violin—Beautiful tone and finish, in case, and with bow; part for 15s. 6d. Very exceptional bargain, and certain to please. Also 20s. worth music given in free.—MR. GRAHAM, College Buildings, Ipswich. [2 s

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [3 s

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [4 s

Repoussé—"The Manual on Repoussé," by John Harrison, Birmingham, referred to in WORK, No 85, may now be obtained from nearly all artists' repositories in London, Glasgow, and Birmingham. Price 6d. [6 s

On Hard Soldering.—A useful work issued by CHARLES E. ROSE, Jeweller, Bolton. With sample of solder, 1s. 6d. [12 R

3 STOPS **THE WONDERFUL ORCHESTRAL ORGANETTE** 3 STOPS

(BY ROYAL LETTERS PATENT.) *Hundreds of Testimonials.*

A FOUR GUINEA ORGANETTE FOR ONLY 35s.

WE are the sole Proprietors in the United Kingdom for this New and Wonderful Instrument. Having for many years manufactured and sold enormous quantities of Automatic Reed Organs, Organettes, &c., it has ever been our aim to produce at a low Price an Organette capable of a **VARIETY OF TONES**, the Organettes heretofore placed before the Public having but a limited compass, and but one range of tone. While we have given universal satisfaction, we still have had as our motto, "Excelsior," and now can exclaim, "Eureka!" because, without increasing the price of the Orchestral Organette (our latest production) over other instruments in the market, we have succeeded in producing the very **ACME OF MUSICAL INVENTION**, an instrument with as much variety of tone as an organ costing £25. The illustration gives you but a faint idea of general make and finish, but every Orchestral Organette is supplied with **28 FULL SIZED AMERICAN ORGAN REEDS**, the same size and quality as those used in a cabinet organ. The reeds are placed in a novel manner (patented) over a double suction bellows, and are controlled by **THREE STOPS**, as follows, viz., Flute, Expression, and Vox Humana. The music is produced by perforated sheets, which pass around the Organette in endless bands, enabling a tune to be played over and over again without stopping, furnishing the **GRANDEST ORCHESTRAL EFFECTS**, either in sacred, secular, dance, or vocal music, affording a rich, sonorous, and powerful accompaniment to the voice, requiring absolutely no skill in the performer, and **THE RANGE OF MUSIC AND TONE IS PRACTICALLY UNLIMITED.** By the manipulation of the stops, a tone as soft and sweet as a zephyr, or a loud, long and swelling melody may be produced; trills and high falsetto, as well as reverberating bass, and all manner of pleasing combinations at the will of the performer.

3 STOPS. Vox-humana, Expression, and Flute.

Two complete sets of reeds.

By Royal Letters Patent.

A MERE CHILD CAN PLAY IT.

We wish to introduce one of these Orchestral Organettes in every town and village in the United Kingdom. We caution you against the many worthless automatic instruments being sold under various names. We are the **SOLE PROPRIETORS OF THE ORCHESTRAL ORGANETTE** (*ne plus ultra*) and you must order direct from us or through our authorised agents. Remember, the Orchestral Organette is **NOT A TOY**, but a **LARGE** and **POWERFUL INSTRUMENT**, built exactly on the principle of **CHURCH ORGANS**; they are made in the most substantial manner, highly polished, and decorated in gold. The reeds are the product of machinery costing thousands of pounds, and are so powerful they produce sufficient volume of music for the drawing-room, chapel, lodge, or ball-room. There is nothing about them to get out of order. They positively improve with age, producing richer and sweeter tones after having been used a few years. For **HOME ENTERTAINMENTS THEY ARE UNSURPASSED.** Bear in mind that each instrument has **FOURTEEN MORE REEDS** than any other Organette in the world, and they are **ORGAN REEDS**, and the special feature is **THREE STOPS**, a characteristic of no instrument except a costly organ. Our regular price for the Orchestral Organette is £4 4s. Having just put it before the public, we will sell a limited number to the readers of this Paper at **£1 15s.**, provided the above Coupon is cut out and sent with order not later than the date given in it, and we furthermore agree to **REFUND THE MONEY** and **PAY CARRIAGE** to anyone not entirely satisfied after receiving it. By the aid of the Stops—viz., Expression, Flute, and Vox Humana, there is not a piece of music which cannot be played with all the varying effects of an orchestra; a false note is an impossibility, and the most difficult operatic air is played with as much ease as the most simple hymn. In many homes will be found a Grand Piano or Organ, with not an inmate of the household, even the most expert player, who can interest company on either so well as a child of three years old can on the **ORCHESTRAL ORGANETTE.** Remember any tune can be played with artistic effect by anyone, young or old. You can play **DANCE, SACRED, OR SENTIMENTAL MUSIC** with as much effect as that produced by a **FIRST-CLASS FOUR-PIECE ORCHESTRA.** Remember our regular price is £4 4s., but as we have found a well pleased customer our best advertising medium, have decided to sell a limited number, as an introduction to the readers of this paper at £1 15s., provided the order is received not later than the date printed in the Coupon immediately beneath the Illustration of the Organette. We will give a selection of **MUSIC FREE** with each instrument. Send Money and Coupon by Registered Letter, Crossed Cheque, or Money Order to **J. DRAPER**, Manager, British Organette Co., Blackburn. For 2s. extra the Organette will be sent to any part of the United Kingdom, *Carriage paid.* List of tunes and Testimonials sent anywhere free. Visitors can inspect the Factory daily from 9 a.m. to 7 p.m. Saturdays close at noon.

N.B.—Above time is extended for Foreign Customers.

COUPON 678.

REGULAR PRICE, £4 4s.
REDUCED PRICE, £1 15s.
GOOD UNTIL DECEMBER 25TH, 1890.

Signed, J. DRAPER.

Any reader of this paper who forwards this Coupon before the date named herewith can receive **ONE** Orchestral Organette at reduced price of £1 15s.

£500 CHALLENGE. We will give £500 to anyone who can prove we ever solicited a testimonial, or that any in our Catalogue are not genuine. From October 1st to October 18th we received over fifty Testimonials for our Organette; surely this speaks for itself.

RD. MELHUISH & SONS,
FETTER LANE, LONDON, E.C.
Gold Medal for Excellence of

For all Workers in Metals, also Joiners, Wood Carvers, etc.
WE HOLD THE MOST COMPLETE STOCK IN THIS COUNTRY,
And all Orders have Immediate Dispatch
Orders for Hardware and Tools over 10s. in Value, Carriage Free.

ESTABLISHED 1851.

BIRKBECK BANK,
Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

THE UNFAILING POPULARITY OF

Cassell's

Family Magazine

has again been shown this year by an increase in its circulation of several thousand copies monthly. **The December Part** (*ready Nov. 26, price 7d.*) **begins a New Volume,** *and contains the commencement of Three New Serial Stories, a Handsome Tinted Picture, and many useful, novel, and entertaining features of interest to every member of the family.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket, Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including **250,000 FRETWORK PATTERNS** and **100,000 ft.** of Solid and Three-Ply **FRETWOOD**, Veneers, &c.; **1,000 Gross of FRETSAWS**, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill,* with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* **SENT GRATIS** *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

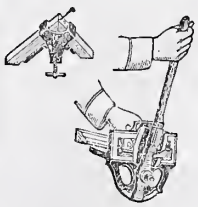
J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, ***EAST DEREHAM, NORFOLK.***

Kindly mention this paper when ordering.

WATKINSON & LONSDALE.

WRITE FOR PRICE LISTS

MANUFACTURERS OF
Photographic Apparatus,
NEW BRIGGATE, LEEDS.



PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine,** any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,
TOOL MAKERS, DUBLIN.

Every Month,] **CASSELL'S TIME TABLES.** *[Price 4d.*

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

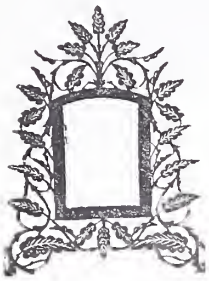
LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores; or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.



The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture-Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

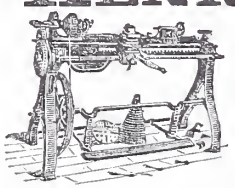
Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6d. OR FOR 7 STAMPS. BIRMINGHAM. [33

London Warehouse: **124, NEWGATE ST.**

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 89.] SATURDAY, NOVEMBER 29, 1890. [PRICE ONE PENNY.

AN INCUBATOR WITH A SELF-ACTING HEAT REGULATOR.

BY C. MAYNARD WALKER.

THE artificial hatching of the eggs of poultry, and indeed of every kind of bird, is by no means new, having, according to reliable history, been largely and successfully practised by the Egyptians and Chinese, probably for thousands of years; and in almost every work treating upon the subject of incubators this fact is harped upon to such an extent that the reader is apt to ask why not adopt the apparatus which has stood such a remarkable test? The answer is a simple one, viz., the method and the means employed in these countries are useless without the favourable climate which obtains there; and that only at certain seasons of the year, at which periods travellers inform us the temperature remains perfectly unchanged.

Under such conditions artificial hatching becomes very nearly as easy as that employed by the ostrich, which is supposed to lay its eggs and cover them up in the hot sand until, in due course, the chick emerges from the shell; but it is easy to see that in such a notoriously changing climate as that of the British Islands, where the average difference between the temperature of day and night amounts to some 20° Fahr., to say nothing of the sudden changes of heat and cold from day to day, it is quite another thing, so that it would appear that instead of the simple ovens or "mammals" of the Egyptians, we need, as a matter of first necessity, an apparatus which can be so regulated as to maintain a constant temperature during the process of incubation never exceeding on the one hand 105°, nor falling below 100° on the other; this I shall show is a very easy matter. Another condition of vital importance is that the eggs shall be open to perfect and *continuous* ventilation, and further, that the process of hatching shall be carried on in a moist atmosphere. Provided that these conditions are met, it matters little how roughly or of what form, shape, or material the incubator is made, or where it is used.

Fig. 1 represents in section one that was made by the writer of this paper, and successfully used as far back as 1882, excepting that the original was very roughly made, and was patched and altered as experiment proved, until it was made successful. The exterior was made from a wooden packing-case, and the boiler of zinc, and was capable of hatching twenty full-sized eggs, and was heated generally by an ordinary paraffin lamp, and sometimes by gas, where the latter was convenient. The question of size is one that each must determine for himself, but I apprehend that an incubator adapted to hatch from one to thirty eggs will be large enough for the majority of persons who will undertake the work of making up. I may mention here that anyone who can do soldering and rough carpentry can undertake the job with every prospect of success; and with the view of rendering the task as easy as possible, I will take care in the following instructions not only to make the work clear, but to give reasons why each particular part is of its particular form and arrangement.

For an incubator to hold thirty eggs an outer case will be required, measuring outside 16 in. long by 16 in. wide by 12 in. deep, to be made of not less than $\frac{3}{4}$ in. deal. If the maker can do dovetailing so much the better; if not, use French nails for the joining, about 2 in. long. The top, however, must be screwed on, to provide facility of getting at boiler in the event of repairs being required; the top, too, should be well battened at the ends, across the grain, to prevent it warping. It will be as well to completely make up the case as though it were a close box before making the fittings, then for the drawer aperture cut out an oblong opening $13\frac{5}{8}$ in. by $2\frac{3}{4}$ in. deep, from the top $5\frac{1}{2}$ in.; this, of course, can be cut with a keyhole saw, and should be finished as neatly as possible.

The drawer itself is a frame with a lattice bottom, and the lattices should be formed of round wood about $\frac{1}{2}$ in. thick, which can be bought at most timber yards in lengths of about ten feet; these are cut up, and then conveniently attached to the bottom by fitting them into holes bored in two sides of the framework, and the space between the bars should be $1\frac{1}{2}$ in. The object of this arrangement is to enable the eggs to lie securely in their position, without jarring

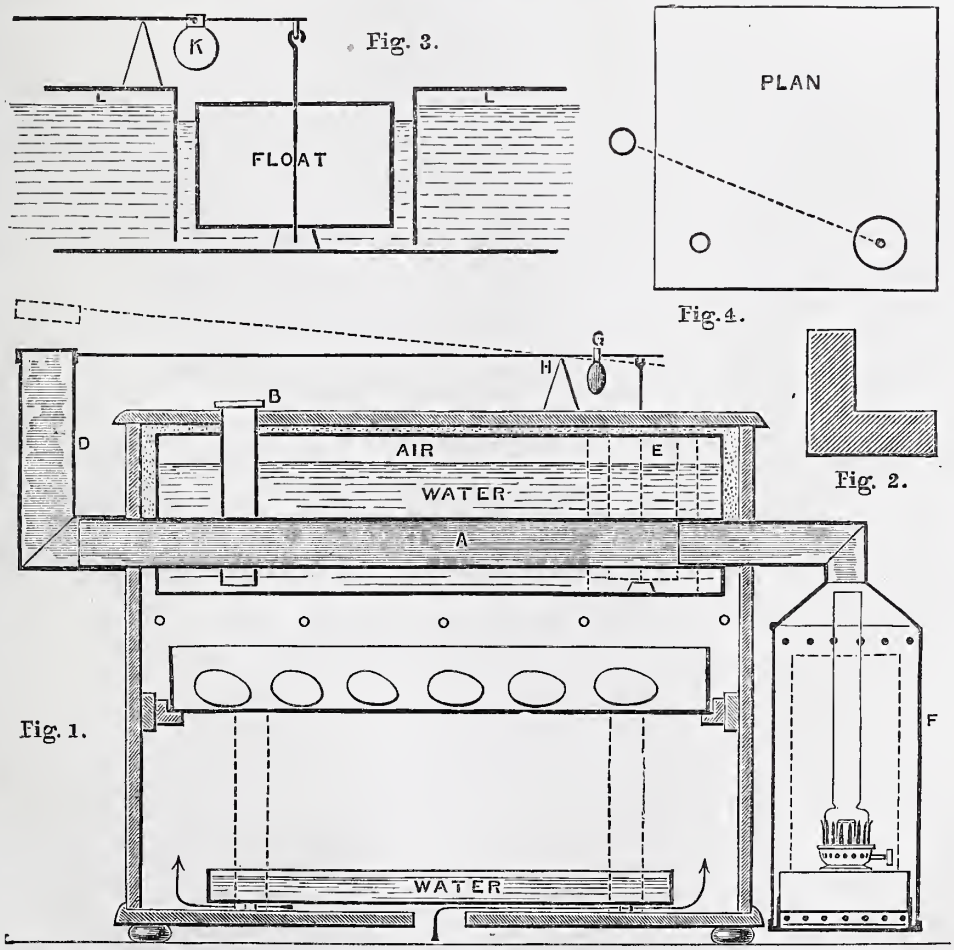


Fig. 1.—Sectional Diagram of Incubator, showing Arrangement when in use. Fig. 2.—Section of Drawer Runner from Front to Back. Fig. 3.—Diagram showing Metal Float Governor with Wire working in Centred Bridge at Base of Boiler—K, Adjusting Weight; L L, Air Space above Water of Boiler. Fig. 4.—Diagram showing Position of Well-hole.

against each other. The front side of the drawer is made sufficiently large to overlap the opening when shut. Inside the incubator a couple of runners are fixed to enable the drawer to run true, and should be fitted so as to move easily (Fig 2), and should be supported at both ends by uprights to bear the weight of eggs and drawer. It will be seen that the drawer is much smaller than the inside of case; this is to allow freedom of circulation of air on all sides of the eggs.

Next, nail on to inside of case, $3\frac{3}{4}$ in. from the top, two lengths of $\frac{3}{4}$ in. stuff to carry the boiler, these to run all along each side of the case; next, at each end of the case bore a $1\frac{1}{2}$ in. hole: these will be for the flue, described further on. Then at a line 5 in. below the top bore fifteen $\frac{1}{8}$ in. holes, five in front, five at back, and five at left hand, putting none at the right where the lamp would be liable to foul the air; also a $\frac{5}{8}$ in. hole in the centre of the bottom. The reason for these dimensions of holes is this: the area of the bottom or inlet hole is much larger than the sum total of all the holes at top—thus the velocity of the current is reduced, and the air gets practically warmed before it comes in contact with the egg chamber. It will be seen that when the incubator is at work there will be a continuous discharge of air from the holes at the upper end of case, impelled by the heat of the interior, and a constant flow of cold fresh air into the incubator at the bottom hole; this continuous ventilation is most important, and in the present form is as perfect as needs be. Two good handles should be fixed to front of drawer, and four knobs fixed to bottom as feet, size immaterial.

The woodwork of incubator may now be regarded as being complete; the metal part now remains. I find it a capital plan to cover the inside of case at this point with thick brown paper, using flour-paste. It is a good non-conductor, and ensures that no cracks interfere with the ventilation, taking care, of course, to leave the holes free. We now require to make the boiler. This should be made of strong tin-plate or copper (zinc is altogether unsuitable), the dimensions being 15 in. by 15 in. by $3\frac{1}{2}$ in. deep, the tube A to be soldered in 1 in. from the bottom; this should be of $1\frac{1}{4}$ in. brass, and in fixing it additional strength in the joint will be obtained if the holes are bored in the sides of the boiler about a $\frac{1}{8}$ in. too small, and then "rhymered" with a blunt tool to their proper size, this turning up a $\frac{1}{8}$ in. edge round the hole. The boiler tube should be nearly flush with boiler at one end, and project about 2 in. at the other; a filling tube 1 in. in diameter (B), and reaching to nearly the bottom, to be fitted in the position shown (Fig. 3), and provided with a screw-cap. The boiler must also have a circular hole (Fig. 4) $3\frac{1}{2}$ in. in diameter, and fitted with a circular well-piece reaching to about $\frac{1}{16}$ in. from the bottom of boiler, and soldered air and water-tight to the top; this is for the regulator, described further on.

The boiler is now perfectly ready to be placed in its proper position by passing the projecting tube through the left-hand hole of case from the inside, and letting it fall on to its bearings. The size of the boiler it will be seen leaves a space all round; this must be filled up with wadding, neatly packed on all sides and on the top, and, before putting on the cover, a couple of layers of brown paper; in this way very little heat will be wasted. A metal water-tray about $1\frac{1}{2}$ in. deep and about 10 in. square (with four feet to keep it clear of the central air-hole at the bottom) should be made, and stood on the bottom inside.

The next operation to this will be to make the lamp box. Whether we use oil or gas this will be required, and here let me say that quite half the trouble and attention necessary to an incubator will be saved by the use of gas. What is called an atmospheric burner should be used, as it makes no smoke; this can be bought of any ironmonger—ask for an upright ring boiling burner. The lamp box (F, Fig. 1) is simply a cylindrical case fitted with a door, and has an elbow joint at top, which passes into and fits the boiler tube, so that when the lamp or burner is lit the heat is passed through the boiler tube; the latter, at the other end, is fitted outside with an elbow (D, Fig. 1), which rises to about 2 in. above the top of the incubator.

The incubator is now practically complete, but if it was set going ever so carefully, with ever so good eggs, it is more than doubtful if any chicks would issue from it, for it still lacks one of the most important parts, viz., a regulator. Let us see how we can manage that. It is a well-known fact that most bodies increase in volume by heat, some but little, some very largely, amongst the latter notably air; so that if we leave about $\frac{1}{2}$ in. depth of our boiler unfilled and enclose it, we shall have about 112 cubic in. of air, which, in its expansion by heat, and its contraction by cold, serve as the motive power to work the regulator; and as there is plenty of it we may rely on its being able to automatically control the temperature. To do this we must fit a float into the circular well (E)—simply a support of tin-plate soldered air-tight—to which is attached an arm working on a hinge (H), having a cap at its longer end to fit loosely over the upright flue (D). If the boiler is now being heated, and the temperature has reached say 105°, if we pass the adjusting weight (G) along so that the cap is made to descend on the flue, all the draught and heat from the lamp will be stopped, and will pass out of the holes of the lamp box instead. It is clear then that the boiler will begin to cool, and the air therein contracts; the moment it does this the float will fall, and the cap be lifted off, allowing the heat from lamp to pass through the boiler, which, as soon as it gets hot, the air, by raising the level in the well, sends up the float, and again puts the damper on; and so on continuously, thus maintaining without any trouble, a regular temperature in the incubator, or rather in the boiler. Thus the incubator should be placed in some kind of outhouse where the condition will be reasonably regular—that is to say, it should not be exposed to strong draughts of wind, etc., or in spite of the regular heat of the boiler the interior of incubator would be disturbed.

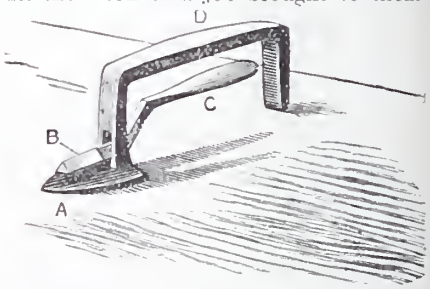
And now a few words relative to the management. Fill the incubator with water to within about $\frac{1}{2}$ in. of the top. To do this, a small vent-hole must be made in top, and afterwards soldered up when water is hot; trim your lamp, or see that your gas-burner is all right, charge the water-tray with cold water, and set the lamp going; put a thermometer into the egg drawer at about the same height as though it were on the eggs, leave it for several hours, and let the temperature get up to about 120°; the reason for this is to ensure sufficient power from the heating source to meet a cold change in the weather. Now adjust the regulator until a temperature of 105° is obtained, without interfering with the gas supply, or lamp, as the case may be. When finally adjusted, the level of water around float should be covered with about $\frac{1}{2}$ in. depth of sweet oil; use it in this way for a few days, up and down in temperature, before you entrust any eggs to be hatched. When eventually you do this, lay a piece of coarse house-flannel on the tray, and mark each egg on its opposite sides with some distinguishing mark—an O on one end and a X on the other will do. This is to facilitate the daily process of turning the eggs—all O's up one day, and X's another. This process is important, as if the eggs lay too long the embryo adheres to the shell and dies. The water-tray must be kept charged with water, adding tepid water when it gets low. The eggs will not require moistening if plenty of water is kept in the incubator, owing to the fact that warm air, if it can get it, takes up in suspension a quantity of moisture, so that the eggs are constantly in a moist atmosphere so long as the warm air can reach the water. It does not matter what kind of birds' eggs are used; they all hatch at the same temperature, whether as small as the tom-tit, or as large as the ostrich. When your chickens are hatched, they, too, for some time will require artificial warmth, and for this purpose a convenient plan is to make a wire cage somewhat larger than the incubator, cover a portion of it with glass, and stand it on top of the incubator, so that the glass pent receiving the heat will form an artificial mother. Having now told my readers what to do, permit me to warn them what *not* to do—*do not* expect to make a fortune with artificial incubation.

THE LATCH PINCERS.

BY J. C. KING.

It is said that a good workman can work with any sort of tools. If a good workman, he would not be content to keep on using inferior tools, but make superior ones himself to do his work with, if a worker in the materials of which the tools were made. This is especially so of metal workers, perhaps more so of blacksmiths than any others.

In most small shops in the country, hammers, tongs, pincers, bits, chisels, drills, and anvil fittings are made by the smith, and often tools and wrenches have to be made to suit the work of a job brought to them—



The Latch Pincers.

from the massive forgings of a "derrick," or a weigh-bridge, to the spring of a lady's purse. Few workmen are so ready in their comprehension of what is wanted and how to do it as are the handy smiths.

A smith was called upon to repair some very fine chain-mail, the links inside the size of a cedar pencil, the steel wire the size of hair-pin wire. He remarked: "The smiths in the time of the Crusaders made this armour; I ought to be able to mend it with a few links, especially as I see how it was done. It is a matter of tools."

hese links showed they were alternately rged and riveted, the riveted ones serving put the forged ones securely together. fine needle drill was the essential tool r the job.

For another job in which delicate iron-ork had to be tried, frequently on a attern, he made a pair of pincers he called tch handle, or "latch pincers," from the semblance to a latch handle and the ction of the latch.

The illustration shows the tool. A is the in flat under jaw that rests on the work r pattern; B is the upper nipping jaw; C e latch, which the closing of the hand uses the pincers to grasp the piece of work; is the latch handle, about 5 in. long and ½ in. deep inside.

If any of the readers of WORK have light onwork to handle and fit, they will find uch a tool easy to make, and serviceable.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

PRIMARY BATTERIES—SMALL BOX BATTERY—ANOTHER BOX BATTERY—ELECTRIC LIGHT FOR PHOTOGRAPHIC DARK ROOM.

N the two previous papers on this sub-ect, I have given the amateur electrician ome idea of the principles which govern he practice of electric lighting, and have lso shown him how those principles may e applied by means of primary batteries. t will have been seen that the area in which these batteries can be used for electric ighting is very much circumscribed by con-iderations of cost and labour entailed in heir maintenance. Within that area I now ropose to work and show what may be lone in a small way by the aid of primary batteries.

Primary Batteries.—I may as well ex-plain here that the word primary is used in connection with electric batteries as a means of distinguishing those batteries which fur-nish electric energy direct by consuming in themselves fuel to develop electric energy, in contradistinction to those batteries which receive a first charge of electricity derived from another source to develop in them the capability of furnishing an electric current. For example, a battery in which zinc is con-sumed to furnish electric energy, is named a *primary* battery; but when this energy is sent into another battery composed of lead plates to make it capable of furnishing electric energy too, then the latter is named a *secondary* battery. A secondary battery is incapable of giving electric energy until it has been made capable by first sending an electric current into it, but a primary battery will furnish current right off at first hand, so to speak.

A list of primary batteries now known would be a very long one, and each week adds its quota to the list, as each experi-menter and dabbler in electricity fancies he discovers improvements. I cannot claim to know them all; but of the many known to me there are very few that can be used for electric lighting with any chance of success.

A battery suitable for electric lighting must conform to the following conditions:—(1) Its electro-motive force must be high—as near 2 volts per cell as possible; 2·15 volts per cell being the highest obtainable from zinc under any condition. (2) Its in-ternal resistance must be low—only a frac-tion of an ohm per cell is admissible, say from 0·04 to 0·10 ohm, the former being preferable. (3) The current at the terminals must be full and strong, and this it will be if the two first conditions are observed. (4) The force of the current must be con-stant through a series of hours—the longer the series the better will be the battery for electric lighting. (5) It must be free from a tendency to polarisation—that is, a tendency to alter the electric relation of its plates and set up within itself a counter electro-motive force. (6) It should be easily set up, and as easily taken in pieces to be cleaned. (7) The cost of its charge should be very low, since zinc in itself is a most expensive fuel.

Among batteries having a high E.M.F., we may rank the single fluid chromic acid battery, having an E.M.F. of 2·1 volts; the double fluid chromic acid battery, having an E.M.F. of 1·95 volts; the Grove and Pog-gendorff, each 1·96 volts; the Bunsen, 1·86 volts; and the Fuller, 1·50 volts. Now as to the second condition, namely, that of in-ternal resistance. This will vary with the density of the solution employed to charge the battery, with the porosity of the porous cells, and with the nearness of the plates, to-gether with their respective areas. Taking equal batteries together, and comparing them with each other, we find that the single fluid chromic acid battery offers the least internal resistance because of the su-perior conductivity of the solution employed to charge the cells, and the nearness of the plates to each other. A cell of this type having plates 6 in. by 4 in. placed not more than ½ in. apart, will have an internal re-sistance of less than 0·04 ohm. Next to this comes the single fluid bichromate of potash cell, but this has a strong tendency to polarisation when in constant work. The Bunsen comes next with an internal resistance of from 0·8 to 0·11 ohm. The double fluid chromic acid and bichromate of potash cells take equal rank with this. The Grove has an internal resistance of 0·1 to 0·12, whilst the Fuller has 0·5 to 0·7 ohm.

Respecting constancy, the Grove and Bunsen bears the palm over either chromic acid or bichromate of potash batteries, but will rarely run longer than six hours without being recharged. Both chromic acid and bichromate of potash cells have a tendency to flag in constancy as time goes on, and the light becomes less and less bright unless the solutions are frequently agitated. This fault is due to the use of an imperfect de-polariser, or one inferior to nitric acid, such as that of bichromate of potash. This de-polariser also forms crystals of its salt on the carbon plates of the cell, and thus increases the internal resistance of the bat-tery. If chromic acid is used instead of bichromate of potash this tendency to crys-tallise is avoided. In a double fluid chromic acid battery, the depolarising quality of the liquid is much improved by mixing chlorate of potash with the chromic acid solution. Mr. S. R. Bottone, of Carshalton, to whom the invention of this new depolariser is due, says, in a letter to me:—"A mixture of chromic acid, chromate of potash, sulphuric acid, and water, in the following propor-tions—chromic acid 1 lb., chlorate of pot-ash 2 oz., sulphuric acid 7 oz., water 1 quart, costing about one shilling—will, if placed in a double carbon, single zinc, porous cell battery of four cells, light up well for from twelve to fifteen hours a 5 c.p. 6 volt lamp."

I have already, in the last paper, shown that the Bunsen cannot be used in the same room with the required lamp, because of the noxious fumes of nitrous oxide given off whilst at work. The same objection is shared by the Grove, whilst this is a more costly battery than the Bunsen. The Pog-gendorff and Fuller are both double fluid bichromate cells, so we are left with the chromic acid batteries as being the best for small installations of the electric light.

I have already shown that an amateur cannot make his own lamps. These must be purchased from makers and vendors. But all other parts of a model electric light apparatus can be made at home, in-cluding specially the battery. I therefore give herewith some instructions on making some two or three small batteries suitable for lighting by means of small incandescent electric lamps.

Small Box Battery.—Beginning in a small way at first, I show a little box battery (about 6 in. square) made for me by Mr. Bottone, who lays himself out to meet the wants and wishes of amateurs with small means at their disposal. The box and bat-tery are cheaply and roughly made to meet the demand for an electric light at low cost. It is shown complete with lamp at Fig. 7, whilst Figs. 1 to 6 give detailed sketches of its various parts. From these it will be seen that the battery is a double carbon, single zinc one of four cells, suitable for use with single fluid bichromate or chromic acid solutions. Fig. 1 shows the zinc element (with dimensions), cut out of ¼ in. rolled zinc plate. In the upper edge, drill and tap a small hole to take the end of a brass tang which must be screwed into the zinc to form a connection with it as shown in section at Fig. 4. The upper part of this tang receives a brass nut securing it to the copper connecting strip shown on the plan at Fig. 5. The zinc plate should be amal-gamated with mercury, directions for which have already been given in the article on the "Bunsen Battery" in the first three numbers of WORK. It is then ready for use. Fig. 2 shows one of the carbon plates, with dimensions given. Close to the upper edge drill two small holes through each plate to form holding pins in the lead collar. Fig. 3 shows how the two plates are held in a lead collar. Fix them both in a mould of sand or plaster, 1¾ in. in diameter, and ⅜ in. in depth, with a core in the middle to form a hole for the zinc, and fill the mould with molten lead. Then cast each pair of carbon plates for each cell. Fig. 4 shows the ar-rangement of zinc and carbon plates in section, and Fig. 5 a plan of the upper side of the box cover, showing together how the plates are secured to the cover and con-nected to each other. Holes to receive the tangs of the zinc plates are drilled in the cover of the box, 1½ in. from each side, and 2 in. apart. Each zinc is then inserted be-tween two carbon plates in the lead collar, and insulated therefrom by a strip of softened ebonite or by a collar of gutta-percha as shown at E E, Fig. 4. The whole (carbon and zinc plates with the lead collar) are then placed in position and secured to the cover as shown at Fig. 4, a brass screw going through the cover and into the lead collar as shown at C, to serve the double purpose of holding up the plates and con-necting them to the copper strip above. In the figure, E E represents the insulating collar, L L the lead collar, C, C the carbon plates, and Z, Z the zinc and its connecting nut.

The battery box shown in section at Fig. 6, and complete with fittings at Fig. 7, is made to the size marked on sketch, of ⅜ in. pine, planed smooth, and stained black. It will be seen on reference to Fig. 6 that the battery is thrown into action by an ar-rangement made to lift the charged cells up

to the elements secured to the cover, instead of lowering these into the cells. This lifting arrangement consists of a false bottom fitting loosely inside the box, on which the cells rest. To this false bottom is secured a small brass rod passing up through a hole in the centre of the cover and terminating in a screwed brass head. Halfway up the stem of this rod a hole is bored, to receive a wire pin to hold the cells up whilst they are intended to remain in action.

On referring to Fig. 7, and comparing it with the plan of the cover, Fig. 5, it will be seen how the plates of each cell are connected to those of the next. Starting on the left-hand side, the screwed tang of a pillar binding screw is screwed into the cover, passing through it into the lead collar of a set of carbons, and thus form the positive pole P of the battery. The tang from the zinc plate of this set comes up through the cover, and is secured to a thin strip of copper by a brass nut Z. The strip of copper terminates at C, where an ordinary brass screw passes through the cover and connects it with the lead collar of the next set of carbons. This arrangement is repeated with each set, until a solitary tang from the last zinc plate on the right-hand side stands up by itself. A short strip of copper is secured under the nut of this tang, and another pillar binding screw is also screwed into the cover through this strip, thus connecting it with the last zinc plate to form the negative pole N of the battery. In these pillars, the connecting wires of the lamp are secured as shown at Fig. 7, or the wires may be led to a separate lamp-holder if desired.

The cells employed in this battery are round pomade glass jars, about $2\frac{3}{4}$ in. in height by $2\frac{1}{4}$ in. in diameter. If bichromate solution only is employed to charge the cells, these may be of stoneware, or even of wood, or of papier-mâché well soaked in hot melted paraffin wax, but glass alone can be safely used with chromic acid. I have seen stoneware jars deeply pitted and scaled with this acid after being in use for a short time. It has a peculiar attraction for anything coated with paraffin wax, and will readily fetch this out of the pores of wood or of papier-mâché. It will also attack ebonite or vulcanite, and soon reduce either of these substances to a crumbling mass. Therefore, glass cells are only admissible for use with chromic acid. Gutta-percha stands fairly well if the battery solution can be kept cool, but if the solution rises in temperature during work, the gutta-percha softens and soon becomes pierced with holes.

The solution to charge this cell is made up of chromic acid or of bichromate of potash, 3 oz.; sulphuric acid, 3 oz.; water, 1 pint. Dissolve the bichromate of potash in 1 pint of warm water, add the acid gradually whilst stirring the solution with a stick, and allow it to get quite cold before using it to charge the cells. In the case of using chromic acid, mix the acid with the water, and use the solution only when cool. If any reader "out of the way" fails to get chromic acid in his neighbourhood, Mr. Bottone will send a sample tin of it by parcels post to any address on receipt of a shilling postal order. The sample will be enough to furnish four charges for the battery, and each charge will light up a 5 c.p. 6 volt lamp for three hours. To charge the cells, unscrew the cap on the brass stem in the centre, unclasp the fastenings of the cover, take this off, lift out the false bottom of the box with its cells, charge and replace them. To set the battery in action draw up the cells by pulling up the stem, and secure it by the steel pin made to go through a hole in the stem. When the battery is not in use, pull out the pin and lower the cells. The zincs will need occasional cleaning and re-amalgamation, and the whole battery elements should be frequently cleansed by causing water to run in amongst them from a tap. Every part can easily be taken to pieces by unscrewing the various screws.

Another Box Battery.—At Figs. 8 and 9 will be seen a different form of box battery. The carbon and zinc elements are the same in every particular as regards size, mode of connecting the carbon plates together, and fastening these with the zincs to the cover of the box. The connections above the cover are also similar. The tangs of the zincs in this form are insulated from the lead collars by small collars of ebonite, vulcanite, boxwood, or gutta-percha made to fit the tangs closely, and furnished with flanges to keep the zincs from touching the lead collars. The box is made of hard wood such as teak or mahogany, and is finished in a superior style. It is also a little taller than the last described, to admit another box inside (which holds the cells), instead of a mere false bottom. This box is made out of $\frac{1}{4}$ in. pine, and is partitioned off in four equal divisions, as shown at Fig. 10. Each of these divisions is intended to hold a square glass cell. The box is lifted or depressed by means of a handle attached to two long ears made of iron or of brass, $\frac{3}{4}$ in. in width by $\frac{1}{4}$ in. in thickness, forged to the shape shown at Fig. 10. The outsides of each ear, from an inch below the cover down to within an inch of the rim of the inner box, is scored with notches to form a ratchet on each ear. To the battery box are fitted two curved springs of steel, A, Fig. 9, with the ends filed to fit in the ratchet notches on the ears. By this arrangement the cells may be lifted to any height by pulling up the handle, and may be kept to any desired height by means of the ends of the curved springs engaging in the notches of the ratchets. When it is desired to lower the cells, the springs can be easily sprung back, and the box with its cells lowered one notch at a time. If preferred, the ears may be drilled with a number of holes $\frac{1}{2}$ in. apart, and the springs made to terminate in pins fitting the holes. This would be an improvement, since then the cells could be raised to any desired height, and kept in position whilst the box is carried about.

If the battery box is made and fitted with lifting arrangement as shown at Fig. 10, the cover of the outer case, carrying the zinc and carbon elements of the battery, must be made to easily come off, for the whole inner box together with the cover must be removed when we wish to recharge the battery. Should this be deemed an inconvenience, it may be avoided by simply making a false bottom to the outer case and fastening the ears of the handle to this instead of to the inner box. In this case the ears must be made longer, long enough to go to the bottom of the outer case, and turn in under the false bottom about 1 or $1\frac{1}{2}$ in. When thus constructed, the outer case may have a small door at the back as shown at Fig. 9, and the battery can then be recharged by withdrawing the battery box from the outer case through the doorway without disturbing the other parts of the battery. The cover can then be screwed down and the outside of the case made to present a finished appearance by fastening a few pieces of beading to the rim and corners, and polishing up the exterior. The cells to be used in this battery are square glass cells sold for the purpose by dealers in electrical goods, and obtainable from such dealers in the following sizes: A, 4 in. by $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in.; B, 5 in. by 3 in. by $1\frac{5}{8}$ in.; C, 6 in. by 4 in. by $1\frac{3}{4}$ in., at the cost of a few shillings the set of four cells. I advocate the use of these cells because, as I said before, glass cells are the only cells which may be safely used with chromic acid; but glass cells are liable to be broken by jostling against each other unless placed in a box divided into partitions, and square cells fit best in such a box. But round cells may be used in the same arrangement, and wide-mouthed glass jars or bottles may be utilised for this purpose. The dimensions of the box must therefore be made to suit the cells to be employed. For instance, if we choose the A size cells the outer case will have to be at least ten inches in height, since we must allow space above the cells to have the zincs clear when the battery is not in use. Such a battery as this will, when charged with chromic acid solution, light up a 5 c.p. 6 volt lamp for three, four, or five consecutive hours, according to the size of cell chosen, because large cells hold a larger quantity of depolarising liquid, and are not so soon exhausted. This is the nearest approach to a portable electric light by means of primary batteries that can be obtained. Other forms, involving the same principle of construction, have been made and sold, but the box batteries just described are the forms most easily and cheaply made by amateurs who wish to show their friends a small electric light, or wish to light up by this means some out-of-the-way niche where other lights would be inadmissible.

Electric Light for Photographic Dark Room.—At Fig. 11, I show an arrangement suitable to the requirements of photographers who may wish to use the electric light (enclosed in a ruby shade) whilst working in the dark room. On referring to the figure, it will be seen that the zincs and carbons are suspended to a board over the cells. They are attached to this board by the same method as that adopted to fasten the elements to the cover of the box battery just described and shown in detail at Figs. 1 to 5. The connections above the board may be made as shown at Fig. 5 if so desired, or as shown at Fig. 11, where each pair of carbons and each zinc plate terminates in a binding screw, and is connected to the next by means of a wire helix made of No. 16 copper wire. The board may be 14 in. by 5 in. by $\frac{1}{2}$ in., and may be of fine teak or mahogany. The frame may be of pine, the base being made of the following dimensions: 16 in. by 8 in. by $\frac{3}{4}$ in., and the pulley supports at each end 14 in. by 2 in. by $\frac{3}{4}$ in. In the top of each end post must be inserted a small pulley of wood, iron, or brass, on which the cords of the lifting arrangement will run. The carbon and zinc plates should have a surface area of 5 in. by 3 in., and when these are fixed to the board, the whole should be exactly balanced by lead weights at each end as shown at Fig. 11. The cells may be glass pickle bottles having mouths a little over 3 in. in diameter, or round glass cells 5 in. by $2\frac{1}{2}$ in. or over. The battery of four cells will, when charged with chromic acid solution as before directed, light up a 6 volt 5 c.p. lamp for some five or six hours, and this time may be taken out of it at

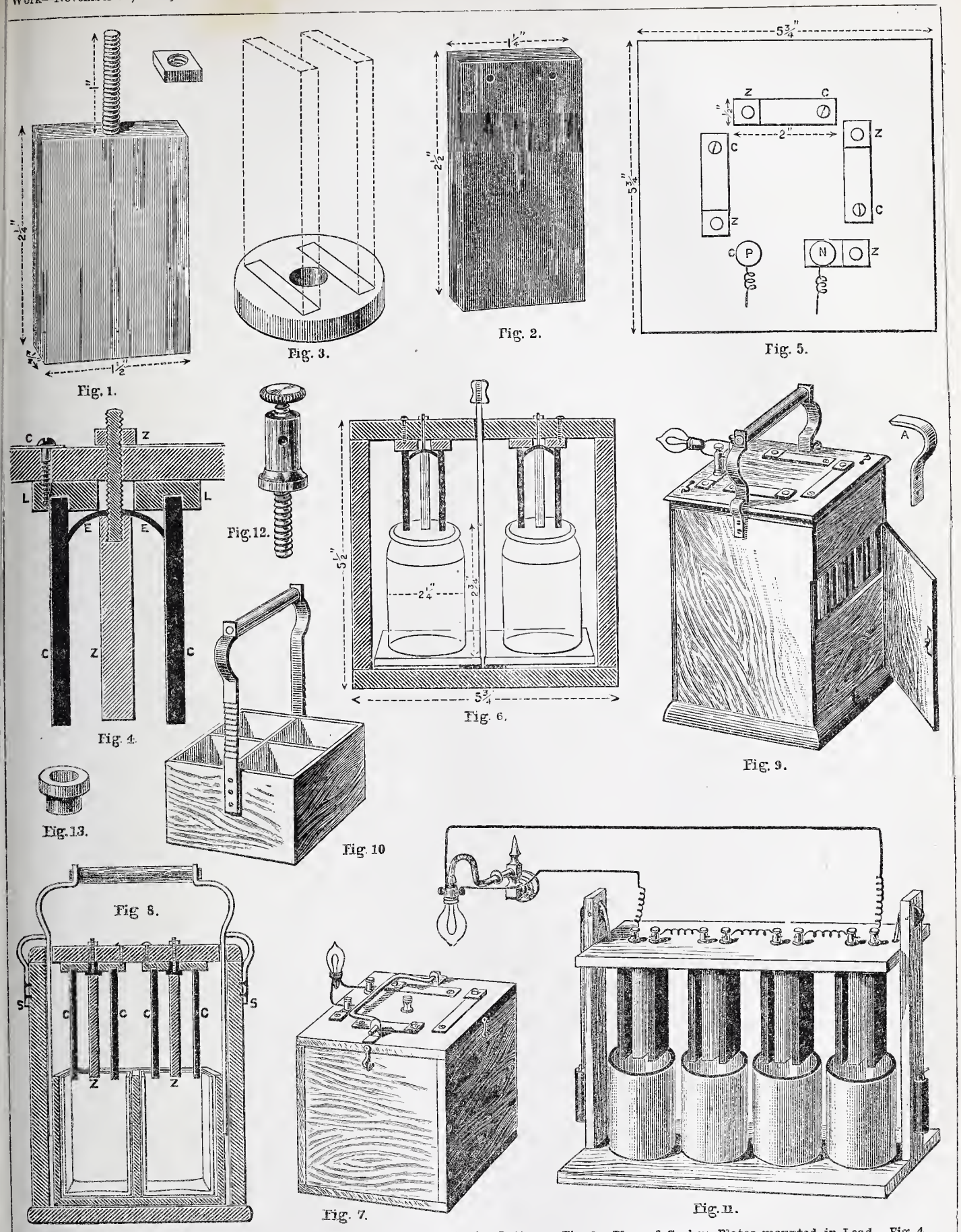


Fig. 1.—Zinc Plate with Screwed Tang and Nut. Fig. 2.—Carbon Plate for Battery. Fig. 3.—Plan of Carbon Plates mounted in Lead. Fig. 4.—Section of Battery Plates, showing Mode of connecting them. Fig. 5.—Plan of Battery Box Lid showing Connections. Fig. 6.—Sectional Plan of Interior of Box Battery. Fig. 7.—Box Battery and Lamp complete. Fig. 8.—Sectional Plan of Interior of Portable Battery. Fig. 9.—Portable Battery and Lamp complete. Fig. 10.—Battery Box and Handle of Portable Battery. Fig. 11.—Battery with Lifting Arrangement for Photographer's Dark Room. Fig. 12.—Pillar Binding Post for Battery. Fig. 13.—Ebonite or Boxwood Collar for Tang of Zinc Plate.

intervals as required, if the precaution is taken to lift the plates out of the cells when the battery is not in use. If the lamp is kept connected to the battery as shown in the sketch, it may be lit up at any time by pressing the plates down into their cells. In doing this, do not expose the full surface of the plates at once, but let them down gently, and so gradually raise the carbon of the lamp to the required light. If the full current is sent at once through the lamp it may rupture the carbon. This battery will require the same care as a box battery, to keep it in repair. A box may be made for it if so desired, by simply boarding up the sides and the ends, leaving the cover free to move in and out of the box. In this case one side should be hinged to fall down when required, for convenience in attending to the cells. If a stronger light is desired, another battery of similar size may be coupled to this, the terminal carbon of one to the terminal zinc of the other, and thus a 16 volt, 8 or 16 c.p. lamp may be lighted up. Any other intermediate voltage lamp may be run from two of these batteries by coupling the necessary cells together, reckoning each cell capable of giving 2 volts.

I have outrun the space at my disposal, so cannot now write any more here on other batteries that have been and are used for model electric lights. I shall be pleased, however, at any time to advise readers on this subject through the medium of "Shop."

THE ART OF GRAINING.

BY A LONDON DECORATOR.

Graining Mahogany and Satinwood.

No particular variety of hard wood has been used more extensively by the cabinet maker than has mahogany; and no higher value has been placed upon either native or foreign grown tree than is recorded of the finest Spanish mahogany. Such being the case, it is, I believe, a somewhat rare matter to come across instances of its general use for the best woodwork of buildings until within more recent years. The erection of vast palatial buildings—the hotels, club-houses, museums, and other national piles, which mark the Victorian era—has, however, created a demand for materials—marbles and woods—for use in their interiors which our forefathers never dreamed of so using in this country; and whilst, apparently, mahogany has thus "come into fashion" for doors and such-like solid woodwork, it has "gone out" somewhat for its original purposes of cabinet-work.

This modern introduction of mahogany in the buildings indicated has naturally not been without some influence upon the architects and owners of less imposing edifices, so that what in earlier days would have been an oak door or panelled dado is now often substituted by mahogany—or that in combination with another wood. Such, in any case, has been the result of the writer's observation and experience gathered in various directions.

The growth, varieties, history, and nature of all woods of the mahogany (*Cedrelaceæ*) order have already been dwelt upon in a very interesting and instructive *résumé*, contributed by Mr. Denning to Vol. I. of WORK, page 421; and this I would strongly advise the would-be grainer to turn up and well digest this before commencing his imitations. The object of my own brief dissertation is here to emphasise this accepted canon of the imitative art—that the imitation is right and acceptable, when properly executed, in those situations wherein the real thing might, or could, consistently be used in a building. To this end I recommend the rising students of graining to make, if not a special, albeit a thorough study of such a beautifully marked and coloured wood, believing myself that as each year goes on, and as the community at large gets educated up to and understands rightly the true mission and value of colour in the home, that the imitation of mahogany may eventually occupy as favoured a position in house decoration as was once generally accorded to the ever useful oak graining.

Oil Grounds for Mahogany Graining are best made with a basis of white lead, and in the same manner as oak grounds are prepared, then stained to the desired depth and strength of colour with pigments ground in oil. *Venetian red* of a good quality is the most useful colour for this purpose, and as it gives with white lead clean and bright tints, the addition only of a yellow pigment is required to make a good mahogany ground. The amount of yellow the grounding paint should give to the eye is a question that most grainers have each their individual notions upon. In cases where the imitation is desired to match with a piece of the real wood, an experienced worker can soon settle the point by judging the light portions of the mahogany against his paint, and making the latter slightly lighter than the real wood appears. Orange red with white lead is the favourite tint of some, but upon such a bright ground there must be the best of skill and judgment to get a good imitation. The two reds and white lead, or Venetian red, orange chrome, and white, give a good ground for light mahogany; but for all-round and general purposes I rather advise the white lead being stained with the best Venetian and bright yellow ochres, which give a medium orange tint, clean in colour, but not vivid in brightness. Experience in this matter will come soon enough to the learner; meanwhile the above will guide him.

The many varieties of figure and mottle which are to be found in mahogany wood are altogether beyond the scope of these papers to consider. I will therefore confine this description to the two principal kinds, usually known as "feathered," or Spanish, mahogany and baywood, the Honduras variety of the wood.

Baywood is usually considered an inferior article to the feathered mahogany; but for general imitative purposes its appearance is much to be preferred to the latter. When elaborate and brilliant mottling and feather are put into door panels, they seem to overpower the plain stiles, and there does not seem to be the repose in its entirety which we obtain by nicely worked baywood graining upon a door; whilst, furthermore, it takes a skilled worker to get a *good* imitation of the former.

Imitations of Baywood—like all descriptions of mahogany—are best grained in water colours and upon a hard and fairly glossy grounding paint. The ground should not be spread until a day or two before the graining. When it has been painted a week or two, it not only gets dirty, and often knocked and dented, but the water colours are spread with much difficulty; and, in fact, it is necessary to damp down the work with a little whiting water and a soft rag or sponge. Freshly grounded work can be grained upon without this process, a litt extra rubbing with the tool or mottle on being necessary to spread the water colou The ground for baywood is rather lighte than for Spanish mahogany; a little mo white lead proportionately and the staine before-mentioned will therefore produce i The chief, or general, features of baywoo are a fine grain running lengthways of th wood, crossed by mottle of varying depth and sizes, and through the whole of which species of fine overgrain runs lengthways c the wood, similar to the outer overgrain c maple imitation. To produce this effe upon our painted ground, we take a littl of burnt sienna and vandyke brown groun in water, and mix them to the desired dept in a vessel with a little beer and water, an keep also a little of each pigment hand wherewith to darken the same if desired The tools required for mahogany are th usual "badger" softener, the large mottle a piece of sponge, tool-brush, the sable an thin hog-hair overgrainers, and one or tw camel-hair mottlers—all illustrated on pag 40 of present volume. We commence b rubbing in the panel with either tool o mottler, using the mixed wash, and the wipe out some parts of it light by either drawing down the mottler sideways o using the piece of sponge. The mottler is then rinsed and wiped, and drawn down the panel, using the top only and with a light hand; this will soften the light into the darker portions, and will also give a slight appearance of the general grain. With the large mottler, and using the point only, we now draw it down the panel, leaving here and there lighter spaces and masses of mottle, chiefly upon the light portions of the work. Then taking up the camel-hair mottler, we quickly mottle across both the dark work and the mottle just formed, making bright and sharp lights. This having been done before the panel can dry, we lightly badger the mottle crossways of the panel, and leave it to dry. The final overgrain is then put on by using the thin hog-hair "oak" overgrainer dipped into a deeper wash of colour, and the hairs then divided with the grainer's comb made for such purposes. When executing a nice imitation of this variety having much mottle as above described, the overgrain may advantageously be worked for a slight distance with the pencil, thus getting an irregular heart grain, which the overgrainer is worked up to. As in maple, this last portion is "softened" as it is worked. The plainest variety of baywood may also be imitated by making the shades in the colour, as we spread it, more distinct, and sometimes giving the work a decided curl; we then mottle with the camel-hair tool to a less extent than above, soften it, and get the undergrain effect by sharply stippling over the plainest parts of the work and lightly softening this, lengthways; and, finally, we overgrain as above with the hog-hair tool.

Feathered, or Spanish, Mahogany has usually a deeper colour of ground, and the graining mixture is also used much stronger, so that the mottle is sharper and more brilliant. In the best polished specimens of Spanish we see also a decided purple or "lakey" tone of colour, and this we obtain in our imitation by substituting a little victoria, or mahogany, lake for the burnt sienna. This lake pigment is purchased ready ground in water, and is inexpensive enough to warrant its use by the grainer. Vandyke brown alone, or mixed with the lake and a little beer, may be used for first

bing in the panel, but the lake is most cessary and effective for the final glazing the feathered mahogany. The best nples of this beautiful wood present to us, the case of a panel, a rich and dark centre rtion, with the extreme limits of such at lower end; out of this there springs a light feather "stem"—if it may be so med—from which, on either sides, bright ky mottle is thrown, and falls like the ape of a feather on either side in graceful d regular lines. The centre stem itself s usually a slight curve, and the top dies way into mottle like the off-shoots on ther side. Nothing but a real specimen n give the learner a true notion of the ture of this wood, and the imitation can ly be successfully learned from such.

The working method in general use is to nickly rub in the panel with the mixed aining colour, and then with a large flat tch to put in the dark tones of the centre consecutive portions. Commencing at e base, we make a dark curve with the rush, then leaving an intermediate space of e general colour, we put in a second curve sing above the first, and gradually decreasing them in size and strength of colour owards the top of the panel or surface. Without loss of time, we take up the *thin* og-hair mottler, or "cutter," and with its op, used edgeways, cut out the bright ising lights which form the stem, and which then spray out on either side as I ave described. We next take the camelair mottler, or, preferably, a "burnt-edge" litto (see page 40)—especially if the former s quite a new one—and with this we put n the sharp, brilliant, and silky lights which flow out of the centre, giving them the naturally curving inclination, and avoiding any straight and harsh cuts or lights; this the camel-hair brush, with its pliable hair, enables us to do, and also lifts the colour off sharper and cleaner than does a hog-hair brush. As I have instructed in previous papers, the mottling tools require repeated rinsing in clean water, and then wiping on the leather, to free them from the colour taken up, enabling us to mottle sharp and clean. As in graining bird's-eye maple, the mahogany may now be wetted over, by drawing the mottler and clean water down the panel, and the contrast heightened by sharpening up lights or adding dark touches of colour with wash-leather and pencil respectively. The overgrain is now put in, using the thin hog-hair brush, and working the grain after the formation of the darker curves of colour—hence *crossing* the centre of the feather. Starting upon the one side, the brush is drawn gently up, twisted carefully across the feather with a wavy and spreading motion, and then returned down the opposite half in similar manner. As each journey is made we "badger" the grain slightly upwards from the base before it sets, and then leave the work to dry. The next process is to bind the graining down with, preferably, a coat of varnish, or else japanners' gold-size and turps. Upon this we work the final stage—a rich *overglaze*, as it is termed. Taking a wash of mahogany lake and beer, we rub it all over the work, and with the damp wash-leather we make a pad, and partly roll it over the work. This method leaves an irregular mottled effect, not decided enough to clash with any of our figure, but sufficient to give a relief to the plain portions and a rich general tone to the whole imitation. Should the previous work have plenty of variety and figure, it may be best to merely rub over the afterglaze, and to soften it without mottling; this question, and also the further advantage of strengthening any other previous work, are matters for individual decision.

Graining Satinwood is a process so similar in method and figure characteristics to mahogany, that the learner can execute the one with equal facility to the latter. Although both belong to the same natural order (*Cedrelaceæ*), the satinwood is really one of the cedar tribe, but differs chiefly from mahogany in its colour, which is a rich golden yellow. The ground and general tone of satinwood are nearest to maple, but the former is rather fuller in colour. The oil paint for this imitation must therefore be stained to a delicate cream with yellow ochre, and our surfaces must be very finely prepared and painted. The graining colour with which we work the curls and mottle as in baywood should be *raw-terra-di-sienna*, finely ground in water. A little finest burnt umber or vandyke brown may be added to the sienna when we wish to soften down the colour, and a judicious combination of the yellow and brown pigments gives the most natural effect. In graining a door, the curl or feather is usually put in the panels rather softer in contrast than with feathered mahogany, and the surrounding mouldings and stiles are best mottled with some slight coolness of colour and in a simple manner. The final overgraining, with the sable-pencil or hog-hair overgrainers, is executed in precisely the same manner as in working mahogany; the colour used may be either a darker tone of the graining wash, or with a slight tinge of redness added to it. If satinwood be worked cleanly and quietly, care being taken to obtain soft *final* colours, it is an imitation that can be most advantageously introduced into the best decorative effects, and will harmonise with many colour schemes adapted for the drawing-room. As with maple graining, the varnish for satinwood must be the lightest copal that can be obtained.

AN ARMCHAIR: HOW TO MAKE THE FRAME AND UPHOLSTER IT.

BY DAVID ADAMSON.

The Turned Work in the Arms, Legs, and Stretchers or Rails.

From the seat and back having been taken first in these remarks about chair construction, it must not be thought that they must in actual practice receive prior attention to other parts. Something has been said about them first, as they seem the only parts about which a difficulty might be likely to occur; and those who understand about them will have no difficulty in understanding the jointing up and general arrangement of other portions. Of course, when making the chair, the various parts will be got and prepared by turning, squaring, etc., before putting them together, and few will need to be told that this should be done "dry," or without glue in the first instance, to see that all the joints, etc., are right. This takes up a little time, but is a precaution which should not be omitted. The making will have to be very good indeed, if none of the joints want a little rectification. Perhaps it will be as well to say that either dowels, or mortice and tenon, may be used at all of them, and if there is any doubt about those at the ends of the arms into the back holding, they may be wedged from behind. It will be as well to explain that, though spoken of here as dowels, this is rather misleading perhaps for the pins at the ends of the arms and stretchers below the seat, as they should be much stouter than is usually understood by this term. They ought, in fact, to be pins of, say, 1 in. in diameter, turned up on this part and not inserted into them. The turnings of the various parts of the chair are shown in Figs. 9 and 17, all lettered to correspond with Figs. 2, 3 (page 410), so that there will be no difficulty in knowing the places they are to occupy. Thus in Fig. 9, marked A, we see that it comes above the seat; Fig. 10, B, just below it, and so on. Only half the length of Figs. 9, 16, and 17 is given, as the other halves are merely repetitions; otherwise all of them are drawn full size.

In Fig. 1 (page 409) the chair is shown without casters, but for those who wish to add these, Fig. 13, showing an alternative foot suitable for them, is given. It will be seen that screw casters are most suitable, the ends of the feet being protected by a ring or rim, which can be purchased along with the casters. In turning, of course, due allowance must be made for the height of the casters, which will be, say, about 1½ in. There is, however, no object in cutting the legs to their exact length till the casters are being put on, so they may be left full. It will be as well, however, to turn them down so that the rims fit on tightly, and as these rims are made in various sizes, it will be just as well to get them beforehand instead of deferring till they are to be fitted. Of course, the feet can be cut down to fit them, and it is often necessary to do this; but it stands to reason that if this work can be dispensed with, or rather, be done while the part is in the lathe, it will be more convenient than to trim them down afterwards.

The turning of the back feet is not shown separately, as no one who can do the work will find any serious difficulty in setting it out, and keeping the same character as the others.

The pieces marked G and H, and the arms, may well be of a little less thickness than the others—say, turned down from 1¾ in. or 2 in. stuff. The parts of the arms not shown on the full-sized turning of these parts are intended to be left square for the pads, with which Fig. 1 shows them to be finished.

Very likely some may prefer to leave the ends of the stretchers under the seat square, tenoning them to the legs, and then running pins through in the orthodox way of old woodwork. Well, they can do so without difficulty or much disfigurement to the chair, but even without this obsolete construction it ought to last a lifetime, and then descend to "generations yet unborn." Those who choose to adopt it may, of course, do so, but I do not advise it, simply because with good workmanship and material it is unnecessary. To be consistent, such people should not have the seat or back upholstered. A piece of tough hide stretched across the former, and a carved panel in the back, will last much longer than any modern upholstery. They will not be so comfortable, but then they will be ever so much more like the crudities of the year 1589 or thereabouts, and by all means let us "advance backwards" in furniture construction, because a few odds and ends of things have had time to become old, whereas our modern work has not had the same opportunities. I say this, because a few people have objected to the remarks in Work which do not imply a profound reverence for all that is old, even though it is not very good, but simply because it is very old. I admire old things: not

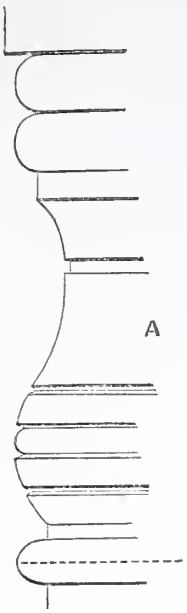


Fig. 9.—Part of Turning on Front Legs: Top, above Seat.

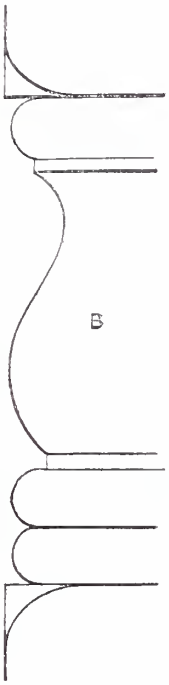


Fig. 10.—Part of Turning on Front Legs: below Seat.

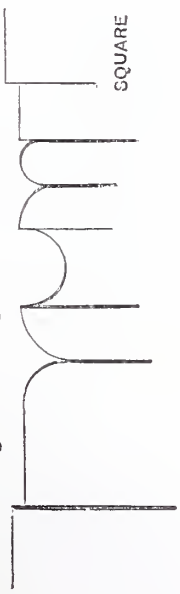


Fig. 14.—Turning on Front End of Arms.

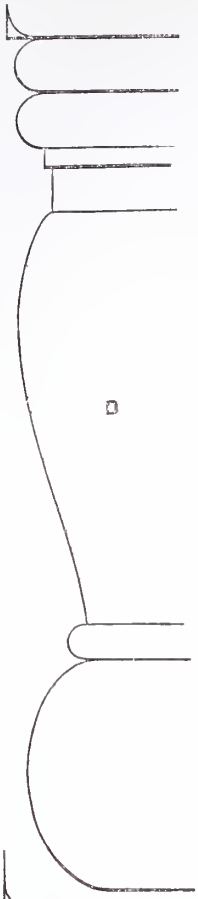


Fig. 12.—Part of Turning on Front Legs: Foot.

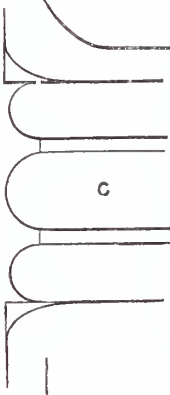


Fig. 11.—Part of Turning on Front Legs between B and D.

Fig. 15.—Turning on Hinder End of Arm.

Fig. 16.—Turning of Stretchers or Rails in Front, etc.

Fig. 17.—Turning of Ends of Side Stretchers.

Fig. 13.—Alternative Foot for Casters.

indiscriminately, but just enough to learn any good lessons they may teach us; but I feel that the opinions of others ought to be respected. Therefore, I have much pleasure in—I was nearly writing, pandering to—their prejudices: but that will not do, so let it instead be said, of indicating the course to be pursued in endeavouring to rival the sound, substantial work of our ancestors, whose constructions still remain (often in a very rickety condition) to show to us effete moderns, addicted to every time-saving appliance and graceful finish, what manner of men they were, what primitive tools they used, and how horribly rough much of their work necessarily was. They did quite as well as a modern artisan would do if he were devoid of education, if he only had a few old-fashioned tools and plenty of time to work, seldom hurried, and without much competition. Yes, the old carpenters were wonderful people, considering their opportunities—nearly as wonderful as their modern representatives, from whom infinitely more is demanded, sometimes unreasonably. Surely, after these admissions, no artistic reader of WORK will venture to think that all due praise, not unlimited in extent, is not given to our old English craftsmen. Let me advise those who wish to imitate them in every way to begin by dispensing with, say, the modern lathe, and get an old-fashioned pole lathe instead. It will be much more cumbersome, and it will not do its work so well; but what does that matter? it will enable the turner to "live up to" the rough old times; and, yes, he must not use glue nor screw-nails, nor if he feels tired must he ever think of resting on any seat more comfortable than the old-fashioned "settle." In fact, he must discard every convenience and improvement which has been devised—not to go too far back—during the last two centuries. This leaves little to be said now to those who want to make a real good, sound, substantial, ugly, uneasy chair, in approved Tudor style, and having told them what to do, the worker who prefers modern ideas may be further directed.

Nothing has been said about the carving on the front legs, as it is of such a trivial character that sufficient indication of its style may be gathered from Fig. 1. It amounts to little more than a few incised lines, with just a little notching, suggesting rather than forming leaves or foliage. Of course, any amount of work may be lavished on the carvings, but, on the other hand, just enough to relieve the plain surface looks very well.

We may now consider the frame made, and ready for the next operation, which may either be the polishing or the upholstering, as far as the stuffing is concerned. The outer covering should not be put on till after the frame is polished. If any staining is required, it should be done before the upholstery is begun, unless, indeed, the wood is to be darkened by fumigation. Even in this case it may as well be done now, though if to be fumed, I should advise those who have no convenient air-tight room, cupboard, or box to hold the frame when put together, to do the darkening while all the pieces are loose. A comparatively small box will hold these, and the chair can be formed afterwards. If the chair is to be wax-polished, which is the best way of finishing fumigated oak, the polishing may be deferred, but if it is to be stained and French polished, this should be done before the cover is put on, leaving a final wipe over to remove any accidental

arks or smears. The chair, in fact, ould be completed otherwise, and only quire touching up by the polisher to finish after the covering is on. It is almost edless to say that such a chair will look tter with a dull polish than with a highly azed finish. Any of the ordinary brown ains may be used, but I would specially ution amateurs not to thickly coat it with rnish. If they prefer varnish to polish, t it be a spirit varnish, which will give uite sufficient gloss without "treacling" e wood. I do not know that anything ore need be said about polishing, so I ill get on with the upholstery in my next.

HANGING MIRROR WITH BRUSH BOX ATTACHED.

BY ED. C. ROE, JUN.

A GREAT number of the newly erected maller class of houses are built with halls, r rather entrance passages, of somewhat imited dimensions, and thus do not afford ufficient accommodation for an ordinary at and coat stand or rack. But, however mall a place may be, it is not any the ess desirable that a piece of suitable furniure should be provided, the essential points f which should be a mirror and a receptacle for a hat and coat brush; a few hat pegs may be added at discretion.

In designing the mirror, care has been taken to render the details so that, while effect has not altogether been sacrificed, the work shall be comparatively easy to execute, and with the tools in the possession or within the power of the average amateur to make. Alternative sections are given of the mouldings.

Regarding material to be used, it is scarcely necessary to point out any particular wood, nearly every variety admissible for use in cabinet work being suitable—even pine or deal, which may be enamelled. It is largely a matter of individual taste; personally, wainscot oak is preferred. The only matter offering any really serious difficulty is the lid of the brush box, but in case this should prove beyond the power of any worker, an alternative method is shown at Fig. 1, and will be described in due course.

It is to be regretted that we cannot have a full-size elevation of at least the side brackets; yet we should be thankful for small mercies, for we have the remedy in our own hands, and it is to set it out for ourselves full size off the 2 in. to 1 ft., or one-sixth full-size, drawings. The sections given are two-thirds size, and each section of moulding should be enlarged to full size and traced from the paper, and then the tracing should be mounted on a thin piece of pine or mahogany, say $\frac{1}{16}$ in. thick, which when dry may be cut to the pattern indicated by the lines upon the tracing paper. We thus get a thin section of each moulding or bead. The use of these sections will be described as we proceed. It is intended that the mirror should be bevelled, the additional beauty afforded being well worth the extra cost; and if we can only do for ourselves, or in the absence of sufficient skill persuade a good-natured artistic friend to paint a few rushes or a spray of flowers from one angle outwards, it will add greatly to the general effect.

We will commence by making the frame which holds the mirror; the outside dimensions of it are 12 in. wide by $14\frac{3}{4}$ in. high. The width of the moulding is $1\frac{1}{4}$ in., thus making the right size $9\frac{1}{2}$ in. by $12\frac{1}{4}$ in. It will not do to mitre together—that is, providing we adhere to the original section. The reason for this will be clearly seen upon reference to front elevation and section: the only part mitred is the ovolo on the inner edge. This being the case, it will be necessary to use the mortice and tenon, which may be run through, or be merely stubbed in. The setting out is shown by dotted lines, and the finished tenons, etc., by thick lines.

Sometimes it is preferred to scribe the ovolo in lieu of mitring; in many instances this is desirable, as in the case of the material shrinking the joint will not gape, or, in other words, open, which it most probably would do were it mitred. The setting out for the scribing is exactly the same as for mitring, the difference being this: the stiles remain as they are with the moulding running through from end to end intact, and the ends of the rails are cut as shown at Fig. 8. The proper method of scribing is first to mitre the ovolo on rail in the same manner as though it was intended to mitre together, and then to clean out with a sharp tool the material which is within the surface affected by the bevel made. If this is properly executed, the exact counterpart of the corresponding moulding will be obtained, and if the mouldings are worked true to section, a

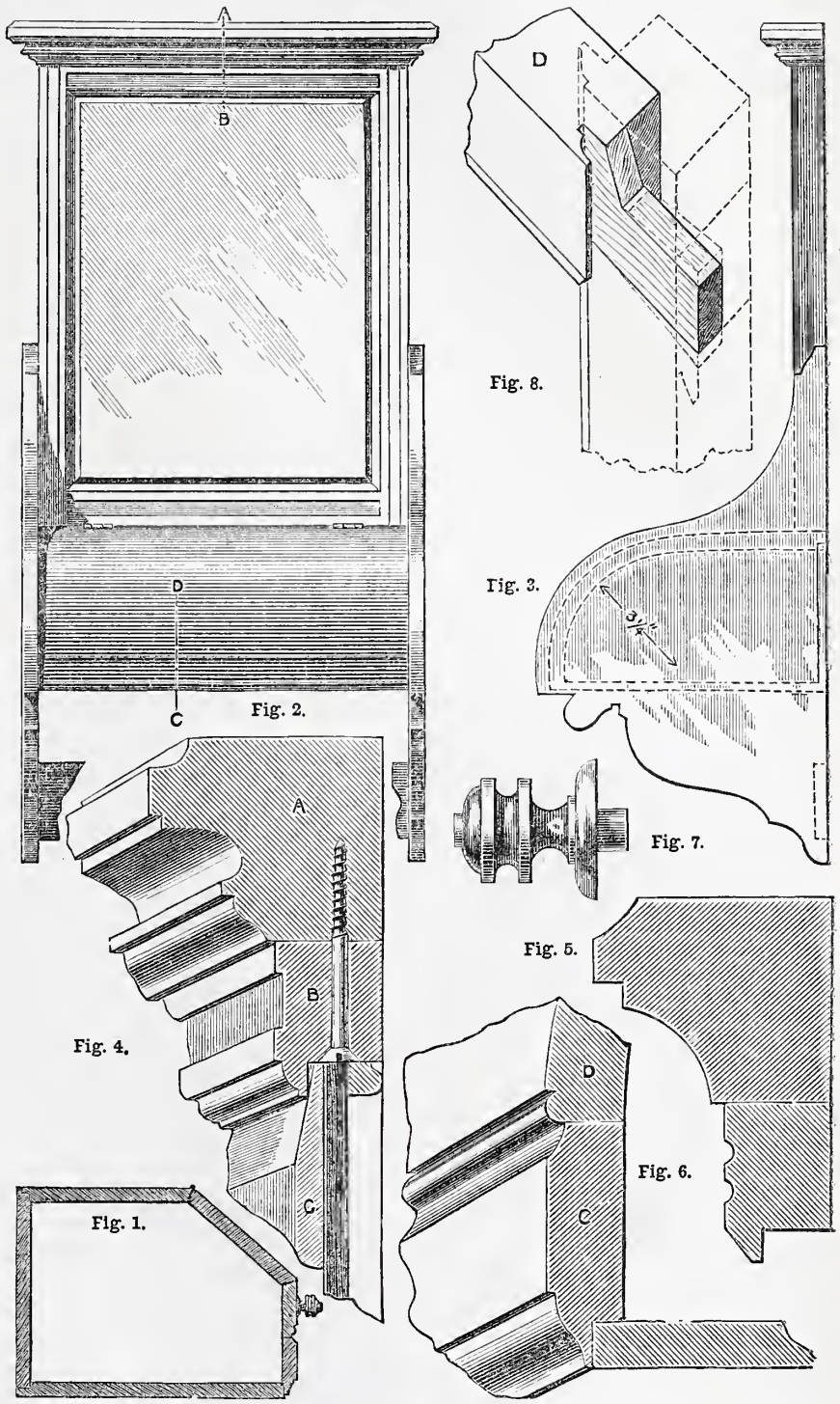


Fig. 1.—Alternative Lid for Brush Box. Fig. 2.—Hanging Mirror: front elevation. Fig. 3.—Ditto: side elevation. Fig. 4.—Section of Cornice of Mirror at A B in Fig. 1. Fig. 5.—Alternative Section of Cornice at A B in Fig. 1. Fig. 6.—Section at C D in Fig. 1. Fig. 7.—Knob of Brush Box. Fig. 8.—Mode of morticing and tenoning Rail to Uprights.

good fit should be ensured. It is rather a difficult matter to describe on paper; indeed, far more so than the actual work, for scribing is, with tools properly in order, a very simple and interesting job.

The frame being completed, let us turn to the side brackets; these should be a bare $\frac{5}{8}$ in. thick. The centres for striking the curves are given. The edge is finished square, and this being the case, great care should be taken to keep the arrises in perfect order.

In the inner face of each bracket we shall require the housings as shown by dotted lines, Fig. 3. These are to receive the ends of the hanging and front pieces, bottom and back, which may be at once got out and fitted; two-thirds size section of front and bottom is shown at C, Fig. 4. Of course, the portion occupied by the lid is not housed, neither where mouldings occur. Accurate fitting into the housings is most desirable. Take each in hand singly and work strictly to the sections. The use of the thin sections will now be apparent, taking as an example the front piece C. After fitting, the ends should be slightly chalked, the thin pattern placed on, and with a finely pointed pencil the outline marked; reversing the pattern, the same thing must be done to the other end, and thus we get a guide each end exactly similar to work to. Of course, proper care must be taken to work quite square. The moulding on the front edge of C should be worked in after fitting by means of a router or bead plane and round. Give great attention to the length of these pieces; the exact length is the width of frame plus the depth of the housings, which are in this case $\frac{1}{4}$ in. deep, this making the total length $12\frac{1}{2}$ in. Glue together with fresh glue, or, if not objected to, screw from outer face with brass cross-cut round-head screws as indicated upon side elevation. Glue is also advisable in conjunction with the screws.

The alternative method is shown at Fig. 1. It is much simpler, but scarcely so effective; nevertheless, the purpose will be served and look well. The section drawn to scale will show what is intended without further explanation; the joints should be tongued and glued. The position of the hinges is shown upon Fig. 2; $1\frac{1}{8}$ in. brass narrow guage pressed butts will do admirably. The various systems of hinging have been so aptly dealt with in previous numbers that a description here may be considered unnecessary.

Having arrived at this stage, the frame may be cleaned off and fitted between the side brackets; great care must be taken in fitting. Strictly speaking the frame should be rebated into the side brackets, but it is scarcely necessary, and tends to make the job longer and more tedious. However, the suggestion is made, and some may possibly wish to act upon it; the same observation applies to bottom edge.

We should now prepare the capping or top moulding, section A. The length required is roughly 1 ft. 10 in.; this will allow ample for mitring. It is advisable to mitre the ends and not to return the moulding upon itself, as the latter method is a longer job, and seldom in amateur hands successful. If carefully mitred, good glue will hold sufficiently. The finished length will, of course, be governed by the width of the finished frame, thus: if the frame is exactly 12 in. wide, the extreme length of the capping will be $14\frac{1}{8}$ in. A couple of screws as indicated at A and B will suffice to fix.

Possibly a hat rail would prove a convenience, therefore one is indicated under the box, Figs. 2 and 3; should a rail be affixed a rebate must be cut in the sides, not through, but the thickness of the stuff one way and say $\frac{3}{8}$ in. the other. The remaining job is the knob; a suggestion for this is given in Fig. 7. This should be executed in the same material as rest of work. A small brass octagon knob might be used with advantage. Should a wooden octagon knob be preferred, the stuff must first be turned to pattern, and then with keen chisels, etc., cut to hexagon form, pencil lines being carefully placed thereon to work to.

When ordering the glass give the sight size, which is the size between the inner edges of frame. The rebate size may also be given in addition. When the glass is placed in the frame, two or three pieces of good stout new brown paper should be laid on the back prior to fixing the back in. By the way, do not omit to blacken the rebate of the frame and the edges of the glass; this operation being omitted, is often the cause of a disagreeable appearance of the edges after the glass is fixed and looked at from the front. The back need only be $\frac{1}{8}$ in. thick, as shown in section. The beads must be mitred round, and will make a capital finish to the back, which is too often neglected. Our job is now completed—that is to say, as far as the mechanical portion is concerned; the beautifying processes must perforce be left to hands more experienced in such matters, and upon reference being made to previous numbers, various methods of finishing will be found lucidly described.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

100.—New Hand-beading and Sash-moulding Tools.

Of late years scratches and routers of the spokeshave class have come very much into use, and the two new tools that I am about to describe are very favourable specimens of their class. Of course, I do not pretend for a

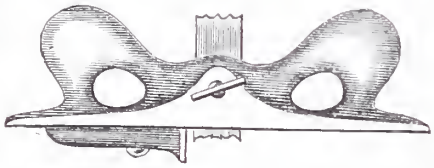


Fig. 1.—New Hand-beading Tool.

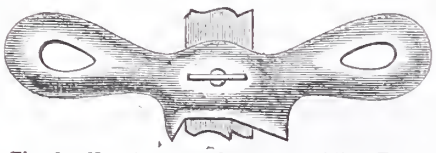


Fig. 2.—New Improved Sash-moulding Tool.

moment to say that they are as effective as planes made for the same purposes as those for which the tools now under consideration are intended, but planes are costly and beading tools and scratches are cheap, and therefore the latter are far more within reach of the amateur and even the individual workman who wants to do an odd job of the kind who would buy them and refuse the planes on the principle of the Jew caterer, who was wont to say that he always bought mutton "becos it vosh sheep," and never bought venison "becos it vosh deer." Possibly some reader may fail to see the joke, but should this be the case, I shall be happy, as many of my contributors say, to render further assistance in the way of elucidation in "Shop." These tools have been introduced by Messrs. Moseley & Son, Tool Makers and Cabinet and Builder's Ironmongers, 323, High Holborn, W.C. Fig. 1 gives a front view of the New Hand-beading Tool, which is accompanied by six irons, each having two cutting edges, comprising in the twelve cutting edges thus supplied, beads, reeds, quirks, rebates, and hollow and fancy reeds. This tool is supplied post free for 2s. 3d. The appliance itself is of japanned iron with a bright front. Its extreme length is about $5\frac{1}{4}$ in. Its construction, by means of the wings at the sides and the holes by which they are perforated, affords a secure grip between the thumb and index finger of the operator. A thumbscrew in front is used to secure or release the cutting iron which passes through a slot in the body of the tool. Below is a fence interchangeable to either side of the cutting iron, and possessing by means of two screw holes in the sole for the screw that secures it, a range of distance from the cutting iron not often found in tools of this description. Fig. 2 also gives a front view of the New Improved Sash-moulding Tool, which also has six irons, and therefore twelve cutting edges—six for lamb's-tongue moulding, and six for ovolo moulding, the irons for each description being $\frac{1}{2}$ in., $\frac{9}{16}$ in., and $\frac{5}{8}$ in., by $1\frac{1}{2}$ in.; $\frac{5}{8}$ in. by $1\frac{3}{4}$ in.; $\frac{5}{8}$ in. by 2 in.; and $\frac{3}{4}$ in. by 2 in. The extreme length of the body of this handy tool is $5\frac{3}{4}$ in., and its height $1\frac{3}{4}$ in. The cutting iron is held in position or released by a thumbscrew, as shown. It will be noted that the peculiar confirmation of the sole in which the cutting irons work is especially adapted for working sash mouldings with this instrument. Its price, post free, is 2s. 6d.

101.—A Manual of Wood Carving.

This is a clearly written, beautifully and effectively illustrated, and well-printed guide to the attractive art of wood carving from the pen and probably the pencil of Mr. Charles G. Leland, F.R.L.S., M.A., who is well known as a practical writer on practical education. It is revised by Mr. John Holtzapffel, whose name is too well known to need any remark from me. Everyone engaged on the book has done his best to render it one of the most perfect of its kind. The subject matter, instead of being divided into chapters in the usual way, is so distributed as to take the form of an introduction, twenty lessons, and an appendix. Of these the introduction gives necessary instructions regarding the woods and tools to be used, and on sharpening the latter, for tools possessing the keenest possible edge are always a *sine quâ non* to the wood carver. The lessons comprise technical teaching on the various operations necessary in wood carving, from indenting and stamping to spot cutting. Nothing is forgotten, and in consequence nothing has been omitted. Ample advice is rendered on repairing, gluing, colouring, staining, oiling, etc. The appendix deals with suitable objects for wood carving. Over eighty illustrations are to be found in the 160 pages of which the work consists, and these are supplemented by six full-page plates. I do not know the price, but this may be ascertained from the publishers, Messrs. Whittaker & Co., Paternoster Square, London, E.C.

102.—Practical Blacksmithing.

That WORK is becoming well known in the United States is supported by the fact that occasionally American publishers send through their London agents books for notice in its pages. "Practical Blacksmithing" is one so sent, and forms the third of a series of four, which purport to be "a collection of articles contributed at different times by skilled workmen to the columns of 'The Blacksmith and Wheelwright,'

ıd covering nearly the whole range of blacksmithing, from the simplest job of work to some the most complex forgings." The volume is ımpiled and edited by Mr. M. T. Richardson, ıe editor of the publication just named. Chapers 1 and 2 of this volume are devoted to the onsideration of various tools and wrenches used ı the smithy, and the remainder to various perations in forging, such as welding, brazing, c., the last being devoted to plough work, a ranch of blacksmithing of the utmost importnce in the United States. The London publishers are Messrs. Kegan Paul, Trench, Trübner and Co., Limited. THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

n answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Size and Speed of Pulleys.—BRASS writes:—"In my reply to DICK, No. 83 of WORK, page 503, two slight mistakes have been made. In line 16 from top of reply, counting such as $\frac{V \times D}{v}$ as one line, there is printed the words 'in a *practical* form'; this should have read, in a *fractional* form. Again, in line 31, a sentence begins—'*Cut* down in the form of a fraction;' this should be '*put*,' etc."

To Make Reversed Tracings Quickly.—J. C. K. (*London, N.W.*) writes:—"Place the drawing face down on a sheet of clear glass with an electric light under it; by placing your drawing-paper over your pattern you can trace the finest lines distinctly."

Speed and Size of Pulleys.—A. R. (*Scorrier*) writes:—"Formulas in letters may be, and no doubt are, very simple to many readers of WORK. But when we think that WORK is chiefly for the working class, we should also think that there are many readers who are not highly educated, and that questions so answered, though very clear to some, may be very puzzling to many others. I notice E. D., in replying to STRAINS (see page 503, Vol. II.), said, 'Don't be startled at formulas, as they are only letters'; also BRASS, in reply to DICK, on the same page, said, 'If this is not clear to you, write again,' both indicating that such formulas may not be clear to some. Therefore I give, for the benefit of such readers of WORK, a very clear and simple rule for finding speed and size of pulleys. For instance, a pulley 60 in. diameter makes seventy revolutions per minute; what number of revolutions will be made by a 12-in. pulley when driven from it?

Example— 60 in. diameter of driver.
70 revolutions of driver.

12) 4200
350 revolutions of driver.

Again, what diameter pulley would be required to run 350 revolutions per minute when driven from a pulley 60 in. diameter, making seventy revolutions per minute? Example— 60
70

350) 4200
12 in. diameter required.

I think the above will be clear to all, and that it will be seen that the above rule will answer for pulleys of any diameter."

Oval Drawing.—J. B. (*Wallington*) writes:—"Surely your correspondent F. C. (*Leytonstone*) (see page 519, No. 84) cannot be in earnest when he says that it is impossible to draw a parallel to an ellipse either by trammel or peg and string. Strike an ellipse with a trammel, then cut three, six, or any number of inches off the end of the rod; if that does not strike an ellipse parallel to the first one, it must be 'awfully near it,' or I must have been working radically wrong any time this last twenty years. Perhaps the following few notes may be useful to F. C. or some of your readers:—(1) An ellipse is the section of a cylinder cut in an oblique direction. Cut it off the broom handle. (2) The circumference of an ellipse is continually altering in its direction. (3) The focii (is that Latin or Greek? suppose we call it focus) of an ellipse is the exact geometrical proportion between the two circles, which may be struck on the transverse and conjugate diameters of an ellipse. (4) Any two lines drawn from the focus of an ellipse meeting together in the circumference are together equal to the transverse or longest diameter. The above is the rule for the string and pin method. F. C., in altering the length of his string, neglects to alter the focus, or points in which his pins are placed."

Simple Wood Carving.—J. E. B. (*Ashton-under-Lyne*) sends, for the benefit of beginners in wood carving, his experience in following this pleasurable hobby:—"Most readers of WORK have, no doubt, read with interest the many articles from time to time inserted on the subject of wood carving, and yet so little has been said of the methods resorted to to produce the artistic carving which decorates the major part of our woodwork, that I venture to offer a few suggestions to the amateur, which, if carefully adhered to, will enable him, with practice, to become a proficient wood carver. The tools necessary for the beginner are few and inexpensive: they consist of a parting tool, which can be purchased, with handle complete, for one shilling, the ordinary joiners, gouges, and chisels of various sizes, and the punches, which can be easily made by filing the end of an ordinary bolt in a criss-cross manner from the necessary outfit of the wood carver. Thus armed, he provides himself with a sheet of black impression or tracing paper, and the wood upon which he intends to develop his designs. The designs can easily be secured by placing a piece of stiff paper over some old carving, and rubbing it with heel-ball until the design is plainly reproduced on the paper, after which the workman copies, by tracing the lines, by means of the impression paper, on the wood he intends carving. If the workman be able to draw and make his own design the copying process is not necessary, but any number of designs can be secured by the above process. The workman takes half his design to begin work on, and cuts out the lines with his parting tool, taking great care to keep the cutting a uniform depth, and to hold the tool firmly in the right palm, using the left as a brake to regulate the speed, and to carefully guard against mis-slips, and guiding the tool with the right hand until the outlines of the design be complete. The shapes of leaves, flowers, pateras, etc., are all outlined with the parting tool; they are next hollowed out with a gouge, a thin stem cut to form a centre, and the fibres finely cut from the centre to the outside edge of the leaves, which are next cut downward with a quarter gouge, a gentle tap with the mallet being sufficient to get the required depth; they are next finished off by gently cutting down to the quarter gouge mark a slant cut with an ordinary chisel. Fig. 1 represents half of a design, consisting of centre patera and leaves. To secure an exact copy of the work completed, the workman turns his design paper over, upon which he will see a fac-simile of the design which he has carved; this fac-simile forms the pattern for the completion of his work. The design in Fig. 2 is a very simple one for the young amateur. There are only two tools necessary in carving this; the centre stem and the outlines of the leaves are carved with the parting tools, and the leaves hollowed slightly with a gouge; the sprays are easily notched in with the parter by cutting in towards the stems about ¼ in. long by ⅛ in. deep; this class of work is known as incise, and opens the way for the amateur to the grander and more artistic raised work. By carefully noting the work of professional carvers the student will readily see how the work has been done, especially as he becomes by practice more and more familiar with the use of his tools; improvements and designs will readily make themselves apparent to the workman. Mr. Adamson's article in a late edition of WORK furnishes some excellent designs to work upon, and those readers who have retained copies of those numbers may easily enlarge the designs by means of a pentagraph, which may be purchased from any artist's colourman. The back numbers of WORK which contain carving designs can be had on application, and to those who still have them they will prove valuable as they gradually become good carvers. More important even than skill to the amateur is sharp tools—in fact, it is indispensable that the tools should be kept sharp, for if dull carving is monotonous, and robs the student of his object. For learners I should recommend cypress wood as being best suited for incise carving, for though soft and easily worked, it retains all the qualities of the harder woods, and cuts even, making a very nice appearance when carved and polished in the white. I do not see why more cabinet-makers and joiners do not add wood carving to their trade, when a very short time spent in practice would enable them to do most of their own carving."

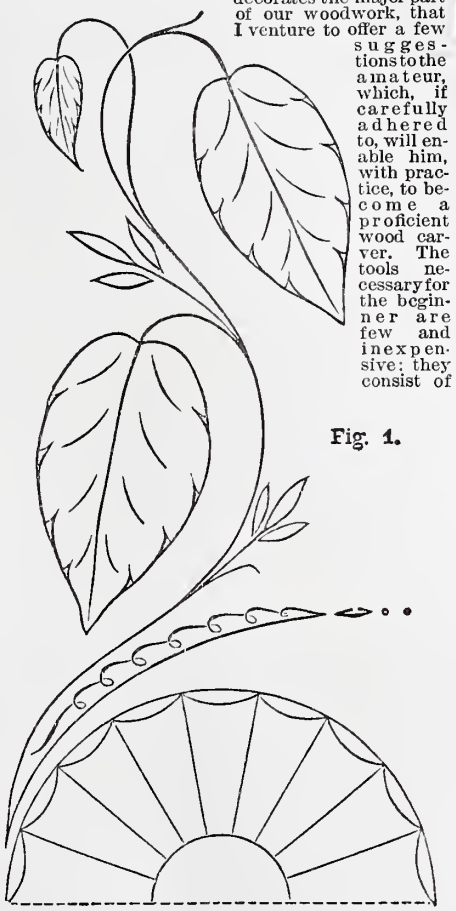
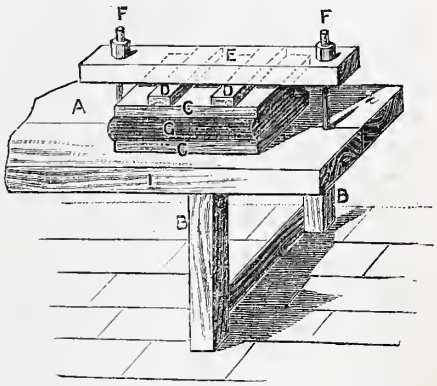


Fig. 1.

Fig. 2.

Simple Wood-carving Designs.

Binding Press.—E. P. (*Warrington*) writes:—"I give you an idea of my own for a binding press. It answers first-rate, and is cheap. I send rough sketch. A is top of work bench. If you have not a bench, get a piece of 3 in. plank. B, B, legs of bench; C, C, two pieces of pine about 9 in. by 12 in. by 1½ in. thick, planed square on edges; D, D, packing which keeps the top board C stiff; E, strong piece of hard wood 3 in. by 2 in., about 20 in. long; F, F, two bolts ⅝ in. thick, 12 in. long; bore two holes through beneh top to clear book 2 in. each end; bore hard piece E to correspond; slip bolts from under side; put C on bench, then book marked O, then C on top, then packings D, then slip E on; press the book into its shape, and screw the very life out of it." [By all means send photograph of your carved arm-chair, with a description of it, so that it can be given in Shop I. for the benefit of WORK readers. The violin papers will probably be given with Vol. III. of WORK.—ED.]



Binding Press.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Netting Machine.—A. G. (*Dublin*).—I do not know of a machine for making nets. Perhaps some reader of WORK may know of such a machine, and will give particulars of it—where it can be obtained, and the price.—G. E. B.

Maker of Electric Scarf Pin.—T. S. E. (*Birmingham*).—These articles are made in Paris. I do not know the maker's name. They are imported to this country by Messrs. J. E. Hartley & Co., 13, St. Paul's Square, Birmingham.—G. E. B.

Spon's Receipts.—STEEL WORKER.—The book you inquire after is "Spon's Workshop Receipts," four volumes, 5s. each, published by Spon & Co., 125, Strand, London.—K.

Bookcase and Piano.—A. E. S. (*London, S.E.*). You know nothing about polishing, and wish to have your furniture restored to its original beauty without running the risk of injuring it in any way. Undoubtedly it would be advisable to pay and have it done by a good man. From your remarks the bookcase probably only requires cleaning and "touching up," in which case the cost of doing it will not be so much as if it required entirely re-polishing. Your piano probably requires this.—D. D.

Re-lining Oil Paintings.—B. A. K. (*Sunderland*).—This work requires great delicacy and extreme care. If you are not accustomed to it, you had better not attempt it. Be content, if the pictures are of small size, with mounting them on a panel; or, if larger, restretching them on an ordinary frame.—D. D.

Decorating a Screen with Christmas Cards.—E. A. (*Dublin*) has a four-fold frame. He proposes "to first cover the frame with stout brown paper, and afterwards cover all with coarse canvas," on which he will place his Christmas cards. Covering the frame with paper will be unnecessary, as it will be covered with canvas or calico. We should advise straining not "coarse canvas," but calico over the frame, whether bleached or unbleached is no matter provided that it will strain, or so shrink as to become perfectly tight after being tacked on damp. All calico will not shrink, and it is better to try a sample before using a quantity. Copper tacks are held to be best, and the edges of the calico should be glued down: for this purpose Le Page's liquid glue is most handy. The calico should then be well sized, and afterwards papered. If the coloured or toned paper which is to serve as a background is moderately thick, this will suffice; but if it is thin, a tolerably thick, but smooth, paper should be pasted between it and the calico. The colour to be chosen must of course be a question for individual taste; but we presume that it will not be garish or staring. Ordinary paste will suffice for sticking his cards, particularly if the precaution be taken slightly to damp the cards before pasting, and after pasting to let them dry under pressure. Folding in a damp cloth is one of the best ways of damping; but by using the liquid glue instead, simply putting mere touches of it at intervals just round the edges of the card and pressing it down tightly. For this plan of sticking, any cards which are not quite flat should be made so by damping and pressing beforehand. The above-named liquid glue is a most handy cement, and a strong one, and may be bought everywhere. As to the arrangement of the cards, much must depend on the materials. White designs do not assimilate well with coloured ones, and the two should be kept separate. The best way is to play the cards about on the space to be filled till they are brought to compose in such a manner as is pleasing to the eye; and then to make a rough sketch on which each card should be numbered, the backs of the cards being numbered also. The multiplicity of straight lines, which must needs occur in any arrangement of such things, may be varied by introducing dried and pressed ferns, grasses, and leaves, which are best fixed on the screen with gum. The entire decoration should, of course, be eventually protected by a couple of coats of hard transparent varnish.—S. W.

Staining or Dyeing Wood.—TOPO.—The only way of making stains penetrate deeply into wood is by no means expeditious, and is not simple to those unaccustomed to the work. For ordinary purposes the ordinary stains are quite sufficient. For the mahogany colour of wood to be waxed, why not stain the wood first, and then wax-polish in the usual way?—D. D.

Magnetising Steel.—P. H. (*Pendlebury*).—Your arrangements for magnetising the horse-shoe pieces of steel are all that could be desired. The machine is short-circuited because the resistance of the two coils of wire is low, and admits too much current through them. Put a resistance of iron wire in the circuit, and thus keep back part of the current. Tap the magnets lightly with an iron rod whilst the current is passing through the coils. The steel loses its magnetism after a few days, because of one or more of the following reasons:—(1) The steel is of inferior quality. (2) The steel is not properly tempered and hardened. (3) The magnets have been heated or subjected to blows. (4) They have been thrown down carelessly, with like poles contiguous, or without iron keepers. Steel of the very best quality must be employed, and made as hard as fire and water can make it; but care must be taken in heating, so as not to burn the steel. The magnets must not be heated or hammered, and they should be fixed by brass screws to brass or gun-metal supports.—G. E. B.

Electric Lighting by Wind Power.—STUDENT.—If you already had a windmill and a dynamo, and wished to know how to utilise both machines for electric lighting, I would tell you how to set about it. But I cannot advise you to build a windmill for such a purpose. Wind power is most unsuitable for driving a dynamo electric machine, and specially unsuitable for electric lighting purposes. I should think you know very little about electric lighting, therefore advise you to read the articles on "Model Electric Lights" now appearing in WORK. From these you will learn the best means to be adapted to your purpose, and the cost of the undertaking. You will require six lights of ten candle-power each lamp, and these will absorb nearly half horse-power.—G. E. B.

Where to get a Book on Coils.—W. R. (*Chesterfield*).—"Intensity Coils: How Made and Used," by Dyer, is published by Perken Son & Rayment, 99, Hatton Garden, London, and is sold by all booksellers at 1s.—G. E. B.

White Spar Stone.—SPAR.—If you write to Mr. S. Barlow, 1, St. Luke's Street, Derby, I think you will get all the information you want.—E. D.

Body and Glaze for Raised Letters, etc.—G. A. K. (*Stoneycroft*).—It is difficult to answer G. A. K.'s inquiry on the above subject, as I do not know what convenience he has for carrying out this class of work, nor what appliances he may have at his command for preparing his clay and glaze, but as he asks for the simplest and best way of making same (I presume he is perfectly satisfied with the result of his moulds, though I should hardly think he has adopted the best means of getting them exact or of the best finish), I would advise him to make a fresh start, and proceed according to the following instructions. To commence, I should either model the letters I required or get them modelled (which would not be a difficult matter) with the same kind of clay that he intends to use; these will require to be made just about one-eighth larger than he requires the letters when fired. When he has procured these, the next thing to be done is to take a cast from each in plaster of Paris, and let them stand for about one hour to allow the plaster to properly set; then remove the clay from each, and he will have what we may call his block moulds. Now make a size, composed of soft soap, 1 lb., to about one quart of boiling water, and when this is cold the block moulds will require to be sized over three or four times with the above size, applied with a soft brush or sponge, and washed between each sizing with a clean wet sponge; re-size, and take another cast of each: these are termed the cases, from which a number of moulds for working from may be produced, either at once or at various times. Of course, the cases require to be washed and re-sized before running each mould. When the moulds are made they must be thoroughly dried, which requires to be done very carefully, not allowing them to get too hot, or they will be spoiled. Another thing to be observed in making the moulds is to mix the plaster well, or until it is free from any particles in a dry or rough state. Having prepared the moulds, we will pass on to the making of the clay, for which we shall require, if for regular earthenware, or, as it is sometimes called, opaque or stone china: Dry blue ball clay, 8½ lbs.; dry Cornish china clay, 15 lbs.; dry ground flint, 15 lbs.; dry Cornwall stone, 10 lbs. When the above is weighed, break it in small pieces, put it in a suitable vessel, and cover it with clean cold water; let it stand for about twelve hours, or until the clays, etc., are perfectly saturated, then mix them well together, and pass the whole through a fine sieve, or lawn, such as is used for the purpose, and may be procured from different makers in the pottery district if he cannot get them in Liverpool. Having passed the slip or clay in its liquid form through your lawn, which takes out any particles of grit, etc., evaporate the water until the mass is about the consistency of dough, when it requires to be well beaten or worked up to make it all of the same consistency, as in evaporating the water some parts will be rather dryer than others. Now the process of making may be commenced by pressing the clay into the moulds and allowing it to partially dry, when it will deliver from the moulds without any trouble. Afterwards, when sufficiently dry to allow of handling, trim round the edges and clear off all roughness. Now allow them to thoroughly dry, which must not be done too quickly, when they will be ready for the first firing; and during this process they must be protected from the flame, otherwise they will be discoloured, and therefore spoiled. After this burning they require to have all dust brushed off them with a dry brush, when they are ready for glazing, which may be done by dipping the parts you require to be glazed in one of the following mixtures:—

No. 1 Glaze or Enamel.		*No. 2 Glaze or Enamel.*	
White Lead ..	12 lbs.	Ground Felspar .	9¼ lbs.
Felspar	12 lbs.	,, Cornwall Stone ..	6 lbs.
Flint	4 lbs.	,, Flint ..	2 lbs.
		Whiting	2 lbs.
		Plaster	¾ lbs.

No. 1 glaze is rather soft and easy of fusion, though not so good in colour as No. 2, which requires a much stronger heat; either of the above glazes may be prepared for use in the same manner as the clay, only they require to be kept in the liquid state after sifting through the lawn. When it is ready for use, the glaze will require to be used about 27 or 28 ozs. to the pint for dipping in. Afterwards they require to be re-fired to complete the glazing. The heat required for this purpose can only be determined by experience, and must be continued until the glaze is sufficiently fused, when allow your kiln to cool slowly and thoroughly before removing the goods.—J. T. B.

Bookcase.—CAIRNGORM.—I do not know what kind of bookcase you require, but descriptions of several which I think might answer your requirements have been given in WORK. Buy the Index to Vol. I. and look the subject up. If there is nothing suitable, say what points you want information on and I will endeavour to assist you. From the things you have made with the aid of WORK, I am inclined to think you will have no difficulty in making such alterations as you may think necessary from the published description. By all means send a description of your contrivance for fret cutting, if the machine is a success, to the Editor, who will decide if it is worthy of notice in WORK.—D. D.

Bookcase.—J. McL. (*Govan*).—You may certainly make this of oak and stain it black afterwards if you prefer to do so. Oak will do just as well as pine for all practical purposes, but you must remember it is more expensive and more difficult to work. When a cheap wood will do equally well, it seems almost a pity to use anything more costly. If you do not consider pine is good enough for you, and you intend to stain the job black, or, as it is usually called, ebonise it, I should recommend you to use a cheap mahogany (baywood). If, on the contrary, you have not decided that the job shall be black, and for any reason prefer to use oak, you will find it look better if darkened either by staining or by fumigation. I must, however, point out to you that the construction of the bookcase as described is of a very simple and elementary character, much more so than if it followed the ordinary traditions of cabinet making. It is, in fact, designed for those who might have the ability to make a really efficient piece of furniture without having sufficient skill to follow the recognised methods of construction. I gather from your letter that you have not read the articles on "Artistic Furniture" which appeared in Vol. I. If I am correct in this surmise, let me advise you to do so, as from them you will learn more of the intentions of the writer in describing the bookcase about which you inquire.—D. A.

Unsound Silver.—OLD BRUIN.—*Re* the causes of silver cracking and blistering when rolled. Of course the rolling is only the means that makes the blisters visible. Rolling might, if unskilfully done, produce the cracks; but the real cause is to be sought more in the direction of impurities, such as zinc, tin, lead, iron, etc., or may be dirt, that has got mixed up with the silver in melting. Severe hammering and rolling, without annealing, would produce cracks, as would crossing in the mills. For the blisters quite another set of causes may have been at work, and before giving the means taken to minimise them I should like to ask this subscriber if he has ever noticed that coins very often blister; and I remember a few years ago one of the teachers of silversmith's work for the City and Guilds of London Institute asked me the same thing as you have done; even now one of the best refiners occasionally sends me in silver which blisters on being annealed, so one is perforce compelled to believe that they cannot be got rid of absolutely. So to minimise them is evidently the only course. The whole process turns on the purity of the metals used, on their being thoroughly mixed, and on their being poured clear and bright into a properly prepared ingot mould. Sterling silver should come out all right when melted with borax alone, but a little powdered charcoal put on top when it is in a fluid state, and before the final heating, improves it; and, in addition to that, a little sal-ammoniac (either as powder with the charcoal, or as a rod with which to stir it) will give nice, bright, tough, working silver. I am told that sub-carbonate of potash is as good. The ingot mould, into which we will pour our metal, must be perfectly clean, and slightly, but thoroughly, greased, and should be hot. I had written at first "warm," but I have got good results from skillets that I could not hear my hand on; so make it hot, but not too hot, else you will find the silver spit just as much as if the skillet were cold. The grease or oil must *not* be dried up. The position is something too: it should slant somewhat, so that the continuous stream of metal can run down and fill the skillet right into the very corner, which it will hardly do if let drop to the bottom, for then it gets chilled; pour quickly and steadily. Of course everything else (charcoal, borax, etc.) must be kept out of the skillet—that is done by holding the poker, or even a piece of wood, across the mouth of the pot in such a position that the silver may be able to run unimpeded, while the floating matters are held back. Professor Chandler Roberts, who is either chemist or assayer to the Mint, has stated that plumbago (in powder) was better for preparing skillets than was oil or grease of any kind. I trust, with the foregoing description, that you will obtain sound workable silver; but it is, I hope, evident that it is a matter of skill to obtain it. As you may not be up to the simple fluxes used to get silver right, here are one or two: sal-ammoniac for obtaining tough and clear ingots; to destroy lead or tin, use corrosive sublimate; for iron, saltpetre or sandiver. One word—above all, look to the copper you use for alloying; it is cheapest to get the best, I find. I do not know of the application of a current of air with reference to this metal in the way you state.—H. S. G.

Enlarging Camera. — AMATEUR PHOTOGRAPHER.—An article on this subject appeared in WORK, No. 13, page 193.

Bicycle Lamps not Burning.—(*Goudhurst*).—One of the many reasons why a lamp goes out while in motion is that the wick is too small and gets jolted down. Examine your lamp directly it goes out, and see if the wick is lower than it was when alight. Or the wick may be too large, and thus prevent the oil from being drawn up properly. A burner in this condition may burn while stationary, but when moved or jolted would easily go out. Again, the air and ventilation holes may be too large or too small. Too large will admit too much air, causing a draught; too small, insufficient air

keep up combustion. Bad oil or a dirty reservoir ll cause it. Some of the best makes have the iling of yours. Why not buy a new one of a fferent pattern? You say yours is a round one. his must be a very old make. I have a small mp in use now which cost me about 1s. 7d. net, d I could not wish for a better one.—F. C. P.

Change of Trade.—W. W. (*Caverton*).—I have ceived yours of the 6th inst. It is impossible for me remember the names and addresses of all persons ho write to me, and the subjects on which they rite; but I am under the impression that I reeived a letter similar to yours a short time ago, nd that I wrote a brief answer to appear in Shop," and directed the stamped envelope to be eturned, with an intimation that replies cannot be ent by post. Your father, with whom you say you ave served your time, is the best person to advise ou in choosing your path in life. He knows your apabilities, and I do not. I may, however, say hat, in my opinion, you had better stick to the rade you have learnt, especially as you have to ive by your labour. You are a carpenter now, but ou want to be a machinist or engineer. Better emain a carpenter than try to turn your hand to lling and fitting in an engineer's shop. If you are, s you say, "just too light" for carpentry, I do not hink you would be heavy enough for filing and itting. If you are not content with what I say, you iad better visit Glasgow, where you say you have riends, and judge for yourself. Again, after inimating your inclination to try Glasgow, you coninue:—"Now, dear sir, you must mention what wages I would receive, as I would have to know that I could keep myself before setting out, and if you approve of the plan. I am twenty years of age now; if you want any more information you must let me know." To go backwards: firstly, you have given me sufficient information to warrant me in saying that you are, or ought to be, old enough to determine for yourself the course that it is best for you to pursue, and I do not wish for any more. Secondly, as far as I dare take upon me to judge, I do not approve of the plan, for reasons given above. Thirdly, it is utterly beyond me to say what wage you would receive, but I should think not much. I know that many Scotchmen—to their honour, be it said—live at times on the merest pittance, and nurture body and mind at the same time on a few pence per diem; but whether or not you are a Scotchman of the same calibre you will best know. Doubtless you will be still disappointed with this reply, but you would be more disappointed if I said "Go to Glasgow and prosper," and you found eventually that the result was not a fitting sequel to the advice. I cannot take upon myself the responsibility of advising in your case. Like my fellow men, I am liable to make mistakes, but I take care never to make a mistake if I can avoid it. An astrologer who could cast your horoscope, a chiromancer who could read your hand, or a prophet who could see into futurity, would be the best man for you to apply to. I am only an editor, which some people seem to think is just one remove from a fool, and I am sufficiently conscious of my own incapacity to feel sure that it is neither desirable nor warrantable for me to say any more than I have said. And I have said as much as I have in your case hoping that it may act as a sedative and deterrent to other inquiring spirits who would seek advice on such points as you have submitted to my judgment.—ED.

Taking Out a Patent.—J. B. (*Dundee*).—I am not aware of any rule debarring a Government servant from patenting an invention to be used in the Government service, but the case is one in which the *employé* would do well to take the opinion of one of his superiors in his department.—C. C. C.

Imitation of Woods.—P. S. (*Kenmare*).—Read carefully the papers on "The Art of Graining" now appearing in WORK, if you wish to imitate by painting; but if by staining, use Stephens' stains, which you can buy, or ought to be able to buy, of any oil and colourman.

Clock Stopping.—LIMITED.—You do not say whether the clock is a weight or spring, ancient or modern, English, French, German, Swiss, or Vienna, so I can only go on guess-work, which is never very satisfactory. If a spring clock the springs may, perhaps, be bound in the barrels, or the oil on them be got thick, or the pivots may be dry; if a weight clock, the same applies, or the lines may be off the barrel and round the arbor, or the clock may be in need of cleaning and repairing, or a little oil to all the pivots, etc., may be all that is required; evidently in winding it takes off the power, by setting the train of wheels backwards, and then it has not the power to start afresh. Try a little oil first; the very best salad oil will do if you cannot get the proper clock oil; if it still stops, write again, giving more particulars; also say if you use a *fan* or *crank* winder.—A. B. C.

Voixophone.—A SUBSCRIBER.—The instrument about which you inquire (and which had entirely escaped my memory when replying to your former letter) was brought out by Messrs. Beare & Son a few years ago, and patented by them. Being thus protected by law, it is obvious that you run some risk if you make one even for your own use; but, leaving aside the law question, I may say that it is by no means a satisfactory instrument either to make or play. Your sketch is fairly correct, except that the compass is three and a quarter octaves. If you still wish to know more of it, I should advise you to apply at the Patent Office for a specification —price 8d., I think.—R. F.

Glass Embossing, etc.—MIEUX QUE ÇA is referred to the reply to W. C. in No. 79, Vol. II., page 436, but nothing less than long articles would suffice to answer all his queries satisfactorily. As to getting a battery for electro-gilding, an electro mechanician in any large town can supply it; or if our correspondent is moderately ingenious, he can contrive one for himself.—S. W.

Patentee's Agent.—J. H. (*Glasgow*).—A directory will give the required information.—C. C. C.

Hardening and Tempering Screw Taps, etc.—A. B. (*Birmingham*).—The question is, can these be hardened and tempered at one operation, and how? Cheap taps are, as a rule, not let down; they are made of inferior steel, and do not become very hard in the first instance; a large box of such screwing tackle having been tested, every tap and die proved soft enough to file. Good steel can be hardened and tempered at one operation by plunging the tool at red heat into a vessel of water having about three inches of oil floating on the top; the shank may require tempering if it, too, has been made hard; but that need not be the case. The great point seems to be to get a good heat to the right degree for the steel, and equal all over the part to be made hard. Where several tools are to be hardened it is a good plan to heat them in melted lead, because that ensures the same heat all over; if, however, any of the lead adheres between the teeth of the tool, that spot so covered will prove soft. Watchmakers, engravers, etc., are very fond of hardening and tempering their small tools at one operation by plunging them when red hot into sealing wax repeatedly till cold. The reason seems to be that the sealing wax and oil cause the heat to be abstracted more slowly than if water were used, and, therefore, make the tool rather less hard and less brittle, so that it does not require the usual "letting down."—F. A. M.

Gilding Copper.—F. B. (*Llandaff*). — Copper can be easily gilded by the electro-gilding process. The most easily made solution for the purpose is prepared by dissolving two or three drachms of potassium cyanide in a pint of hot rainwater, and dissolving enough gold in this to form the gilding solution. Make up a battery of two cells Daniell, Smee, or Bunsen, connect a strip of pure gold to a wire leading from carbon or copper of the battery, and hang the strip in the hot potassium cyanide solution. Connect another strip of gold to a wire leading from the zinc of the battery, and hang this also in the solution contained in a stoneware vessel. A current will pass from one strip of gold to the other, and dissolve some of the gold. At the end of an hour's time, remove the strip of gold from the wire leading to the zinc, and replace it with the piece of copper you wish to gild. The electric current will then dissolve gold from the strip of gold on one side of the solution, and deposit it on the copper on the other side of the solution. Keep the gilding bath hot during the process.—G. E. B.

Electric Bells and Galvanic Battery.—ELECTRIC. — Electric bells are worked with electric current obtained from galvanic batteries. The little machine you have heard about as being good for neuralgia is not a galvanic battery, but a small magneto-electric machine—one of the oldest forms of the magneto-dynamo. These little machines generate an electric current at a high pressure, and this, when sent through a person, gives a series of shocks which are said to be good for the nerves. I do not believe a word of what is said about their merits for this purpose. They are only toys. Similar results are obtained from machines named shocking coils, worked with current from galvanic batteries. I hope to tell readers of WORK how these are made at some future time. You will learn how electric bells are made if you read my papers on "Burglar Alarums," published in Nos. 12, 18, 20, and 27, Vol. I. of WORK. A good book for your purpose is "Electric Bells, and all about them," price 3s., as this also tells you about galvanic batteries. You can get this through any bookseller, or I can get it sent to you by post if you experience any difficulty in obtaining it elsewhere.—G. E. B.

Xylophone.—A. B. L. (*Barnsley*).—For the construction of this instrument see WORK, Vol. I., page 669, otherwise No. 42. The number can be had of any bookseller or newsvendor for 1d., or post free of the publishers for 1½d.

Wiring Dulcimer.—G. E. (*York*).—I am really surprised that you should have experienced any difficulty in stringing your dulcimer. If you will refer to page 615, No. 41, Vol. I. of WORK, you will find there a diagram of the dulcimer, and on this diagram, those letters which appear on the right indicate the notes which are to be strung with brass, and those in the centre the notes that are to be strung with steel wire, the latter being divided nearly halfway by the bridges, whilst the former have the bridges only a short distance from one end. The only other way I can think of to make it plainer to you is to tell you to number all the holes in the *outside* row in the wrest-pin block, commencing at the bottom with No. 1, and continuing to the top, which, of course, would be No. 20; and then string the *odd* numbers with brass, and the even ones with steel wire. From your letter, you appear to have had a good deal of advice on the subject, most of it evidently from those who did not know much about it (hence, probably, their anxiety to give it). But if you find any further difficulty, do not be afraid of writing; we like to smooth away difficulties, and that particular one raised by one of your friends, pertaining to the scale, you will find vanish almost as soon as you commence practising. So far from its being really difficult, I can assure you that it is one of the easiest to learn. On this subject, see also reply to P. J., page 436, No. 79.—R. F.

Leakage of Water Barrows. — KALULU. — I cannot see how your barrows should leak if you have used red lead at the joints; our way of making barrows watertight is to paint all the joints with red lead ground in boiled oil only, no turps or driers being added when dry next day. We mix some of the very best and purest red lead with boiled oil into a stiff paste, and cement all the joints, laying it on with a putty knife, just the same as a bricklayer would in setting a brick. Then put the pieces together and screw down. White tub lead and red lead mixed with a drop of boiled oil make a very good cement, which sets as hard as a stone, if left a few days before being painted over, for if painted too soon it keeps the putty soft. In making a barrow watertight you require the cement between the joints, and not at the outside. In the corners of the barrow, both inside and out, we nail three-cornered pieces of wood, well embedded in this cement. When thoroughly dry, clean off with a knife, and paint the barrow, the first coat having more boiled oil in than the after coats. If you have to take the sides out of your barrow, have the joints thoroughly dry before using the red lead cement, or it will not adhere to the boards if wet with damp.—W. P.

Cleaning Coral.—W. A. P. (*Hackney*).—You give no details as to whether the large piece of coral is in the rough, or if it has been cut and polished. Washing it in warm water with soap and a brush (no soda) should clean all kinds; but as the chances are that some little polishing is required as well, if that be so, use finest putty-powder; that being, perhaps, inconvenient to obtain, then try either powdered rotten-stone, fine whiting, or jewellers' rouge, any of which will improve a polished surface when used with water and applied by means of leather buffs, linen rags, etc. etc., or, in fact, anything that will enable the polishing material to be brought with considerable friction into contact with the work. It can be washed afterwards, to remove the powder from the crevices. —H. S. G.

Imitation Stones.—McA. (*Barrow-in-Furness*). —Write to R. Pringle & Co., 40 and 41, Clerkenwell Road, or Brown & Langley, 121, St. John Street, Clerkenwell, or to W. A. Couch, 45, Great Sutton Street, Clerkenwell. One or the other can supply the desired colour and quality of imitation stones. The last mentioned I know turns out very good and well-finished plasters. The other two I know only from good reports. Give all particulars as to size, cut, colour, etc., or better send them a specimen if you can, even if it be a real stone. This is particularly necessary with regard to cairngorms, for they vary so much in colour. I am sure the stones in Scotch work used to be genuine, so I trust no reply of mine will help to introduce imitations in a class of goods which has up to now been one of the very few thoroughly genuine styles that survive. —H. S. G.

Cleaning Plaster Casts.—T. P. (*Shooters Hill*) would have done well to have spoken more particularly of the "old casts," which he wishes to clean. He should have said whether they have or have not been painted. If they have not been painted—are merely the natural plaster—and are only become dusty, his plan will be to sprinkle new plaster (fine) over them and work it about with a soft brush. This will bring away with it dust and any slight discolorations which are quite on the surface; but it will not touch any stains which have sunk into the substance of the plaster. Nothing, so far as I am aware, will clean plaster so stained and discoloured. The only thing to be done is to paint, or gild, or bronze it. If T. P. wishes to clean old casts that have been painted (*i.e.*, to soften and remove the paint which chokes up the modelling, before repainting them), let him make a strong solution of American potash, mix this with sawdust, and cover the cast with the mixture. In a few hours the paint can be washed away with cold water and a sponge, a soft brush being used for the hollows.—M. M.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Illuminating.—GILT writes:—"I have never before talked in 'Shop,' but shall be glad if any reader can help me by giving information on the following points:—During some of my spare time I have attempted a little illumination in gold and colour, and in gilding I have obtained good results by using oil gold size on paper that had been previously prepared with thin gum on the parts to be gilt, to prevent the oil in size spreading; when tacky, I lay on the gold leaf, and then burnish with a piece of cotton-wool by briskly rubbing; but I should like to go a little further—I believe there is a water gold size used by illuminators that may be afterwards burnished with some kind of burnisher made on purpose, which gives to the gilt surface great brilliancy. Can anyone tell me how to make the size and burnisher, or where to get it, and afterwards how to use it?"

Paint for Tickets.—A. J. S. (*Moseley*) will be thankful for the best opinion as to the most desirable paint to use in making tin window tickets—*i.e.*, paint that will dry with a smooth glossy surface, and whether it is necessary to stove the tickets to obtain this end.

Gilding.—JACK writes:—"Would some reader of WORK be kind enough to tell me how to use or gild with leaf gold?"

Hanging Paper.—JACK OF ALL TRADES writes:—"I wish to decorate one of my rooms with Japanese leather paper. Would some reader of WORK be good enough to tell me how to hang this class of paper, and give the names of one or two firms where to buy it?"

Waterproofing. — OLD TIPTONIAN writes:—"Can any valuable helpers tell me if there is any oil or indiarubber solution with which I could coat a cart sheet or cover, as it is called? The continual wear has made it quite useless as a waterproof covering, for which it is required."

Banjo.—W. P. (*Burnley*) writes:—"I should be greatly obliged if R. H. H. (*Crewkerne*) (see page 503, Vol. II.) or F. H. (*Streatham*) will give me information as to size for good banjo; also price of same for a good plain instrument; and also what is the difference between the ordinary banjo and Brewster's grand orchestra size banjo? Which is best—five or seven strings, and why? Is the banjo a difficult instrument to learn?"

Bird Cages, and Address Wanted.—Will J. G. (*Nottingham*) (see page 734, Vol. I.) advertise his address in the "Sale and Exchange," WORK, for M. D. C., Liverpool, who wishes him to undertake some bird-cage front making?

Lathes.—B. S. (*Edinburgh*) writes:—"Barnes' foot lathe, No. 4, for which Churchill & Co. are agents, costs £9. Does any reader know of a lathe that is as good and cheaper?"

Fretwork Cabinet.—J. W. L. (*Hull*) will be obliged to any reader who will kindly tell him the best way to finish a small fretwork cabinet in white holly, and how to proceed as to polishing.

Chocolate.—"I should be obliged if any reader would give me a few hints on sugar boiling and sweet-making, such as toffy, brandy balls, cocoanut candy, etc; also the tools required, and how to fix and work them; also the pans required, the best form of furnace, and about the cost of the whole. Diagrams will oblige."—[This "sweet" question is hardly within the scope of WORK. However, it is submitted in the hope that some tool or boiler maker will kindly enlighten CHOCOLATE concerning the appliances which he will need in order to administer adequately to the cravings for confectionery exhibited by the juvenile portion of the community, in which, of course, we all take interest.]

Cabinet Fittings.—W. H. (*Hinckley*) writes:—"Will any reader tell me where I can get handles for drawers and fasteners, door to match, to suit cabinet in fretwork issued with No. 1 of WORK?"

Luminous Paint.—INQUISITOR asks—"Where can I obtain luminous paint in small quantities, about the price, and is there a special way to apply it?"

Sash-bar Dowelling. — W. H. (*Hinckley*) writes:—"Will any workman give me information through 'Shop' on sash-bar dowelling?"

Camera Fittings.—J. C. (*Glasgow*) will be glad of the experience of any readers as to the best place to obtain brass fittings for a half-plate camera, what they would be likely to cost, and also the price for racks and pinion only.

Lithographic Stone Press.—R. T. (*Glasgow*) writes:—"I am instructing myself in photo-lithography, and wish for a press to pull a few proofs. I want a press to print from a lithographic stone about seven inches long by four and a half inches wide. Will any reader oblige me with a description, or even a few hints, how to make one, if possible in wood, if not, in iron?"

Zinc Plates.—SIGNBOARD asks for addresses of makers of zinc plates, also for the strength to make acid, so as to bite, say, ⅛ in. deep.

Blocking Powder.—JOINT writes:—"Could one of our many helpers let me know through 'Shop' what powder is used for blocking Dutch metal on fancy cards, boxes, etc.? I have a powder for gold leaf, but it will not take the Dutch metal on cardboard. The metal rubs off after blocking. Of course I know about glair, but that won't do. I want something dry. Could you tell me also the pay per gross a workman gets in London for blocking cap B 8 in. mems. in gold leaf?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Glass Signs.—C. E. H. (*Tottenham*) writes in reply to W. McC's. query (see No. 81, page 522):—"We can undertake the class of sign which he requires."—[Messrs. H. and R. should advertise in our "Sale and Exchange" column.—ED.]

Graph.—F. A. J. (*Canonbury, N.*) writes in reply to W. W. (*Chelsea*) (see page 522, Vol. II.):—"Having tried every graph in the market, I strongly recommend the Simplex Hectograph. The composition may be bought in one pound jars for 3s. It must not be put into metal trays. I make my own trays of thin wood, and paint them with enamel paint. One pound of composition will make a graph foolscap size. The writing sinks in, and disappears after a few hours."

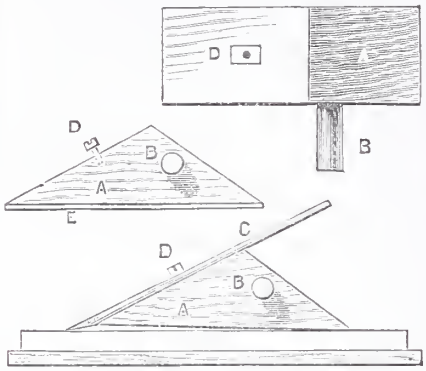
Patent.—F. A. J. (*Canonbury*) writes to T. H. (*Wandsworth*) (see page 521, Vol. II.):—"Why not go to the Free Library, Chancery Lane, where every specification may be seen easily?"

Artificial Water.—J. M. (*Manchester*) writes in reply to W. E. D. (*Hull*) (see page 522, Vol. II.):—"We have, in our Queen's Park Museum here (Harpurhey, Manchester), several models of vessels mounted on rough plate glass by cement (glue, I should presume), and which possess a very natural and power-like surface. As a matter of course the models are stopped off at the water line—*i.e.*, that below the water line is not constructed."

Coal Saver.—J. W. B. (36, *Railway Walk, Birkdale, near Southport*) writes in reply to J. S. (*Oldham*) (see page 535, Vol. II.), that he will be glad to answer any inquiries respecting "Coal Saver" (Vol. II., page 471).

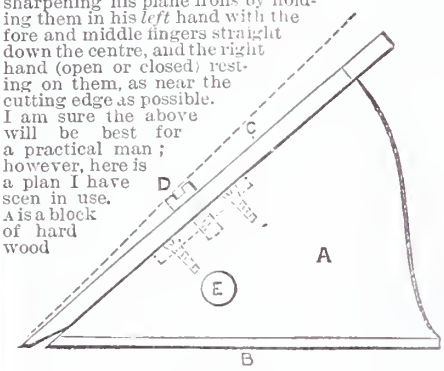
Painting Venetian Blinds.—L. J. (*Huntingdon*) writes in reply to ASPIRANT (see No. 84, page 522):—"I have seen painters colouring these very quickly. They get a piece of guttering (half round, not O.G.), and lay the slat as in diagram, when it lies quite firm."

Plane Irons.—L. J. (*Huntingdon*) writes to ONE IN DISTRESS (see page 522, No. 84):—"I never saw a plane iron that did not want sharpening, but this may help ONE IN DISTRESS. A is a piece of ash about 8 in. by 2½ in. by 3 in. deep, cut to an angle a little quicker than the bevel of the plane iron is ground; B the handle, about 2 in. long, ¾ in. round; D, the screw to fix iron to block, is an old back iron cut and let in flush. To use, screw the plane iron on the block, and rub the whole length of the oilstone. Sharpened thus, I find the edge lasts longer."



Plane Sharpener.

Plane Sharpening.—CHIPS writes:—"I think ONE IN DISTRESS (see Vol. II., page 522) should try sharpening his plane irons by holding them in his *left* hand with the fore and middle fingers straight down the centre, and the right hand (open or closed) resting on them, as near the cutting edge as possible. I am sure the above will be best for a practical man; however, here is a plan I have seen in use. A is a block of hard wood 2½ in. thick, with a piece of hoop iron; B, same width screwed to bottom; C is the plane iron held by screw D tapped in iron plate let in flush, or a wood screw with a washer would do; E is the handle which projects about 4 in. each side of block. The slope of block should be about 5 in. less than the iron when fixed in plane, which is shown by dotted line. This mode has the advantage of always sharpening to the same angle, also of wearing the stone even. The edge can be rounded by pressing harder with one hand alternately. All irons should have edges which are arcs of circles, although in the case of a smoothing plane it would be one of immense radius."



Plane Iron.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—O. H. O. (*East Dulwich*); CEDAR; A. E. J. (*London, W.*); JOURNALIST; NOVICE; SIDEBOARD; A. T. M. (*Lichfield*); LINENS; W. G. J. (*Portsmouth*); T. H. (*Glasgow*); OBED; G. H. (*Liverpool*); W. B. (*Maidstone*); H. W. (*Peckham*); GLUE CO.; G. R. R.; C. T. C. (*London, S.E.*); ARGENT; ESPERANZA; T. B. (*Northampton*); A. H. F. (*Cheltenham*); ORNAMENTAL; J. G. W.; S. F. W. (*Kidderminster*; J. S. K. & CO. (*Coventry*); J. F. (*Cornwall*); J. A. G. (*Sunderland*); J. E. H. (*Southampton*); EXPERIMENT; AMATEUR; W. H. (*Bolton*); J. H. B. (*Manchester*); A. F. W. (*Oldham*); D. D. (*Aberdeen*); L. S. L. (*Kirkcaldy, N.B.*); J. H. B. (*Pendleton*); J. B. (*Glasgow*); F. A. (*Portsmouth*); MIST; A. H. (*Birmingham*); S. F. C. (*Workington*); CELT; F. F. F. (*London, E.C.*); T. S. & CO. (*Hersmonceaux*); SCHEMER; S. R. (*Newry*); W. S. (*Preston*); J. H. H. (*Belfast*); W. H.; CONSTANT READER; A. T. (*Eastbourne*); S. B. C. (*Trowbridge*); BANJOIST (*Sussex*); STATIONER'S ASSISTANT; LOCO.; FRANKLIN; WATER GAUGE; JEAN.

"WORK" EXHIBITION.

NOTICE.

IN connection with the "Work" Exhibition to be held at the Polytechnic Institute, Regent Street, London, W., from December 29, 1890, to January 10, 1891, inclusive, a Special Exhibition Number of WORK (separate from the weekly or monthly issue) will be issued on December 31, price 3d. This Number will consist of 32 pages in a wrapper, and will contain an Illustrated Descriptive Account of the most remarkable Exhibits.

From One to Two Thousand Examples of Art, Industry, and Invention, furnished by readers of WORK, will appear in this Exhibition, which for the impetus it is calculated to give to Practical Education may be regarded as one of the most important ever projected in this country.

The variety of the Exhibits is as remarkable as their character is interesting, and the very ample manner in which they are described in this Special Number will render it of value, not only to all workmen, professional and amateur, but to everyone who has at heart the progress of Technical Education in this country.

*** Subscribers desirous of obtaining this Special Number should order at once the "WORK" EXHIBITION NUMBER, price 3d., from their Booksellers or Newsagents.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Waterproof Advertising Paper Letters and Figures in all colours and sizes. Best and cheapest. Liberal terms to agents. Sample sheets, gratis. Factory, 17, Arthur Street, W.C., London. [19 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [15 R

Picture Moulds.—15 to 25 per cent. positively saved. Send for wholesale list now.—DENTS, Importers, Tamworth. [16 R

Machinery and Tools.—Largest stock in London. BRITANNIA Co., 100, Houndsditch. Cash or hire purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks, Dies, Forges, etc.; catalogue of new, 6d., or list second hand, 2d.—BRITANNIA Co., Colchester.

Best Book on Lathe.—Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA Co., Colchester. [17 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [1 S

Sign-writing Made Easy.—Every man his own writer. Illustrated instructions for easy, cheap, simple, and rapid process by which elaborate lettering can easily be done equal to professional work. Also Diagrams for marking out eight different sized alphabets. The lot 1s., post free.—F. COULTHARD, Terrace Road, Bournemouth.

Cheap Lots of Designs.—100 Fretwork (speciality). 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [2 S

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured. Money returned in full if not entirely satisfactory.—ETHELBERT HENRY, Alvaston, Derby. [18 R

Model Engine Castings.—Illustrated Catalogue, 4d.; Screws and Bolts; list, stamp.—STIFFIN & CO., 324, Essex Road, London, N. [3 S

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,
84, 85, 87, Fetter Lane, LONDON.

CHEAP EDITION, NOW READY, PRICE 9s.

A Electricity in the Service of Man.

Popular and Practical Treatise on the Applications of Electricity in Modern Life. With nearly 850 Illustrations.

"A book without which no physical library can be held to be complete."—*Knowledge.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

TOOLS
MOSELEY & SON
323 HIGH HOLBORN LONDON. W.C.
200 PAGE CATALOGUE
700 ILLUSTRATIONS
PER POST 6D
ORDERS OF 10/-
CARRIAGE PAID

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

STERN'S
PUMILINE LINIMENT

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

FOO-CHOW ENAMEL.

Patented and Registered. PRIZE MEDAL. REAL CHINESE.

DRIES IN FIVE MINUTES.

For House Decoration, for renewing faded furniture, for *bric-à-brac* generally, there is nothing like it.

FOO-CHOW is the only Enamel suitable for Floors. Try the Oak and Mahogany. Can be used on any surface, oily or greasy.

The Gold, Silver, and Bronze are simply invaluable, the effect being equal to leaf gilding. For Baths it is made in White, Aqua Marine, and Cerulean Blue.

THE QUEEN states:—"The uses of Foo-Chow Enamel are practically limitless."

THE LADY states:—"In every way the most satisfactory."

THE BAZAAR states:—"Having tried other kinds of enamel, we feel quite justified in saying that it is quite the simplest and most pleasant in use."

GOLD, SILVER, BRONZE, AND ALL COLOURS.

☞ Write for Pattern Card, which will be sent POST FREE from the Manufacturers.

FOO-CHOW ENAMEL is sold everywhere in Sixpenny and One Shilling Tins; or from the Manufacturers, three stamps extra.

ADDRESS—
Donald Macpherson & Co.,
KNOT MILL, MANCHESTER.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

MELLIN'S FOOD

For INFANTS and INVALIDS.

MISS BARBER.
Age 15 Months.

"96, Brixton Hill, London, S.W.
"4th March, 1889.

Mrs. E. BARBER writes:—"I beg to forward photo. of my little girl, brought up entirely on your food."

E. Barber.

MELLIN'S FOOD BISCUITS.

PALATABLE, DIGESTIVE, NOURISHING, SUSTAINING.

Price 2s. and 3s. 6d. per Tin.

SHAKESPEARIAN WISDOM ON THE FEEDING AND REARING OF INFANTS.

A pamphlet of quotations from Shakespeare and portraits of beautiful children, together with testimonials, which are of the highest interest to all mothers. To be had, with samples, free by post, on application to

G. MELLIN, *Marlboro' Works, PECKHAM, S.E.*

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores; or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.
SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

PRICE, TALBOT & CO., LIMITED,
LATE DALE & Co.,
26, LUDGATE HILL, LONDON, E.C.

NOW READY, **Part 1,** price **6d.,** of

Figuier's Popular Scientific Works.

With ***Several Thousand Illustrations.***

The Series commences with "The World before the Deluge," *Revised by the late* H. W. BRISTOWE, *Director of the Geological Survey of Great Britain, the Text newly Edited and Revised by* Dr. ROBERT BROWN, F.L.S., &c.

"Admirable works of popularised science."—*Daily Telegraph.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design. No. 102.

Wall Bracket.
Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill,* with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 90.] SATURDAY, DECEMBER 6, 1890. [PRICE ONE PENNY.

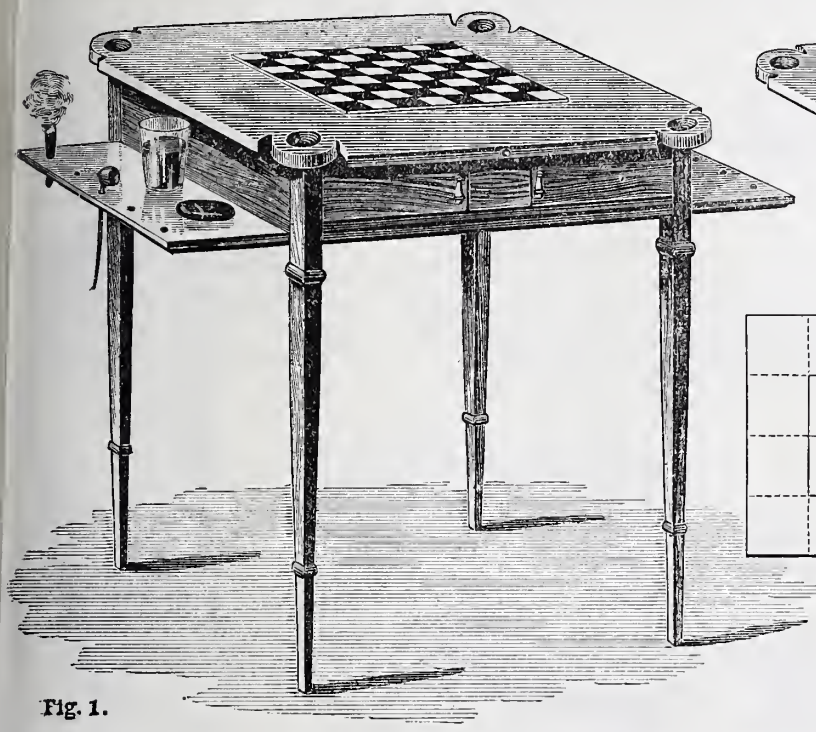


Fig. 1.

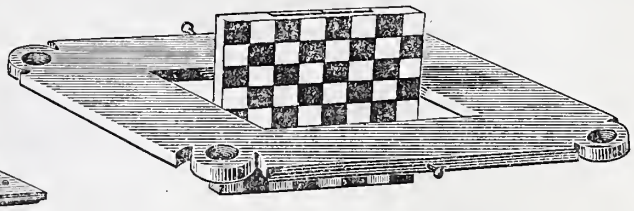


Fig. 4.

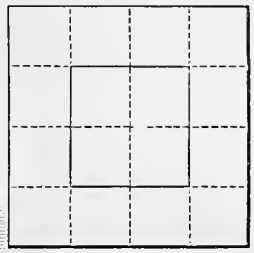


Fig. 6.

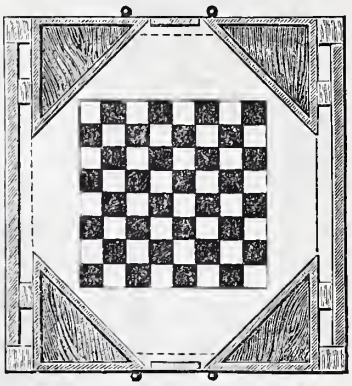


Fig. 5.

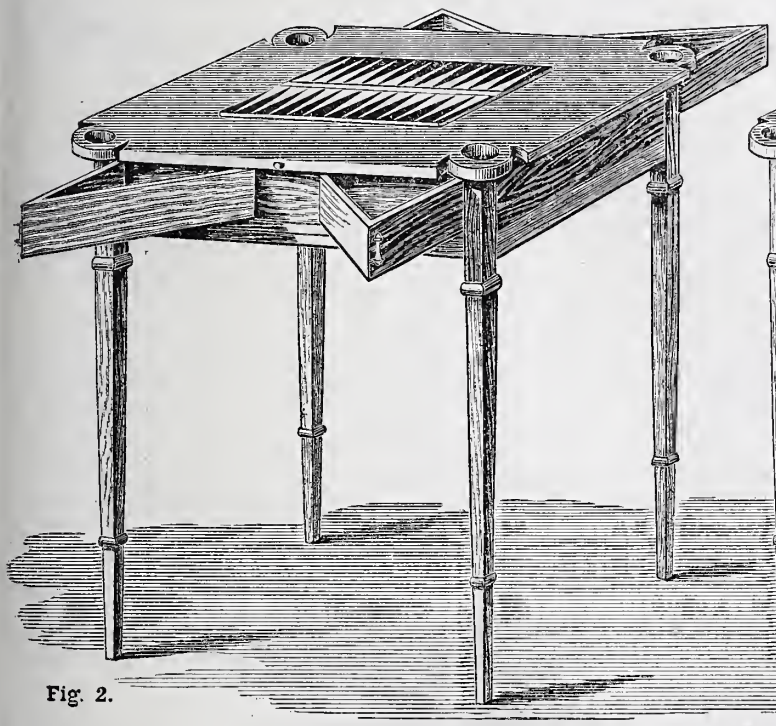


Fig. 2.

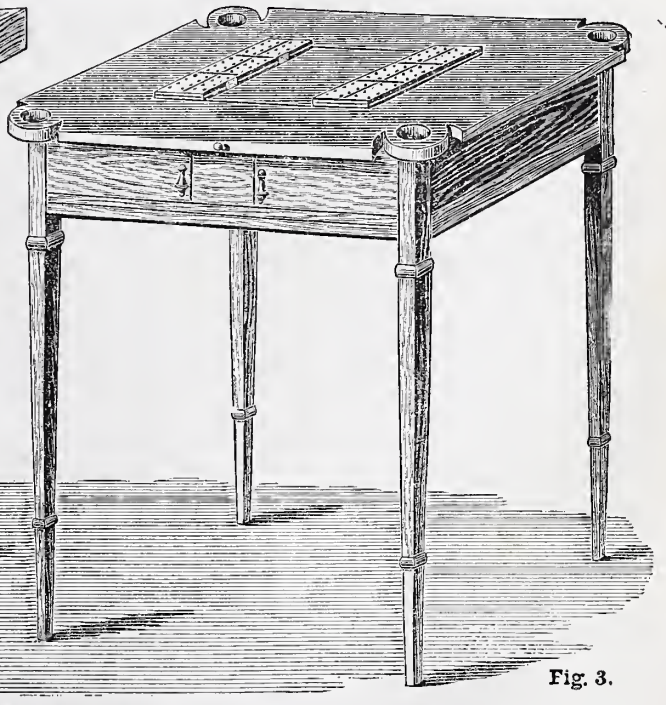


Fig. 3.

A NOVEL CHESS, BACKGAMMON, AND CARD TABLE.

Fig. 1.—As Chess Table. Fig. 2.—As Backgammon Table. Fig. 3.—As Card Table. Fig. 4.—Showing how Chess Board revolves. Fig. 5.—Plan of Table showing Triangular Boxes or Drawers. Fig. 6.—Diagram showing Proper Proportionate Size of Chess Board in relation to Table Top.

A NOVEL CHESS, BACKGAMMON, AND CARD TABLE.

BY JAMES SCOTT.

Nearly every nation in the world has to grieve over the spirit of gambling which exists to a more or less extent in mankind as a whole.

Men, both those who belong to the clergy and the laity, have striven energetically in, and deserve praise for, their endeavours to quell the desire that is rooted in most men for participating in games of chance, or speculating upon coming events in various directions. But there are undesirable extremes even in intended philanthropy; and it is to be sincerely regretted that some of the gentlemen, who certainly merit reward for their good intentions, push matters to a further extent than is really needful, by tendering their opinions that until games of all descriptions, where two or more sides are opposed to each other, become extinct, the gambling tendency will continue to receive nourishment in every rising generation.

I have somewhere read a very able essay upon the state of society during the Puritanic times of a comparatively recent reign (Charles I.—Cromwell) in this country, which also described the demoralised condition of the community which resulted as an after-effect; and it was therein hinted that the same things would again happen if the masses and classes were purified beyond a reasonable limit. All this appeared to me to contain nothing but truth. Deprive men of their recreations, and for a time all would seem well; but the very goodness gained would be the evil, for upon the slightest opportunity there would be a rush of immorality a hundredfold stronger than was previously the case. A man washes his face in clean water: he becomes clean; the water becomes dirty. If that water is then allowed to remain, it turns impure and creates evil—it was at first the purifier. In like manner, when a supposed good condition had been arrived at in relation to mankind's morality, the men who had accomplished such a result would have no further occupation in this direction, and would allow the goodness to remain thus until suddenly the lurking dangers within it burst forth in terrible power.

Perhaps I am too philosophical in my remarks, but my aim is to show that because some men ruin themselves by gambling for money at cards, etc., insufficient reason is adduced thereby for the abandonment of the games by anyone or everyone who may desire to play at such for purposes of recreation. I think I am not far wrong in saying that those things which are abused to the greatest extent are those which, if indulged in in sensible moderation and used legitimately, morally speaking, in the latter cases afford much benefit to us.

I will not enter further into these questions, for fear of being unable to extricate myself honourably from the intricacies in which one so soon gets entangled and muddled; but will proceed to explain the purposes, advantages, and drawbacks—nay, it has none—of the small table which I have evolved for my readers out of the head which I have been told frequently by a certain near relative is made of a similar material to that which most people would make this table with.

Here is an article which can be made in any size—we will say, for example, 2 ft. square—and can be used as a chess, backgammon, and card table. In a very simple manner the middle portion of it revolves, so that the table is altered respectively for use in connection with the three games named. No one requires the table top to expose all three conditions at the same time; at least, I have never heard of anyone playing at chess while his opposite companion played with him at cards. The alterations can be effected in the table without any necessity existing for the players to rise from their seats.

Under the table there will be two boards, capable of being drawn out as in Fig. 1, whereon a glass of ale or ginger beer can be placed, thus leaving a clear space on the top of the table. Then there are a few holes in these side flaps wherein can be accommodated lighted pipes and cigars; and I feel certain that this simple arrangement will be appreciated, for although I at present do not indulge much in pipes and cigars—I relish the milder cigarette in large quantities, as does a fellow-contributor, according to his own account—I am aware that such things are apt to burn anything upon which they are indiscriminately laid.

The drawer compartments differ from the usual thing. Most people know how inconvenient it is, when one is sitting at a table, to open a drawer which may be upon that side of the table where one sits. These boxes or drawers are hinged to open out at each side of the player, and will cause as little annoyance as possible. The shape of them is incumbent, for there must be a clear open space underneath the table to allow the chess, etc., board to revolve.

The table top will be square, and whatever may be the size of it, the middle revolving chess board must be one quarter of it—*i.e.*, the top would be divided into sixteen equal parts, as in Fig. 5, of which the four middle ones would represent the space occupied by the chess board. I will describe the latter first. Supposing the table top to be $\frac{3}{4}$ in. thick, the chess board will be about 1 in. thick at two ends of it and $\frac{3}{4}$ in. in the middle portion, which latter comprises one half of it. Two boards, $\frac{1}{4}$ in. thick, will be hinged respectively to the inner edge of each projection, as in Fig. 7, each board of course being in width equal to a quarter of the chess board's width.

On the side of this combination board, which is quite level, will be painted black and white squares, their number being, as most people are aware, black thirty-two, white thirty-two. The reverse side of this board will be painted for backgammon; there being on each half of it twelve black and twelve white portions, the point of each triangle of one colour being between the sides of the other triangles. The two small flaps are then folded over, one to each side, as in Fig. 7, and small holes drilled partly through them for purposes of which most readers will be acquainted with. In Fig. 9 I show a plan of a cribbage board. There should be a small hook and eye to connect the boards when upside down.

The chess board is placed in a square hole in the table top, chess side undermost, while a quarter of its thickness, in which are contained the two cribbage boards, is allowed

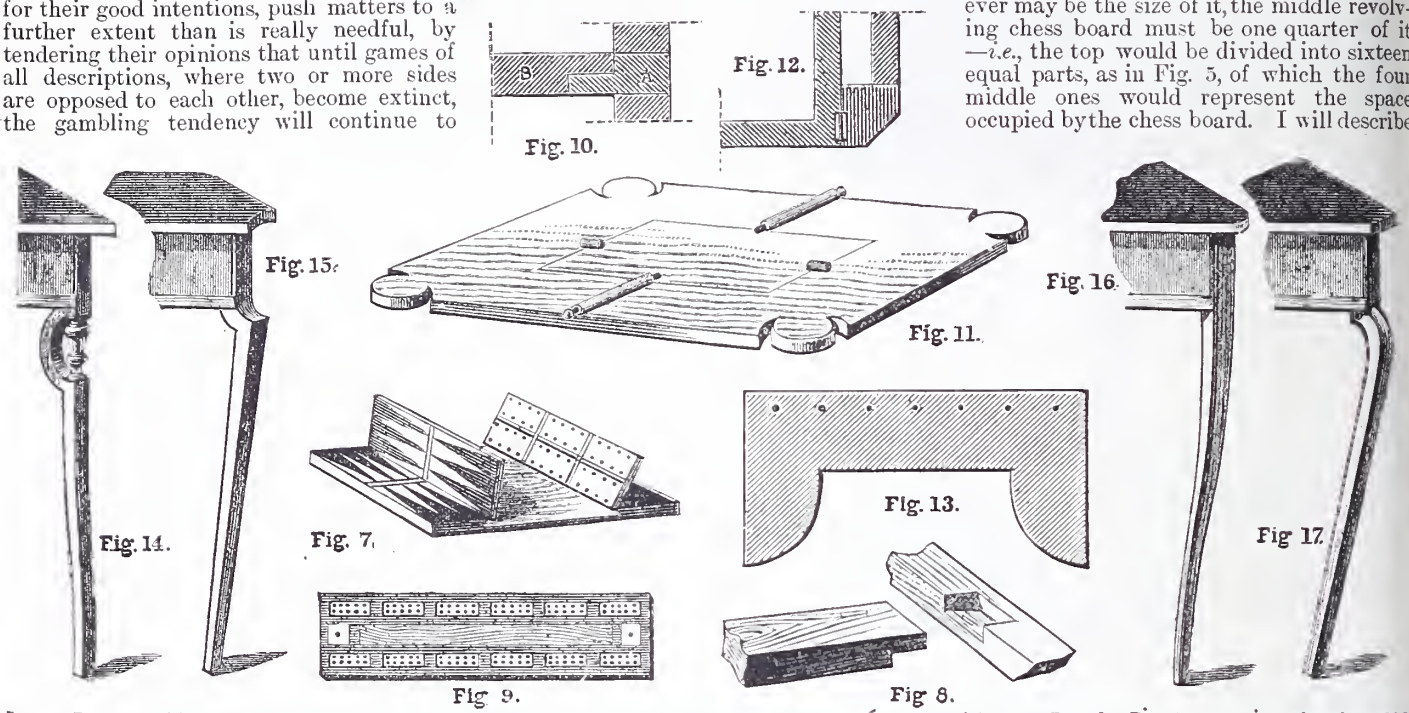


Fig. 7.—Reverse Side of Chess Board. Fig. 8.—Joint for Cross Rails under Table Top. Fig. 9.—A Cribbage Board. Fig. 10.—Section showing Side Shelf (B) and Rabbeted Rail (A). Fig. 11.—Alternative Method of securing Chess Board: under view. Fig. 12.—Plan of One Corner under certain circumstances. Fig. 13.—Plan of Side Shelves. Figs. 14, 15, 16, 17.—Patterns of Suitable Legs.

remain above the main surface of the ole top, and there pivoted by holes being red completely through the width of the ble top. Only two opposite points must fixtures, and it is unimportant which way e board revolves.

At the sides of the table, holes should be illed right through the width and partly rough the chess board. Through these o holes will pass metal or wooden rods, ch having a small knob or ring at the tside end. Thus, when the players wished alter the table, each would draw out the d on his side of it for an inch or so, and ter the chess board was properly turned, ould place it back again; in this way taining all in a steady condition.

As an alternative, narrow tubes could be cured under the table top and chess board, in Fig. 11, and the pivots and rods passed rough them. This saves drilling such long oles; but if this method is adopted, the ness board will have to be fitted to work uch looser than it need otherwise be; and would be advisable to round off the dges. The chess board, too, would not lay ush with the table surface when adjusted; ndeed, it would be below the thickness f it.

The table legs may be dowelled to the able top. They must be joined in such a nanner that they will be square with the able, as shown in Fig. 5. I have given everal different patterns of legs in Figs. 14-17. Where a flat surface is shown as running ornerways to the table top, the leg will be haped in section, for part length, and fitted s in Fig. 12. A framing, about $\frac{3}{4}$ in. deep nd $1\frac{1}{2}$ in. or $1\frac{1}{4}$ in. in width, should be joined o each side of the table between the legs. The right and left-hand sides between the able top and this framing will be fixtures. Across the table, between the framing, might e two rails, the joints used to connect them eing something similar to that shown in Fig. 8.

Under the framing at the front and the ack of the table will be joined rabbeted rails, as shown in Fig. 10 (A), in such a way that part of their length will project beyond the legs towards the middle line of the table. Along these rails will travel the flaps (Fig.1), whose end edges must be shaped as shown in Fig. 10. The width of each flap will depend upon the depth of the table sides, which latter might conveniently be 4 or 5 in. If the table top is 2 feet square, the chess board will be 1 ft. square, which, when revolving, will require a depth of 6 in. to allow it to do so; so that if the table sides are 6 in. deep, each flap can be as wide as half the table framing. The flaps, or shelves, may be cut as in Fig. 13. It is only necessary to allow room for the chess board to revolve; therefore, the two ends of each flap can be equal to half the width of the table proper. Underneath each flap there should be a notch of some sort to facilitate the drawing in and out of it.

Returning to the drawers or boxes, it must be remembered that they also must be made to permit the chess board to revolve. Plan, Fig. 5, shows this. The sides may be as long as I show, for the drawers would only be opened when the chess board was adjusted. The hingeing and fixing of the handles need no explanations. Between each drawer, at the sides where they open, will be joined a small board to close the side up properly. Little blocks of wood could be glued inside the table, against the fixed sides, as stops for the drawers when the latter are closed.

The shape of the table top could be varied infinitely. The circles indicate small globular cavities, suitable for containing such things as card counters, etc.

The finish of the table and the choice of the material are left to the reader's discretion. Finally, I may be permitted to remark that this simple, yet novel and useful, little article ought to be found serviceable in any workman's home, and that in many a workingman's club it would also prove accommodating.

MODERN FORGING.

BY J. H.

Bossed Levers—Eccentric and Valve Rods—Slide-valve Spindles—Bridles of Various Forms.

It is often the case that the arms of bossed levers have to stand at right or other angles with each other, and also are not in the same plane: then the methods described (p. 544) are not applicable. Fig. 73 shows a portion of a lever, with arms at right angles to each other, and placed on opposite sides of the boss. There are two ways in which these levers may be attached to the boss. One is by "dabbing on"—that is, the arm A, with a portion of the boss, is welded flat upon the main portion of the boss B, along the plane *a*, the surfaces being first hatched over with the corner of a set; in the other (Fig. 74), one side of the boss is fullered, as at A, with a round-faced fuller (Fig. 75), and the end of the lever arm B is upset, and the two welded together. This is a very common method of welding. Note that the fuller not only indents the boss, but, by means of blows delivered diagonally, is made to throw up the metal all around in a ridge, thus giving some extra metal for finishing off. In Fig. 74 C is a die-block, in which the boss is held while the arm is being welded; D is a thickness piece, or washer; E, the anvil. If no die-block is available, the boss will be held with large, open-mouthed tongs of rudely globular form.

Eccentric and valve rods afford some good typical examples of engine forgings. The eccentric rod (Fig. 76) is not usually made in one piece, but in two, and welded at about the centre; or, if rather long, the ends are welded to a central plain bar.

The extreme dimensions of the end A represent roughly the original size of the bar, from which the shank B is drawn down. From that original bar there is swaged down a length sufficient for welding. The large end is cut off to the precise length required with the knife tool (Fig. 77), or with the curved knife (Fig. 78) if the steam-hammer is used, or with a hot set if power is not available. Then it is necessary to cut off any sharp corners upon the anvil with a cutting-off tool, giving the appearance of Fig. 79, and swage the end A, rounding with a hollow swage, letting the shoulder B lay against the beak of the anvil, and finally finish in a die-block (Fig. 80). Of course the die-block is only used for finishing when the quantity of forgings required is sufficient to pay for its expense.

The body A of the block is of cast iron, and a wrought iron ring B is shrunk on. The recess C, it will be seen, corresponds with the outline of the end A in Fig. 76.

Another way to forge the forked end is to take a bar about half the thickness of the forked end, and double the iron over, and weld a length that will extend rather farther than the termination of the radius.

In both of these methods the gap may be cut out roughly by the smith, or left to be machined out. The general methods of forming forked ends were shown in a previous paper, and now I need only show by a sketch how the shape of forked ends whose gaps are formed by forging, and not by machining, is imparted. After the metal has been cut out from the gap and roughly brought to form, a filler, shown shaded at C, Fig. 76, is inserted, and the outside of the forked end finished with flatter and hollow swage, while the filler remains in. The filler is usually furnished with a square shank to fit the square hole in the anvil.

The end D in Fig. 76 is made by one of three methods. The shank B is either fullered down from a bar of the original section of the end D; or the shank A (Fig. 81) is welded to a piece of flat bar B, of the dimensions of the end D in Fig. 76; or the end of a bar is divided and opened out (Fig. 83). The first method is not correct in principle, because the grain fibres are short, but it is often adopted; and there is not very much stress on the flat end when bolted up to the eccentric straps, and the hammering it receives at the welding heat helps to consolidate the metal. The second method has the advantage of preserving the best arrangement of the fibres. In this method the flat piece A (Fig. 81) is fullered and upset with a round-faced fuller, like Fig. 75, and the end B, similarly fullered, is welded to it. In either case the section of the iron selected is a trifle larger than the finished section, to permit of finishing off. In the case where the shank is drawn down from the solid, a good deal of finish with the flatter on face *a* (Fig. 76) has to be done, the rod being held vertically, with the face D upon the anvil face. To prevent the rebounding backwards of the forging, in consequence of the edge of the flatter striking the shank, a turned round bar of iron (Fig. 82, A) is fitted with a shank into the hole on the anvil face. The flatting of the inner face *a* of course has a tendency to spread the edges and bulge them in some places, and this is corrected with hammer blows, and blows from the flatter on those edges.

A third way of forming the flat end is by forking the end of a stout bar in the fashion shown in Fig. 83, and opening the ends outwards. Continuity of fibre is thus preserved. The end A is then fullered down thinner, and drawn out—cut off the main bar, whose length may serve as a porter—and scarfed for welding to the stem.

When these rods are made in quantity the final finish is imparted in a cast-iron die of the form shown in Fig. 84, where A is the recess that gives the flat end its perfect finish, and B a flat piece of steel, whose depth B makes up the precise difference between the depth C and of the flat end A, and by means of which the T-end is driven out of the die immediately after it is turned off the anvil block of the steam-hammer. The block being turned upside down, a blow or two on the piece B drives out the finished T-piece, and releases it from the die.

When the fins formed at the edges are being cut off with the set, the forging is placed upon a piece of sheet iron, bent over at the ends to clip the edges of the anvil. This sheet of iron prevents the cutting edges of the set from becoming dulled by contact with the hard steel face of the anvil.

Slide-valve spindles of the bridle form are made in two or three ways. The bridle is sometimes of circular, sometimes of

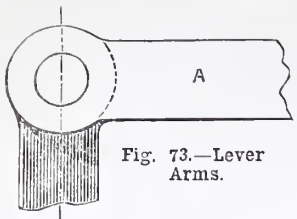
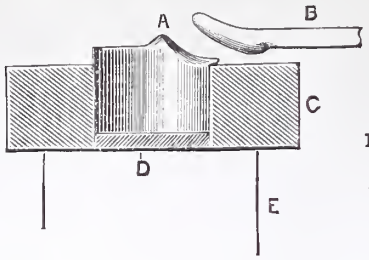


Fig. 73.—Lever Arms.



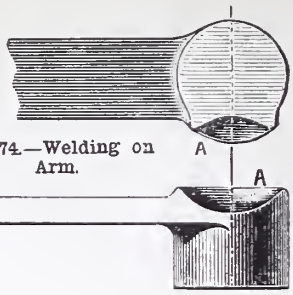
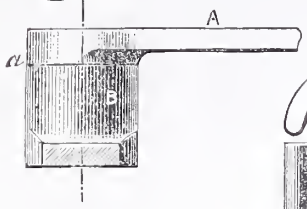


Fig. 74.—Welding on Arm.

Fig. 75.—Round-faced Fuller.



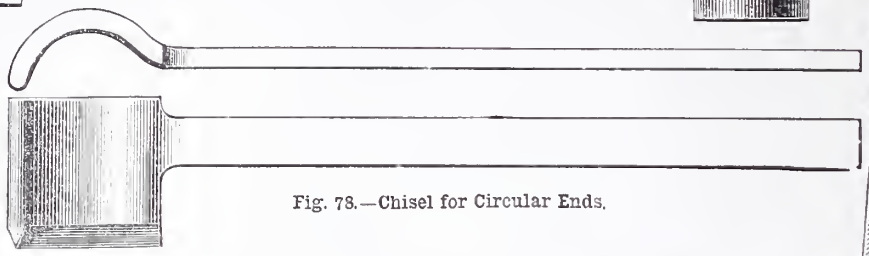


Fig. 78.—Chisel for Circular Ends.

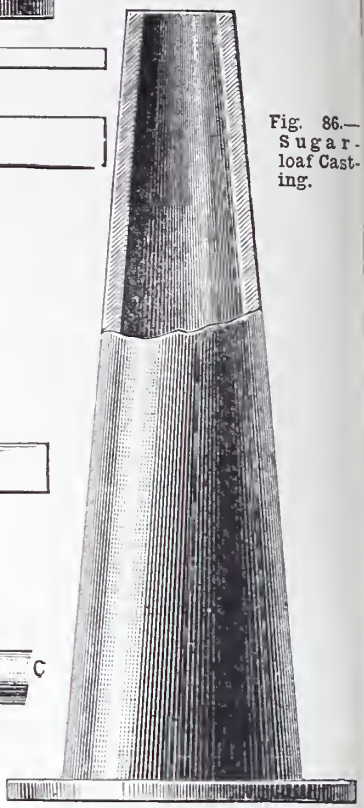


Fig. 86.—Sugar-loaf Casting.

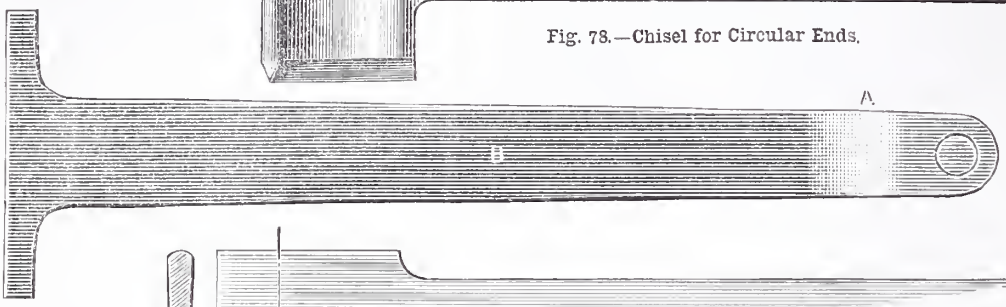


Fig. 76.—Eccentric Rod.

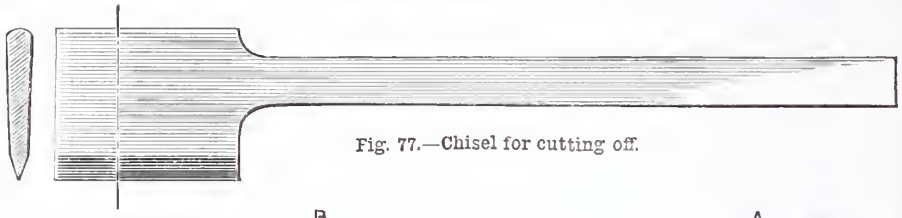
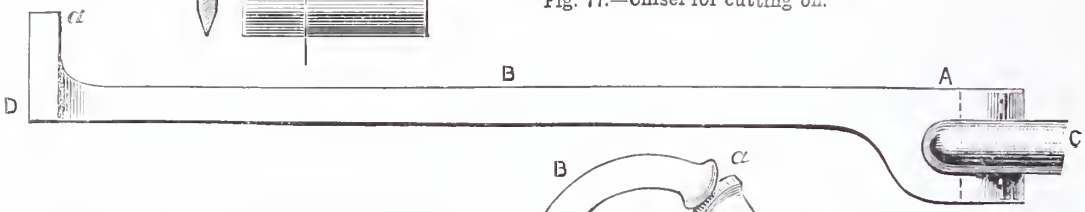


Fig. 77.—Chisel for cutting off.



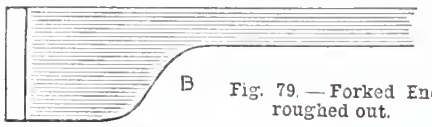


Fig. 79.—Forked End roughed out.

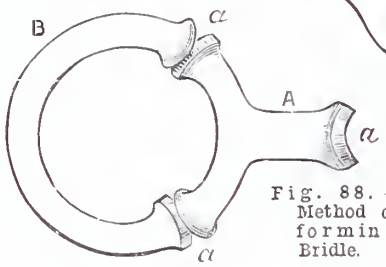
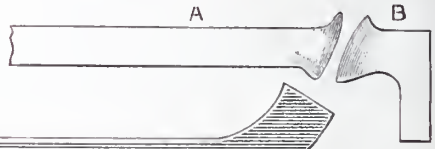


Fig. 88.—Method of forming Bridle.



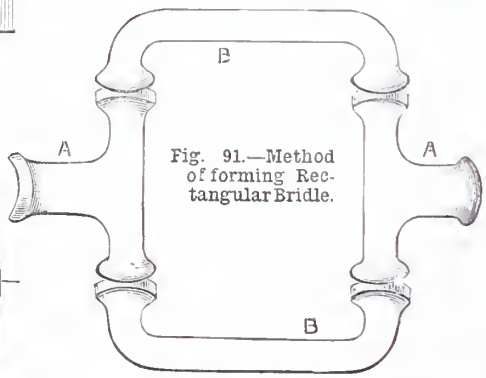


Fig. 91.—Method of forming Rectangular Bridle.

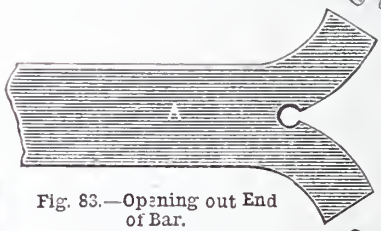


Fig. 83.—Opening out End of Bar.

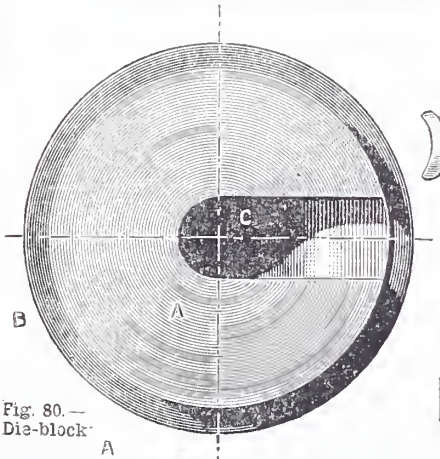


Fig. 80.—Die-block.

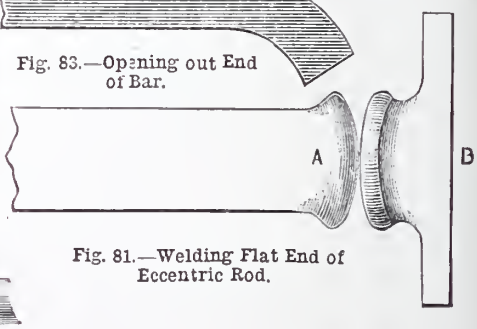
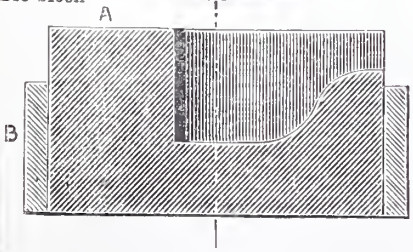


Fig. 81.—Welding Flat End of Eccentric Rod.

Fig. 82.—Anvil Stop.



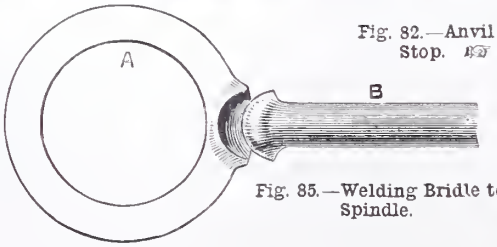
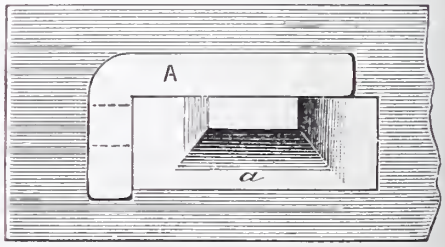


Fig. 85.—Welding Bridle to Spindle.



ctangular, shape, but the principle of its rmation is the same.

Take a bridle of circular form first. By ıe method the eye would be turned round ıd welded as a distinct ring, and the stem ıen welded to the eye; by another method a portion only of the eye would be formed, and welded to another portion made in one with a portion of the stem; by a third method the eye would be turned round of the same metal as that from which the stem is formed, and welded.

Fig. 85 illustrates the first method. Here A is the ring which has been upset and scarfed, turned round on the anvil beak, welded and fullered to receive the upset and fullered stem B, placed in position for welding.

The iron from which the bridle A is made is somewhat larger than the finished section—say, $\frac{1}{8}$ in. each way—and the ring is first turned round to a smaller diameter than the diameter of the ring when finished. The object of this is to allow some finishing work to be done upon the bridle with fullers and flatter, which will have the effect of reducing the area and increasing the diameter. In this way the size of the ring will be increased, and may be easily augmented to any reasonable extent, but it could not be reduced.

The details of finishing the ring and bridle need not be commented on, as they are just like the same kind of work noted in earlier papers. The truth of the ring is guaranteed by slipping it over the anvil beak and correcting its form with the hammer, or over a sugar-loaf-shaped casting (Fig. 86), kept in three or four sizes in well-appointed shops, and flatters, fullers, and swages are employed for finally finishing the various flat and curved surfaces.

When the bridles are large, the bending is best done in the manner shown in Fig. 87, and the same method is likwise applicable to the bending of large rings in general. A cast-iron disc A, of suitable size, and having a central hole, is bolted down on the face of

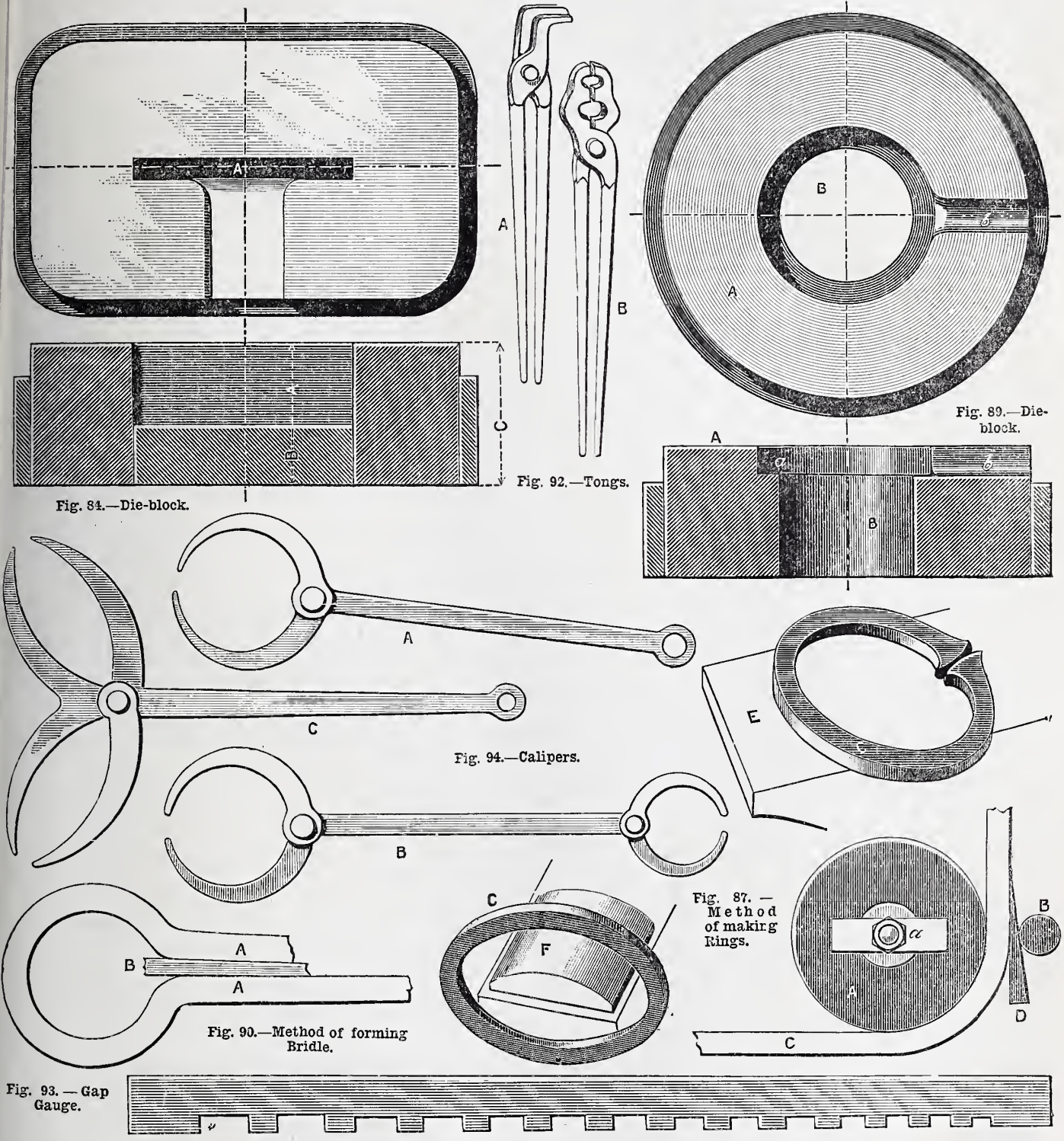


Fig. 84.—Die-block.

Fig. 92.—Tongs.

Fig. 89.—Die-block.

Fig. 94.—Calipers.

Fig. 87.—Method of making Rings.

Fig. 90.—Method of forming Bridle.

Fig. 93.—Gap Gauge.

a swage-block, the bolt *a* passing through one of the holes in the block. At a suitable distance a stop or pin B is inserted in another of the holes. The bar C to be bent is, when heated, placed between the disc A and the stop B, and is held securely with an iron wedge D, and the free end is pulled round by hand if sufficient length is allowed, or with tongs if short, and tapped with the hammer the while to cause close bedding of the iron to the disc. When the ends of the intended ring well overlap—say, by an inch or two—it is removed, and the ends are scarfed and upset with hammer or fullering tool, and welded upon the flat face of the anvil E, and finished upon a curved bolster F laid upon the anvil face, or provided with a shank to fit into the square hole in the anvil.

The valve rod bridle may be made alternatively thus. Take a rod of larger section than the valve rod, and fork one end as in Fig. 83, first punching a hole and then driving the hot set inwards, first from one face, then from the face opposite, until the nicks meet in the centre of the bar. Open out the divided ends, bring them into a rudely curved form, and reduce slightly so as to approximate nearly, but not quite, to the finished dimensions, leaving, however, the ends *a* (Fig. 88) of the original dimensions, and fullering them in a diagonal direction for scarfing (A, Fig. 88, showing the T-piece finished for welding). The iron that is to form the remainder of the ring B will be simply curved and fullered, and scarfed at the ends to match the T-piece A.

The diameter of the ring at this stage will, as in the previous example, be less than the finished diameter—say, by $\frac{1}{2}$ in. or thereabouts, dependent on the bulk of the work—to allow of working and finishing subsequent to welding, which inevitably stretches the iron. The spindle will be welded on to the free end *a* with a scarfed joint, or if the spindle is short it may be drawn down from the T-piece itself.

Where these bridles are made in quantity for standard engines a die-block is employed for final finishing. Its shape is that of Fig. 89. A is of cast iron, cored or bored out at *a* for the bridle, and cored out at *b* for the stem to lay in; B is a central steel plug or pin of the size of the hole in the bridle. The bridle is hammered into the die with a couple of blows of the steam-hammer, the die turned upside down on a suitable bolster, and the pin B and the forging struck out at a blow. On the pin being released from the forging the bridle is finished, except for the cutting off the fins around the top edges with a set.

Fig. 90 shows the third method, in which the bar is turned round and welded at A. To preserve the continuity of the circle, a glut or wedge-piece B is inserted in the weld, and forms an integral portion of the forging. Without this it would be difficult, or impossible, to form a perfect internal curve by this method. The finishing of the bridle by means of the tools and of dies differs in no respect from that of the previous example.

In the case of a square bridle, unless of small dimensions, the mode of construction would be that shown in Fig. 91. Two T-pieces A, A are formed by division similarly to the T-piece in Fig. 88, and the remainder of the rectangle is formed of the two pieces B, B, bent round and scarfed to meet the scarfed ends of the T-pieces. The rods may be drawn down from the ends of A, A, or welded on.

For holding and manipulating rings, tongs of the forms shown in Fig. 92, and of various sizes, are employed. Tongs known as hoop tongs are shown at A, and pick-up tongs at B.

When work is being reduced to final dimensions, it is necessary to check dimensions by other means than by that of the steel rule. For flat rods the gap gauge is commonly used. It is of the typical form shown in Fig. 93, each gap being of a definite width to $\frac{1}{8}$ in. or $\frac{1}{16}$ in. Their depth is unimportant, but bears some proportion to width. These gaps, which are really fixed calipers, can be made to embrace and test the dimensions of a red-hot forging in an instant.

For circular work, calipers like those shown in Fig. 94, with long shanks, are used, so that the hand need not become scorched by too close proximity to hot forgings. A is a single caliper; B, C are two forms of double calipers.

FAN MOUNTING.

BY E. CROSSLEY.

UNTIL quite lately, England has depended for many years past on foreign countries for her fans. The French, the Viennese, the Chinese have had the trade in their own hands; and the English, though they have only themselves to thank, have been left entirely out of the field. That this is not as it should be the Fan Makers Company are now doing their best to demonstrate. The exhibitions of home-made fans, of designs for the ornamentation of fan leaves, and of fan sticks, held by the Company, have done much to prove that English workers may in time meet foreigners on equal ground in this important manufacture. So far, we must own, there are very few native artists who can vie with the French in the decoration of the leaf, as our first-class artists do not deign to spend their time on such miniature paintings. The French have done it—Watteau, Boucher, Fragonard, Greuze, in the old time—and why should not the English just now and again execute a masterpiece on the dainty *éventail* that would be handed down for generations as an heirloom to be prized more and more as the years roll on. During the reign of Queen Anne and onwards until far into the eighteenth century, fans were manufactured here in large quantities, then the trade gradually declined, unfortunately for our workers. It will take us years to regain our lost place, though the Fan Makers Company and others are doing their best to stir both men and women up by offering prizes for original designs, and for artistically painted decorations. Even though English girls have copies placed before them which are done by French artists, they find it difficult to reproduce the paintings with equal grace, lightness of touch, and the beautiful harmony of colouring so essential for perfect examples of fan decorations.

It is not my object, however, to dwell on the merits or demerits of fan painters, but rather to describe how the leaf can, when decorated, be mounted on the sticks, and so be made into a fan worthy to be wielded by the fairest of our living belles, and, possibly, by their descendants for many long days to come.

Fan mounting is a pleasant occupation. Many ladies have old favourite fan sticks by them, but, alas! the leaves are worn out, they are frayed at the edges, cut down the folds, the paintings have partially disappeared through constant friction, and they are but useless cumberers of wardrobes. What shall be done with them? If any fan leaf is a masterpiece of art, save it and treasure it in a cabinet, never mind how old or ragged it may be. But there are not many ladies in these enlightened days, when an art education comes to one almost will she nill she, who does not know something of the value of old fans. Those of ordinary merit, when worn out, may well be replaced by new ones. Of course this can be done at shops where fans are sold; but many women who are fond of artistic work may like to paint new fan leaves themselves, and probably would also like to mount them if they but knew how to do it.

I will take one of the simplest fans and describe minutely the mounting of the leaf; then, if anyone follows the directions exactly, the result will be a very presentable piece of work.

Imagine that the gauze leaf is already cut in the shape of a semicircle and painted with a *genre* subject or a spray of flowers. Now about the materials for mounting it.

First there are the fan sticks. The size of the leaf depends on the length of these, which may be 10, 11, or 12 in., or more. If the fan leaf is painted before the sticks are obtained, you must choose sticks of suitable size for it; but the wisest plan is to buy the sticks first, then you are not restricted in your choice on account of the size, and if a particular pattern takes your fancy you are at liberty to have that and no other. There is an immense variety of fan sticks. I was looking over a small portion of the stock of these in a wholesale house a short time back, and was greatly interested in the multiplicity of exquisite designs and the perfect workmanship. The sticks of mother-of-pearl alone were well worthy a long examination. One with the *panaches* wholly undecorated was of mother-of-pearl tinged with blue, like an opalescent lake under a summer sky. Others were smoke coloured, and very handsome they would be when mounted with grey gauze, or white bordered with fine Chantilly lace. Most were of white mother-of-pearl, and the best of these inlaid with silver and gold. A pretty fashion is to arrange all the ornamentation towards one edge of the *panache*, leaving the other plain. There are names for the fan sticks, such as the "Sultan" and the "Shell." Then there were the lovely tortoise-shell sticks, plain, carved and inlaid; the carved ivory and bone, the carved boxwood, and the many cheaper kinds of wood which are ebonised, polished, gilded, to suit the fashions of the hour. But I must not dwell longer on these, though I could willingly do so. Sad to say, these are all of foreign manufacture; the few sticks made here are scarcely worthy the name of fan sticks, so clumsy, so rough are they. The principal number of the foreign ones are made by machinery, but some of the better wooden ones are carved by the peasants of the Black Forest and elsewhere.

A *moule* is indispensable for the fan mounter. We may translate *moule* as mould or model, but that hardly gives a fair idea of the thing. It is a piece of cardboard semicircular in form. It has cuts down it that correspond with the folds of a fan leaf. The cuts do not pierce the cardboard through, but they are deep enough for it to fold up like a fan leaf. In the centre of the top edge there is a piece snipped out to show the middle; this is a guide to the folder. At the edge on one side of the *moule* are short lines, numbered to indicate to the worker where, before commencing to fold, the top edge of the fan leaf should be placed. By this plan the necessity of having different-sized *moules* is obviated. If the

n leaf is as large as the *moule*, the top lge is placed just a little above the top lge of the *moule;* if one inch smaller, then is placed one inch below the top of the *moule*, and so on.

A long pair of cutting-out scissors, a long nd very sharp knife, such as is known as a acon knife by cooks, only more rounded at he top, a quire of tissue paper, a medium-ized iron, good white gum, a sable brush, uch as skies are washed in with, about an ich and a half in size, some yards of picot o match the colour of the gauze leaf, sewing ilk also to match, and a sheet of white, lack, or coloured paper to cover sticks vith, as the plain wood does not look well howing through the gauze—these are the equisites of the fan mounter. One other tem remains to be mentioned, viz., a square f white marble measuring about 22 in. A quare of tin may be substituted for it, pro-vided the latter is firm enough to lay quite flat.

Now, the gauze has been cut out by lay-ng a semicircular piece of thick cardboard pon it and cutting it round the edge of the ardboard, but leaving a slight margin beyond. It has been fixed on a semi-ircular frame of wood, and the design has been painted, after which it has been left to dry. Next, the mounter takes it in hand.

Laying the quire of tissue paper on a smooth wooden table or on the marble slab, she places the gauze leaf on it face down-wards. Then, taking an iron, moderately heated, she passes it lightly over the back of the painting in an upward or downward direction; thus she irons *with* the selvedge, not across it, or in a slanting direction. It is more like laying the iron on the gauze than ironing in the usual manner. The warmth from the iron *brings up* the painting and gives it value.

The first fold is made with the hands. This is not right down the centre of the leaf as would generally be supposed, but takes a slightly slanting direction; this leaves a piece of the gauze single, whilst all the rest is double; the single piece will form the lining of one of the *panaches*. The single portion is about 2 in. wide at the top, or rather less, and comes to a point at the bottom. Let anyone take a half-circle of paper, and fold it as I have described, and they will see at once what I mean. Whilst the leaf is still only folded this once a small half-circle is cut from the bottom of it; this will be cut again later on, so sufficient margin must be left to allow for that.

A piece of thin white paper, not tissue, is cut the same shape as the leaf, though it may be a trifle larger with advantage; it is folded once just like the leaf. This is put outside the mount to keep the latter clean. The *moule* is taken up in the left hand and held just below the centre snip, and between finger and thumb. The leaf, covered with the paper, is slipped into the *moule*, the centre fold of the leaf being brought into the centre one of the *moule*. Doubled as it is, the mounter lays it on the marble slab. She keeps the centre fold tightly pressed with the left hand, whilst she makes the gauze and paper lay flat inside the *moule*. Now comes the need of dexterity. She must never let go the centre fold until the first half is folded. She sets it straight longwise in front of her, and draws up with her fingers the other folds until they are level with the centre one. This is done by keeping the thumbs on the outer side of the middle fold, and with the fingers of both hands drawing up the half of the *moule* that lays beyond on the marble slab. When the half is done, and still held tightly, the other half is tossed over so that it, in turn, lays on the slab; it is treated exactly in the same way, and now all the *moule* is folded. This is pressed tightly between thumbs and fingers, which are passed up and down the *moule*, which still rests on the slab; the folds are patted along the top to keep them level, as every-one must be perfectly even. When this is finished, the first end fold of the *moule* is turned back, and the edge of the gauze leaf is neatly trimmed off with the large scissors, only just enough being left to cover the inside of the *panache*. Then the edge of the other outer fold is cut in similar fashion. The *moule* is again closed, and the bottom of it is held tightly down on the slab, whilst with one stroke of the big, sharp knife the bottom edge of the fan leaf which projects a little below the *moule* is cut off.

The leaf is now taken from the *moule*, and to keep it in folds a narrow piece of paper, which has been previously gummed so as to form a ring, is slipped over it. The mounter gets her needle and silk and the picot. Then she takes off the paper ring and proceeds to sew on the picot. Long stitches at the back of the gauze do not signify down the sides, as they will be gummed down to the *panaches*, but along the bottom edge the work must be rather neater. Still, the less the mount is handled the better. Any good worker will see at once that the only difficulty is in putting on the picot around the lower edge of the fan leaf, and at the top. The gauze being cut in half-circular form, the material *pulls*, as the saying goes, more in one part than another. The great point is not to stretch it, and not to draw it in; the only way to manage this is to keep it as flat as possible on the tips of the fingers of the left hand whilst working.

If the sticks are cheap wooden ones (and I suppose none would make a first attempt on the better kinds, such as carved ivory or tortoiseshell, and perhaps not on carved bone), it is necessary to scrape them to make them smooth, and then to cover them with thin white, black, or coloured paper to match the tint of the gauze leaf. This, it goes without saying, it is wisest to do before the fan mounting is commenced, as the gum must be allowed time to dry or the paper would tear off at a touch. The sticks are now taken in the left hand, the sable brush mentioned amongst the requisites is dipped in gum, and the paper that covers the sticks (or the sticks themselves if they are uncovered) are brushed over on one side only. This has to be done carefully; if too much gum is used it would run to the other side of the stick, and so spoil the leaf; at the same time every portion of the sticks, on the one side, must be gummed, else the leaf will not adhere properly. The insides of the *panaches* are also gummed. On no account must the sticks be folded together at this juncture. Now comes the test whether the fan mounter is an adept in the art. The fan leaf is folded and taken in the left hand, the sticks are held in the right. One by one the sticks (just the tips of them) are laid between each fold of the leaf. We have nothing to do with the *panaches* at this moment—they are left loose. The sticks are laid about an inch up on the bottom edge of the folds. Now the leaf and sticks are tightly folded, and the bottom end of the sticks is rested against the worker's chest whilst she gently draws the leaf down the sticks until the picot just reaches the shoulders. The skill is shown in doing this so that all the folds are drawn down the sticks equally at once, and as a result the picot being perfectly level on the shoulders of the sticks. To do this the edges of the sticks and folds must face the worker; she holds the folds of the leaf at the bottom edge only between the thumbs and two first and second fingers of each hand, and gently draws it down. The fan is again taken in the left hand, and one *panache* is turned up and laid on the outer fold. This has to be done with great nicety too, as just the extreme edge of the picot ought to show beyond the edge of the *panache*. It is the careful, or the want of careful, attention to all these little details which makes the difference between a good and an indifferent fan mounter. The second *panache* is fixed, and then the worker takes a strip of gauze, or a piece of ribbon, or tape, or anything that lies handy about, and ties round the top of the fan leaf, and then the bottom. After which she leaves it for awhile until the gum is dry; a few minutes will suffice for this.

The needle and silk are in requisition again to fasten the picot on the top of the fan leaf. It is rather awkward to do, as the sticks are in the way, but practice soon teaches how it may be done with the least trouble. The tip of each stick is caught in with the stitches to make them so firmly fixed to the leaf that the two cannot part company. After the picot is on, the tip of the leaf needs a touch of gum to refix it to the *panache;* it will have been unloosened to sew on the picot.

The fan is then opened and examined; if there are any gum spots detected, they are removed by damping them with the tongue slightly. The mounter then lays it aside as finished.

The single gauze leaf is one of the easiest to mount. Having learnt how to do it skilfully, the mounter will be able, by examining the double gauze fan leaves, to mount them also; to introduce lace as medallions, to border with lace, to mount the "Shell" fan and the "Sultan"—all will come easy after once the knack is acquired. Dexterity, cleanliness in working, patience in overcoming difficulties at the outset, steady perseverance, and great nattiness—these are some of the needful qualities of the clever fan mounter. Girls are apprenticed for four years to the trade; this alone shows that there is something more to be learnt in it than can be done in a day. To any girl of average intelligence who is clever with her fingers, and dainty in her ways of handling materials, fan mounting offers fairly lucrative employment. It needs no special talent, but quickness in working and industry tell here; and a girl who makes up her mind to do so, will soon excel.

FITTING AN ELLIPTIC CHUCK.

BY JAMES LUKIN.

Revolving Nose-piece—Division Wheel.

The addition of a revolving nose-piece, with its division plate and ratchet wheel, or its worm wheel and tangent screw, offers many advantages. Without this the ellipses of a surface pattern must lie upon the same diameter, being merely a series of elliptic rings within each other, with their longest diameters in the same direction. The simpler chuck is therefore chiefly of use for small picture-frames and such like articles, and for plain elliptical boxes; but a series of interlacing rings can be cut round them

by the usual eccentric cutter, using the division plate or the mandrel to space them properly; and simple mouldings of elliptic form can also be easily cut by suitable hard wood or slide-rest tools. But if an ellipse chuck has its own division plate, the figures can be cut on any diameter, so as to range in a star-like form round a common centre. This, of course, opens up a possibility of an infinitely varied series of patterns, both superficial and perforated, as well as a power of carving designs on the solid by using fixed and revolving tools. It is consequently well worth while to expend such extra labour as will produce a chuck capable of these extended uses; and as it only needs a very easily made addition, I will at once describe it in detail. Fig. 11 shows the loose nozzle as a mere casting. It is exactly similar in form to that of an eccentric chuck, being a round plate of brass or gun-metal, with a cylindrical projection in the centre, which is to form the screw on which to mount ordinary chucks carrying the work to be turned. There is no difficulty about turning this part, as the nose gives such facility for mounting it in the lathe, in order to turn the base level and circular; and when this is finished, it only needs to be seized by the base in a grip or wood chuck, in order to turn and thread the cylindrical part; but during this process a hole has to be drilled quite through the centre, and enlarged to receive a good-sized pin of steel, upon which it will turn when in actual use. This is not, however, always so mounted. A screw is sometimes put in from the back, the head of which is recessed into the back of the slide. The screw shank is left cylindrical for a distance below its head, equal to the thickness of the plate, to allow the division plate and its nose-piece to turn easily with its screw, which latter should be a somewhat tight fit. It cannot, however, become unscrewed by the movement of the division plate, as the base plate of the chuck prevents it. Fig. 12 shows this method, Fig. 13 the other; and here is also shown a turned fillet, fitting a circular groove worked in the sliding plate, by which, in all such cases, stability and freedom from shake are obtained. Some makers sink a portion of the division wheel itself, turning it down at the under side, like Fig. 14. This is scarcely so good a plan as the fillet, but easier to fit. There is no need to describe in detail the process of turning and fitting these parts. It can be very easily done, even by hand tools; and if the pieces are securely chucked, failure is hardly possible. If indeed the fillet is used, it will be necessary to chuck the sliding plate; but this has to be done with a solid nose-piece, as already described, and it is only a case in which, as in so many others, the lathe face plate and clamps come into use. Supposing the work thus far completed, the circular disc or flange will need to be cut into teeth, either for gearing with a tangent screw, or for a click or ratchet. If the lathe is not fitted with the necessary apparatus, a practical clockmaker will readily undertake to cut the teeth and mark the divisions; and I strongly advise this, because, simple as it is, it needs tools and appliances seldom found in an amateur's workshop. The Britannia Company of Colchester will also undertake the job, and so would many others who advertise in WORK, and the charge would in no case be great. Ninety-six is the usual number of teeth, numbered at every eighth, with a dot also over each fourth division. My own chuck has, however, a hundred divisions, marked in figures at every fifth, and the tangent screw is of ten threads to the inch. Its diameter, to take a hundred teeth, or rather a hundred recesses, is 3·18 in., as given in Mr. Evans' book on ornamental turning. My own before cutting was, I observe, exactly 3 in. diameter; but I would rather trust to Mr. Evans' statement. If it is decided to have a worm wheel and screw cut, instead of a click plate, a short bit of screw, say 2 in., should be ordered at the same time, the ends of which can be subsequently reduced to plain cylinders, and one such end squared for a key or winch handle. There is no real difficulty in fitting up this part, which should not have its bearings screwed to the sliding plate, but turning on a pin, and retained by an eccentric cam. Fig. 15 represents this arrangement: A is a part of the sliding plate; B, the frame shown in plan at C, and being in fact a small poppet-head in general form. The actual screw to drive the worm wheel being larger than its shank, is put in at F; and into this hole, therefore, is put a pointed centre screw, of which the body is slightly larger than the bit of driving screw. This centre is then screwed up until the shoulder of the spindle takes its bearing against the inside of the opposite end of frame. Fig. 16 shows the driving screw; Fig. 17, the short, thick centre screw; and close by letter A of Fig. 15 is seen the screw upon which the frame turns horizontally. Fig. 18 represents the whole in action, A being the eccentric cam, and B a part of the worm wheel, upon which the tangent screw acts when the cam is turned, so as to secure the parts in close contact.

The advantage of this arrangement over a fixed frame screwed to the slide is very

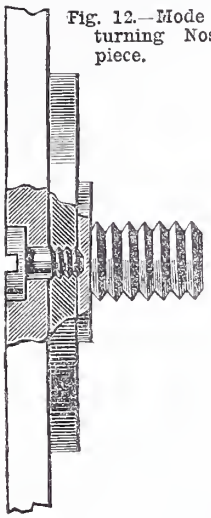


Fig. 12.—Mode of turning Nose-piece.

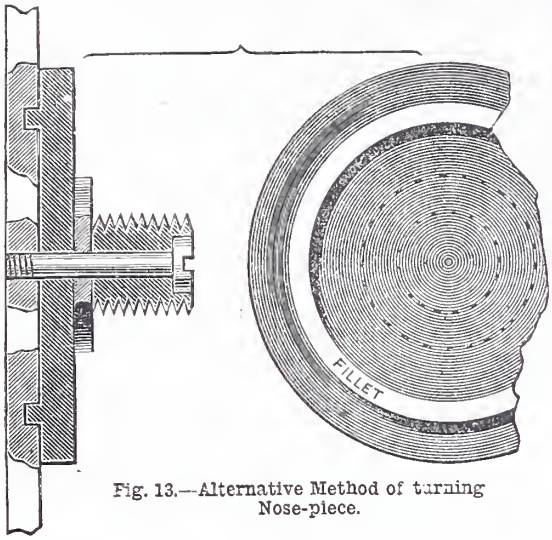


Fig. 13.—Alternative Method of turning Nose-piece.

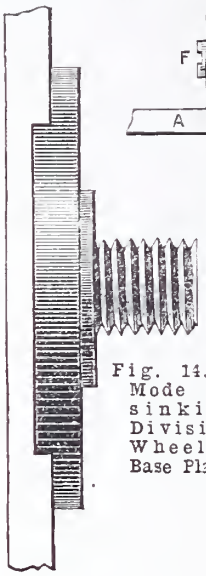


Fig. 14.—Mode of sinking Division Wheel in Base Plate.

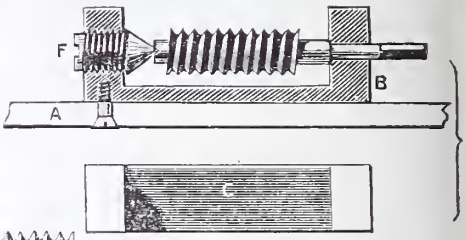


Fig. 15.—Fitting to actuate Worm Wheel.

Fig. 16.—Driving Screw.

Fig. 17.—Centre Screw.

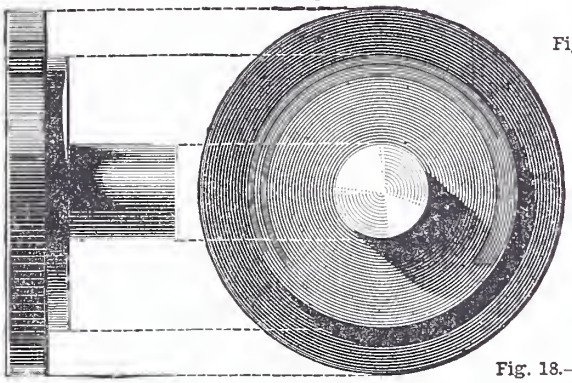


Fig. 11.—Casting of Loose Nozzle.

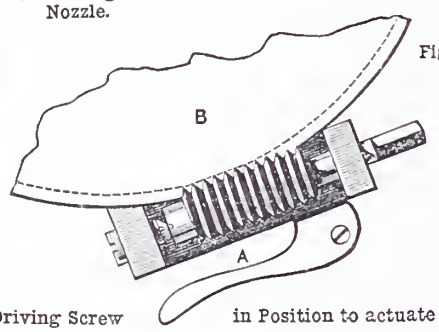


Fig. 18.—Driving Screw in Position to actuate Worm Wheel.

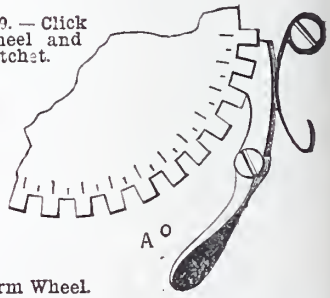


Fig. 19.—Click Wheel and Ratchet.

reat, as the divided wheel can be turned y the fingers on releasing the cam; and ven with a winch handle this is a tedious peration when many divisions have to be passed over, as in dividing the circumfer-nce of the work in hand into two, three, or our parts only, as will often be necessary. An inspection of Fig. 18 will show that part of the frame carrying the tangent screw will project beyond it. This can be avoided by allowing it to go under the worm wheel by turning the latter with a shallow rebate, as dotted. It need not be so wide as here drawn; but being only attached at one end, the broader its base can be made the better, as it will be less liable to work loose. The click wheel and ratchet, of which a segment is shown in Fig. 19, is too simple to need much explanation. If a hole is drilled at A, and a pin fitted in such a position as to retain the ratchet when pressed down far enough to free the divided wheel, the latter may be adjusted by hand, which is sometimes convenient at the commencement of work, when the pressure of the spring is inconvenient, and both hands are temporarily needed. This will, of course, not be needed at any other time.

A NEWSPAPER OR MUSIC EASEL.

BY S. F.

In these days of cheap literature, when people "take in" so many weekly and daily pennyworths, and the more substantial monthly magazines, it often becomes a matter of importance to our friends of the gentler sex to make them look a bit tidy. They accumulate daily and are not always read regularly, and so cannot be assigned to limbo all at once; besides, there are often things in them to be referred to at no distant date. For instance, you cannot get through WORK so very quickly, particularly when you have only an hour or so at your disposal every day for reading; and then there are hosts of other papers that have to be at least run over, and these facts make it imperative that they shall be at hand at any moment within the current week, at all events.

To meet the demand for a tidy, the article I am about to describe is of the best. Light, easily made, portable, and, above all, ornamental, it forms a very pretty addition to any drawing-room. It is equally available for all sorts of papers, music blotters, and let me gain the ladies' ear, fashion plates.

To make the easel, we require but a very small outlay indeed: a couple of shillings for wood, a shilling for enamel paint, and another for hinges, is about all that is required. The wood used is supposed to be white or yellow pine, and then painted, but, of course, any wood may be used. The wood required is of the following sizes:—For the two side pieces, 4 ft. 5 in. long by $1\frac{1}{8}$ in. square, when planed; for the laths, 3 ft. 10 in. long by $\frac{3}{4}$ in. or $\frac{5}{8}$ in. wide, and $\frac{3}{8}$ in. thick; for the joining bars, stuff of $1\frac{1}{2}$ in. by $\frac{5}{8}$ in. thick, and of the sizes and shapes in the sketches. For the pieces to which the frames are screwed, we require pieces of the various lengths and $1\frac{1}{8}$ in. square. One edge is then to be planed off till they are $1\frac{1}{8}$ in. on the top edge and $\frac{1}{2}$ in. on the lower edge. These cross-bars are screwed on from the back through the side pieces, and the frames are fastened to them by two hinges. The frames are made double, Oxford pattern, as shown in the drawings; the wood is $\frac{5}{8}$ in. square when planed; the ends projecting are 1 in., and the spaces are $\frac{5}{8}$ in. each; the pieces are halved into each other and glued into place. The frames are not all the same size: the top one is smaller each way by $1\frac{1}{2}$ in., and the bottom one is larger each way by $1\frac{1}{2}$ in. than the middle one, but the pieces are all of the same scantling. The strut is 3 ft. 10 in. long by $1\frac{1}{2}$ in. by $\frac{5}{8}$ in. thick, and is morticed into a top piece of the same scantling 7 in. long. This takes two hinges, which are also fixed to the top joining bar, and a cord keeps the strut from spreading too far. Lastly, come the two little turned knobs for the tops of the sides, which, if you have not got a lathe, may be bought for 3d. or 4d. The whole affair cost me 3s. 6d., made up as follows:—Wood, 1s. 4d.; paint, 1s.; hinges, 1s.; screws, 2d. Total, 3s. 6d. This ought to be cheap enough to satisfy everybody. Of course, it may be made larger and heavier, or smaller, if required, but I think the sizes I give are about the most convenient, as the one I have made looks remarkably well.

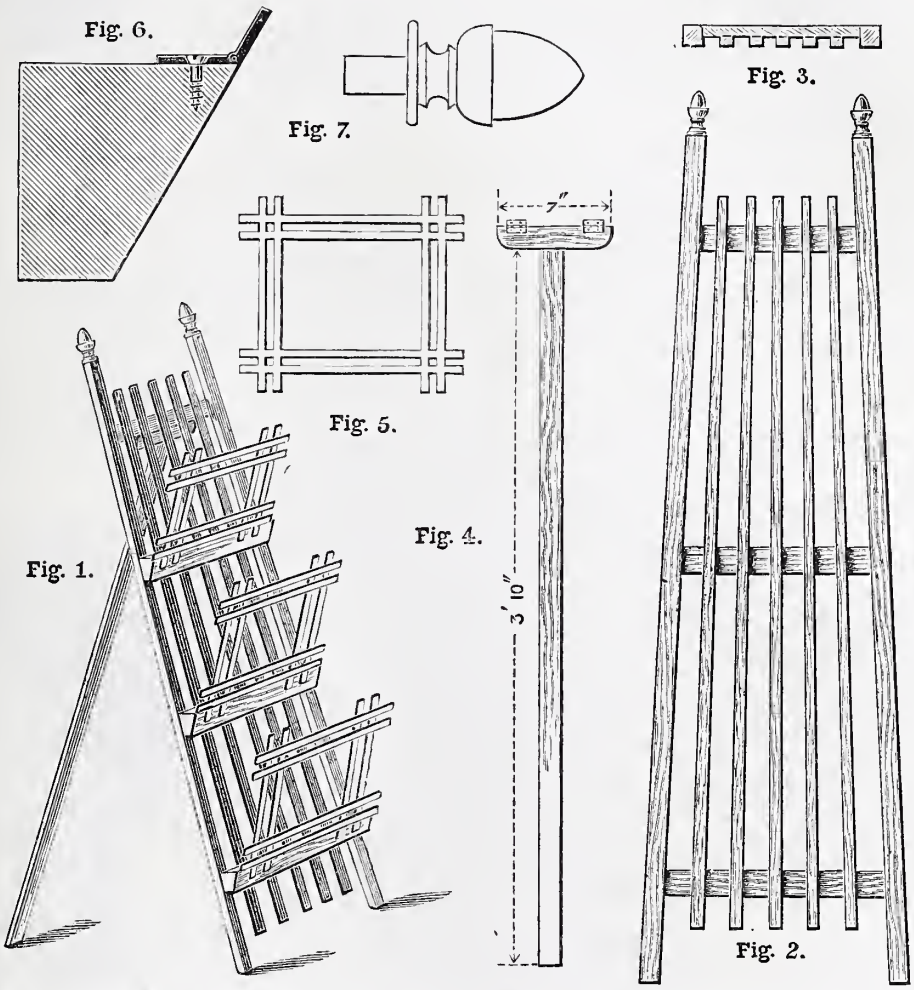


Fig. 1.—Perspective Sketch, not to Scale. Fig. 2.—Framework. Fig. 3.—Section of Laths. Fig. 4.—Strut, $\frac{5}{8}$ in. thick. Fig. 5.—Middle Frame. Fig. 6.—End of Frame Support (full size). Fig. 7.—Finial (half size). Figs. 2, 3, 4, and 5 are drawn to $\frac{1}{12}$ scale.

MEANS, MODES, AND METHODS.

A Few More Hints for Working with the Graph.

I do not recollect having seen the one or two tips I am going to give mentioned by previous contributors in their hints upon the graph composition so extensively used at present for copying letters, music, and drawings; and therefore it may happen that, humble as they are, they may prove serviceable to some. The use I make of this method of printing is very considerable, and consequently my remarks have personal experience for their foundation. Of all the modes of printing, whether large or small, I should say that the one in question is the most productive of tantalising labour and impatience. Others besides myself must have felt annoyance during the warm weather at the manner in which the graph became sticky, and *would* come away with the paper, which was supposed to receive no further impression than that for which the ink was used. I find that in such crises a useful thing to do is to fill a flat dish of some sort with cold water, placing the graph tin in the water, and allowing the latter to reach nearly to the top of the tin. I notice that it is an almost invariable rule with most users of this composition to rub and scrub away at the surface of this stuff after they have finished printing. Now, in my humble opinion, this is detrimental for more than one reason. By these means a comparatively rough surface must be the result, and a consequent waste of the material must take place. The way I proceed is different to this. I first give the stuff a slight rinsing to wash off dirt, etc., and then cut it out of the tin, and place it in a can preparatory to being put into a saucepanful of hot water already prepared to receive it. I let it melt in the same way as glue is treated, and give it a thorough good stirring. When it is in a condition to flow freely I pour it back into the tin and put a board over it to keep off dust, etc., and allow, according to the state of the

weather, four or six hours to elapse before again using it. By these means a clean, smooth surface is obtained, and I find that by allowing the ink to thus mix with the composition the latter is improved. Of course, everything wears out in course of time, and this stuff will become leathery; but by occasionally adding a drop or two of water and glycerine whilst the stuff is in a melted condition, great improvements are effected, and I think it is a less expensive way than rubbing the impression off.

I have heard it advised that to use very *smooth* paper for drawing or writing upon with the ink is best, but experience has told me that paper more of the texture of that with which WORK is fed is preferable. I am not a chemist, and therefore cannot explain satisfactorily what I should like to be able to; but there is some ingredient in the ink which the rougher paper absorbs, allowing but the vital property of the ink to adhere to the composition. On smooth paper, I think that this "something" must be the cause of the lines sometimes smearing.

I find that some papers I use, upon which the original may be, after being pulled from the graph, leaves a lot of fluff on the latter which in no way improves the quality of the copies. Until lately I hesitated to adopt what I thought would be the best way to proceed in such a case, but I finally experimented, and can give it as a useful hint that when such instances arise, if a damp sponge is firmly but carefully run along from one end to the other of the graph (the impression, of course, being upon the latter) with a from side-to-side movement, going over the surface but once, the fluff is taken off, and instead of the ink being smeared, an improvement is added to it.

I have never made any of this graph composition, as I believe the cheaper and best way is to obtain it from makers who have thoroughly learnt to manufacture it. The firm from where I obtain that which I use manufacture exclusively this class of goods, and I have always been satisfied with their wares. Should any readers be desirous of knowing where this place is situated, with the wish to purchase material with which to copy fretwork designs, etc., I shall be very glad to give them the information, if the Editor will permit me to do so.—J. S.

How to Avoid Wet Feet.

Now that the winter and rainy season are busied in treating us to their various inconveniences, it may not be unadvisable to give a means of making boots waterproof against the ordinary rains or snows. Of course, a well-made boot which has not been in use very long is, or should be, proof against ordinary wet for a considerable time, but, unfortunately, not all boots are well made (I was almost going to say all boots are not well made), and many of us have boots which have been in use for several months.

What I do with my own boots, and advise others to do with theirs, is this:—Firstly, I see that the boots are in good repair; as I sole my own, I never let the sole get too thin. This in itself is a great aid to keeping one's feet dry, for if the boot sole is worn through, or as thin as blotting-paper, wet is bound to find its way in somehow or other. Secondly, when I am going out in a regular downpour of cats and dogs, I warm the soles and the boots generally, and rub in with a stiff brush—an old tooth-brush is excellent for the purpose—as much neat's-foot oil as the leather will take in; and in very bad weather, or in snow time, I rub over the uppers as well. This oiling process is no hindrance at all to the subsequent daily repolishing of the boots; in fact, they polish better after it.

For anyone engaged in farm work, country work, policemen, watchmen, and others, I would advise that two or three ounces of oil, either neat's-foot or horse oil, be put inside each boot, and the boots placed near a fire till the oil has oozed through. The boots then, if in good condition, will be as proof against wet as it is possible to make them. The smell of the oil is a trifle unpleasant, but I prefer it to wet or damp feet.

It is not everybody who can afford waterproof over-boots or shoes, or even the old-fashioned and much ridiculed goloshes; I don't recommend anyone to wear them as a rule, as a tight-fitting, impervious covering to the feet makes them tired much sooner than usual.

My summer holidays are often spent botanising or geologising in Devonshire. I should not dream of starting from home without my little flask of neat's-foot oil. I persuaded the ladies of my family to try the oil on their boots, and in bad weather they often ask where I keep my oil, and, if they think I am oiling my own boots, they bring theirs to be done at the same time.

Any animal oil would, I think, answer the purpose, and sperm or horse oil, though I have not tried them.

When I was a boy, I remember having my boots rubbed with mutton fat, and I can recall the ridicule I underwent for entering school with well-besmeared boots—but those that win may laugh, and so may those that have dry feet.—H. J. L. J. M.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

103.—Clog Iron Repairing.

Mr. Hollingworth, 136, Balfour Street, Oldham, sends me a specimen card of his "Clog Iron Repairers," and wishes me to mention them for the information and benefit of all who wear clogs in the manufacturing districts. There are eight irons, four large and four small, on the card, which is sold for 2d. As Mr. Hollingworth sent me a clog to look at, the first of this kind of footgear that I have ever seen, I may say that they appear to me to be cheap and well adapted for the purpose they are intended to serve. The irons are spiked at the back for driving into the wooden clog. He claims for them that any person can fix them, the best way to do so being by laying a piece of iron on the repairer and driving home with a hammer, and that, having no nail heads to wear off, the repairers will maintain their position on the clog sole until worn through. Further, that when the sole irons are worn very thin, by putting these repairers on the clog sole, it will have as good effect as re-ironing, and that when any part of the heel is worn away, it can be replaced by using the heel repairers, without pulling the other portion of iron off.

104.—Greenall's Steam Washer.

Everybody who runs a laundry and who is interested in washing day should send for and read "The Greenall System of Washing Clothes," sent out by Mr. John Greenall, 120, Portland Street, Manchester. Of the two systems, the cold water one chiefly followed by the French laundresses, and the hot water one, the latter is obviously the most expeditious and economical, and Mr. Greenall's system seems to

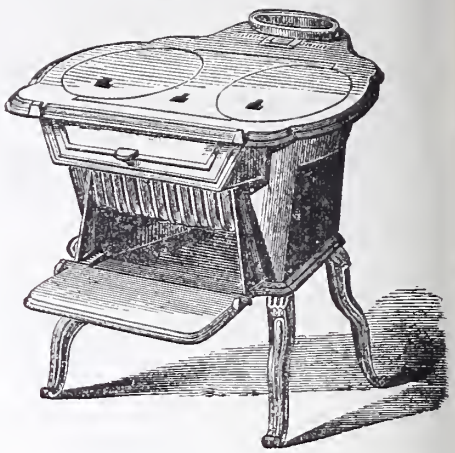


Fig. 1.—The "Petrel" Stove.

be the most expeditious and economical of the many modes of washing under this plan. Of its merits the readers of WORK may judge by the following description and accompanying illustration of the machine (Fig. 2). It is somewhat like a large knife-cleaning machine, 45 in. high, on a frame about the size of the frame of a sewing machine. The box that forms the casing of the washing apparatus is of bright copper, with a handle for turning by hand an inner specially formed cylinder that holds the clothes. Beneath

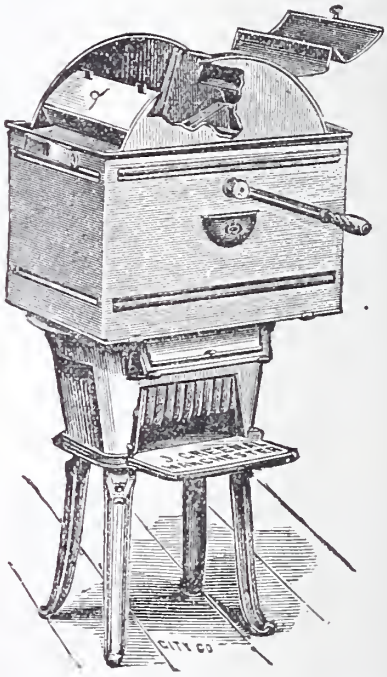


Fig. 2.—Steam Washer heated by Stove.

it is a stove for coal, gas, or liquid fuel. Whichever form of combustion may be desired may be used, optionally, from gas or any stove-range, or from a cooking stove range, as the "Petrel," which serves both purposes, and to a certain extent both operations may be carried on at once by this handy stove. Fig. 1 is a view of it. With this washer, the handle turning is the mechanical operation; the cleansing within the cylinder is by the aid of steam made to reciprocate all these movements of a handle. In the copper case or box is another, the actual revolving cylinder in which the clothes are put having been previously soaked well in cold water. In

the stationary case, about three inches of water only is necessary, on the principle that the less the amount of water, the more room for steam and for steam *beating*, for this rightly is the *modus operandi* of extracting the dirt from the clothes after it has been converted into liquid mud. The revolving cylinder, as partially shown by Fig. 2, has its inner periphery formed of ridges which beat the mud out of the clothes under the expansive force of steam, rinsing them and disinfecting them at the same time. The two small sizes of the machine will cleanse a double blanket or eight shirts, or a collection of collars, cuffs, handkerchiefs, and lace of a family in ten minutes or a quarter of an hour. Larger sizes take a greater bulk of things, but no longer time, so that what used to be called a day's wash is now the fraction of an hour. The wringing, blueing, mangling, etc., made easy by similar simple machines made and sent out by Mr. Greenall, should be welcomed by families as an addition to their comfort, whether small or large. £3 3s. is the price of Steam Washer on stand for gas heating. This costs ½d. per hour for 16 feet. THE EDITOR.

SHOP:

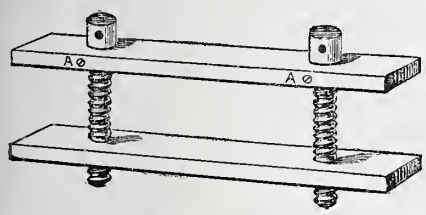
A CORNER FOR THOSE WHO WANT TO TALK IT.

**** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Double Bench Screw (Wood). — W. H. P. (*Hornsey*) writes:—"I think amateurs may find the enclosed sketch of a tool useful in more ways than one. I bought one some time ago, and have found it answer very well for bookbinding, as it is



Wooden Bench.

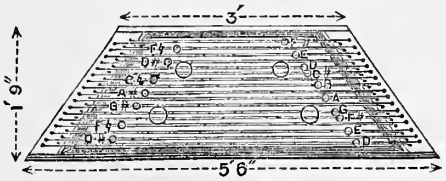
much cheaper than a press, and answers the purpose. I fixed a screw in the top slab above each wood screw, so as to keep the side up to the head of wood screw marked A A. It would be better to have a wooden runner at each end, so as to make it run free. The price is about 5s."

Official Label for Exhibit.—J. W. H. writes to F. J. R. (*Cardiff*).—This has been returned to the secretary by the Post Office, and awaits your sending new address.

WORK Exhibition.—J. W. H. writes in answer to several correspondents, and for the benefit of other readers, that no admission tickets will be issued until the exhibits, which entitle the exhibitors to them, have been received, examined, and finally accepted. Applications for transfers of tickets to friends in London should be made *only* after 20th December next. In reply to letters from country readers, London exhibitors have no privileges whatever beyond being on an equality with those in the country. They have to pack their exhibits, send them by carrier, and will not be allowed to enter the Exhibition until after the jurors' awards have been made—*i.e.*, before the public opening. Thus perfect fairness, irrespective of distance, will be maintained for all alike. The above applies also to Mr. Thomas Jorrance, 47, Blue Vale, Glasgow, and to Mr. George F. Crowther, 6, Park Road, Lewisham High Road, S.E. All changes of address should be communicated to the secretary immediately. N. B.—When exhibitors prefer to save trouble and expense by enclosing several exhibits, either of their own or of other exhibitors, in *one* case or package, they may do so if they affix *all* the official labels referring thereto to the outside of package.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Bass and Octave Dulcimers. — A PLAYER (*Welshpool*).—I am very pleased that you have been so successful in the construction of your D dulcimers, and hope your attempt at turning out the bass and octave instruments may be equally satisfactory. The bass is an instrument of somewhat different construction to the ordinary one, as it consists of seventeen notes, or rather semitones, only. Some are made of even less compass than this—viz., twelve notes; but the capabilities of these are necessarily so limited as to render them nearly useless. The dimensions of a bass of seventeen notes would be as follows:—Length in front, 5 ft. 6 in.; length at back, 3 ft.; from back to front, 1 ft. 9 in.; depth of shell, 4 in. The wood necessary for its construction would be, for the belly, yellow, or, preferably, Swiss pine finished to



Bass and Octave Dulcimer.

a thickness of ¼ in.; for the back, braces, facings, and inner bridges, ¾ pine; and beech for blocks and bridges. The construction of the shell is exactly the same as given in WORK for other dulcimers, except that the belly will not require grooving into the blocks, but will rest on beads of ½ in. square stuff fastened on by glue and brads to the inner side of the blocks, and it will also be necessary to strengthen the belly by three stays on the under side. These stays are of ¾ pine 1 in. deep in the centre, and tapering off to ⅛ in. at each end, where they are to be let into the top edges of the braces. They are placed 6 in. from each edge of the belly and the third one 2 in. from the right of a line drawn straight across the centre. The inner bridges are placed 4 in. from the blocks on each side, and an additional one is introduced quite in the centre, thereby cleaning the centre stay. The stays are necessary to prevent the belly splitting, and the centre bridge is intended to give support and thus prevent "swamping" or "blowing." As the tension of the strings will be considerable, it is of the utmost importance that the joints should be thoroughly well made. The inside lining blocks should be of 1½ in. square stuff and all of exactly the same size, and it is on the top of these that the ½ in. bead for the support of the belly rests. When this bead is in place it should be ¾ in. below the top of the pin block, so that when the belly is fixed it may be ½ in. under. Four sound holes should be made at the same distance—viz., 10 in. from each block, the lower two 3 in., and the upper two 2 in. in diameter, and of course may be fitted with rings or frets as desired. The bridges should be 1¼ in. high and 1 in. diameter at base. They should be turned slightly hollow at the base so that they may stand on their outer rims. They should be placed 4 in. from the blocks *on each side*, and herein lies the difference of the scale of the instrument, all other dulcimers having their upper register divided by bridges running down the centre (or nearly so) of the sounding board. When the work is so far advanced that the blocks may be set out, proceed as follows:—Draw two lines 1 in. apart down the centre part of each block, and, allowing 1½ in. at bottom and 2 in. at top, divide the intervening space on the *outer* line of the right hand, and the *inner* line of the left, into fifteen, so that you have seventeen marks on each line. Mark these well with a punch or pointed awl and *number* them from the bottom. Now bore numbers 1, 3, 5, 6, 8, 10, 12, 13, 15, and 17 on the right, and numbers 2, 4, 7, 9, 11, 14, and 16 on the left for wrest-pins. Now mark the other two lines in the same way, but ¼ in. lower down, and bore to correspond. The numbers between the wrest-pins in *each block* are occupied by the hitch-pins, so that you have twenty wrest- and fourteen hitch-pins on the right-hand side, and twenty hitch- and fourteen wrest-pins on the left. Put your hitch-pins, 1 in. long and made of No. 10 (B.W.G.) iron wire, in first and level off, leaving ¼ in. above the block, then insert the wrest-pins, ordinary piano-pins, and the instrument is ready for stringing. I have been thus particular in describing the setting out of the blocks, as an error once made is not easily rectified, especially if the holes have been bored. You will observe that provision has only been made for two strings to each note, and this is all that will be required, they being of the kind known as covered, "open" and "close." The "close" covered are used for the lower, and the "open" for the upper notes. You will have to get these strings made, which you can do by sending to Messrs. Chilvers & Co., Norwich. In stringing up commence with the stoutest strings, D hitching on the left and winding on the right; the next, D♯, is hitched on the right and wound on the left; and so on till the stringing is completed. The scale is shown in the accompanying diagram, from which it will be seen that it is unequally divided, and although this may appear at first sight rather awkward, it requires very little practice to get into the way of handling it, and being chromatic, any music that is written for the double bass (that lies within its compass) may be performed upon it. The beaters should be fairly heavy and well clothed and of a convenient length (about 13 in.), and, by way of variety, they may occasionally be laid aside and the strings plucked with the fingers instead. The octave or piccolo is simply a D in miniature, being exactly half the size of that instrument; it is easy, therefore, to work out the proportions by simply dividing the dimensions of a D by two, and working to that scale till the body is complete. The bridges, however, must be ¾ in. high, and ⅝ in. at base, with ¾ in. top, and the pegs 1 in. long with square instead of oblong heads, while the strings should be all of steel, No. 8 for the first six notes, No. 7 for the next eight, and No. 6 for the remainder. As its name implies, it is tuned an octave higher than the D, and the beaters should be very thinly and tightly covered.—R. F.

Diagonals.—J. L. P. (*Airdrie*).—A diagonal is a straight line joining two opposite angles of any quadrilateral—*i.e.*, four-sided figure. Thus, in the illustration, the lines A B and C D respectively are diagonals. To find the diagonal of any given square, as you ask, merely draw a straight line from any angle to the one opposite, as from A to B. Now we know from the 47th proposition of the first book of Euclid, that the square described on A B is equal to the squares on A D and D B added together, or—

$$A B^2 = A D^2 + D B^2 ;$$

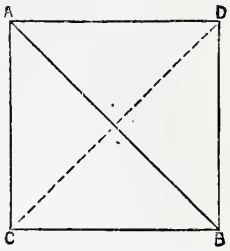
but A D and D B are equal, because they are both sides of a square: therefore—

$$A B^2 = 2 (A D)^2.$$

By taking the square root of each side of the equation, we obtain the length of A B, our diagonal, as—

$$A B = \sqrt{2 (A D)^2} = A D \sqrt{2}$$

In case you do not understand algebra, I will give an example with figures, so that you can substitute your own. Let the side of the square be 3 in. long; then A D will be 3 in., and D B will also be 3 in. We wish to find the length of A B; let us call this x; then x squared equals A D squared (that is 3 × 3) and D B squared (again 3 × 3) added together, or—



A Square, showing Diagonals, A B and C D.

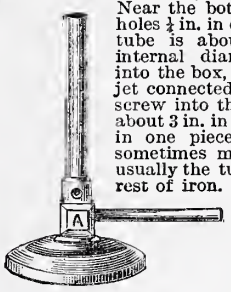
$$x^2 = A D^2 + D B^2$$
$$x^2 = 3^2 + 3^2$$
$$x^2 = 9 + 9$$
$$x^2 = 18$$

then x will be found by taking the square root of 18, or—

$$x = \sqrt{18} = 4{\cdot}2426406, \text{ etc.}$$

This requires that you should know how to extract the square root of any number. Probably it will be sufficient for you to draw a figure carefully to scale and measure; this will give you a fairly accurate result, but if you wish to know more exactly, write again, and give the length of the side of the square.—F. B. C.

Bunsen Burner.—HARO.—In a Bunsen burner the gas is conveyed through a narrow jet into a wide tube at the base of which are several holes to admit air. When the gas is turned on, a quantity of air, about twice the volume of the gas, is drawn in through the holes, and the mixture of gas and air is ignited at the orifice of the wide tube. The upright tube is generally 2¾ in. long by ⅝ in. internal diameter, and screws into the box A. Near the bottom of this tube are two holes ¼ in. in diameter. The horizontal tube is about 2¼ in. long by $\frac{5}{16}$ in. internal diameter, and also screws into the box, which contains a narrow jet connected with it. The box may screw into the circular foot, which is about 3 in. in diameter, or both may be in one piece. The whole burner is sometimes made of brass, but more usually the tubes are of brass, and the rest of iron. As they are sold at 1s. each, it would not be worth your while to make one. You do not give any address, but, presuming that you live in London, you can get burners, and any other chemical apparatus, of Townson & Mercer, Bishopsgate Street Within, or of Orme & Co., 65, Barbican.—F. B. C.



Bunsen Burner.

Jewellers' Waste.—DIAMOND MOUNTER.—*Re* the best way to treat the general waste material of a jeweller's workshop, in order to reduce the loss in working gold and silver to a minimum. First, for literature on the subject, it is, I believe, only written on in one book, "The Goldsmiths' Handbook," by George E. Gee, published by Crosby Lockwood and Co., price 3s., to which reference can be made for further details. From our own personal practice what follows is derived. The lemel is kept as free from impurities as possible, even from polishing materials; as for base metal filings produced in making patterns, we rigorously insist on their

being kept quite apart for separate treatment, and for that purpose a special box or drawer is provided for them, until such times as we melt the packet of grains left from the sweep after grinding. At the regular weighing up, be it weekly, fortnightly, or monthly, the lemel should be well looked over, and all pieces of wire drills and other things picked out; and at the same time take out all the pieces of gold and silver that can be seen, this latter being weighed up with the other scrap that the man may be returning. Then burn the remainder in an iron ladle or tray in which a layer of stout paper is previously placed. When the lemel ceases to smoke it will be thoroughly burnt; then pound it up in the mortar and spread it out on paper, so that by passing the magnet through it a few times all wire and filings from steel and iron are extracted. Keep this separate for later treatment. Now, and not before, should the lemel be weighed in. The allowance for loss in working given in Gee's book is 6 grains per ounce troy. This, I suppose, is a fair allowance, but should only be granted if the lemel is very clean. There cannot be a hard and fast rule for this, for there must be more waste in making carved, pierced, or open work than there is in plain and solid articles. Every master must think this out for himself. In checking the amount used and returned, if the difference is much, I have the one man's lemel melted separately and assayed, then if there is less than there should be, I warn the man that his gold account is not correct; if there be a surplus, as sometimes happens, then I carefully check the weight of every article, and pay particular attention to the quality of his filings. To be always doing this would be irksome, so my chief trust lays in the knowledge that all the men know that there is one portion selected now and then—this portion thoroughly gone into without his knowledge. While the lemel is being pounded up, it is as well to use the fire to anneal the melting pots, so that if they are to crack on the application of heat they may do so before the gold, etc., is in them. The simplest way of melting lemel is with powdered pearlash as flux. This method is only one of several, and its success depends on the *absence* of iron, therefore special care must be taken to remove all that is possible, for if we do not we shall have to remelt it, and use saltpetre as a flux. About one-fourth of powdered pearlash, well mixed, will do to start with; the mixture is to be placed in an annealed pot, but not within an inch of the top. The size of the pot should be such that at least half of the mixture can go in at first, the remainder being added as the mass sinks in the pot. Two details, often followed out for the sake of safety, are: first, the placing of an old pot under the one containing the lemel, to form a secure base, and to retain the metal and flux should there be an accident after all; second, keeping the fire low, so that it can be made up at the time the pot is inserted, thus gradually applying the heat. In the course of an hour or two, or more, according to the quantity dealt with and the heat obtained, the flux should be in a completely fluid state. It may, however, form a kind of crust or cake; if it does, then add more powdered pearlash; if it appears as if it will boil over, then add a little dry powdered common salt. Experience only can teach if more heat is required; but if a portion of the flux is taken out on the tip of the poker, and if this is smooth and uniform both as regards colour and density, and if, on breaking, no trace of metal is seen, or the composition of one part in no way differs from the rest, then we may think about pouring it. If the flux does not appear thus, then make up the fire again, and give it more pearlash, and, if you like, a little borax too. The ingot mould should be well warmed and slightly greased; it should be quite large enough; and, personally, I would be sure to have an open ingot mould, or skillet. The molten mass should be poured rather quickly, for then the flux will float to the top. If a closed skillet must be used, then use the poker to hold back the flux by placing it across the mouth of the pot, at such a distance that no impediment is offered to the run of the molten metal. On the appearance of the ingot when cold will depend the answer to the question—Is it good enough to assay as it is? When it is clearly melted, then cut off at least 12 grains (½ dwt.), and send it to Johnson, Matthey & Co., Hatton Garden, for parting assay. This costs 1s. 6d., and gives the exact quantities of fine gold and silver in the pound troy; from this one can get at the value, and so compare with the gold book. At my place we obtain an offer, and afterwards sell it to the refiners, for we know now that refining on a small scale does not pay. So much for the lemel; now for a few words about the floor sweep. The principle on which this is worked is that all the material that can contain gold is treasured, and all such stuff as coke and ashes from the heating stove is thrown away. The floor should be swept at least once, but better if done twice daily. If the expense can be allowed, it is best to have the floor covered with zinc, and just where the men are there should be wooden gratings; such improvements as these will soon pay for themselves. The sweep is to be well looked over for gems, pieces of gold, etc., and at the end of one or two weeks it should be burnt and sifted. After which it can go into the sweep-box; this being the receptacle for all secondary matters that may have precious metal in them, such as old metal pots, flux, etc. When the accumulation of sweep is sufficient, it should be ground (Simpson & Co., Chiswell Street, E.C., is a good firm), and offers obtained from two or three refiners for it. As for the residue, the grains, etc., they should be melted with the brass filings, and polishings, and residue of colouring water—that is, if there is not enough of the latter to keep separate. As for the water from washing the hands, which must always be done before a man leaves the workshop, this water is run into some large receptacle, and when it is quite full the pipe is changed into another tub or jar. Gee recommends strongly a solution of photo-sulphate of iron (green copperas), 2 ounces to 16 ounces boiling water. This is to be added, and the pan or tub is to be left undisturbed for a day or two before the water is drawn off by a syphon, so as not to disturb the sediment. As soon as it runs cloudy, then stop, for some gold will be sure to come out too. Of course, after some months' use the sediment will have accumulated, then it has got to be dried and burnt previous to being added to the sweep. The way of doing that is by making two strainers, one of coarse canvas, and under that another of finer canvas or cloth; under that, again, a tub to catch all that runs through, which, if clear, is allowed to run away; but if cloudy, then it is left to stand until the sediment rests on the bottom. After some days the muddy mass will get thicker and more like clay; then, as it can be easily moved, it is placed in some iron vessel, and burnt previous to mixing with the sweep. The furnace or forge where this is done should have a good draught, for it smells strongly.—H. S. G.

Gipsy Table.—G. A. (*Pembroke Dock*).—Gipsy tables can be purchased so cheaply that you might aim at something higher. However, obtain the octagon by drawing a circle on a board, divided by two cross lines and two diagonal lines, all running through the centre, into eight equal parts; and draw straight lines across from different points where they touch the line of the circle. The tops are usually 18 in. each way, and about ½ in. thick. Turn the legs from 1¼ in. or 1½ in. stuff. They will be in six parts, each about 14 in. long, their ends entering a middle ball, three above and three below it, by means of screws (Fig. 3). The

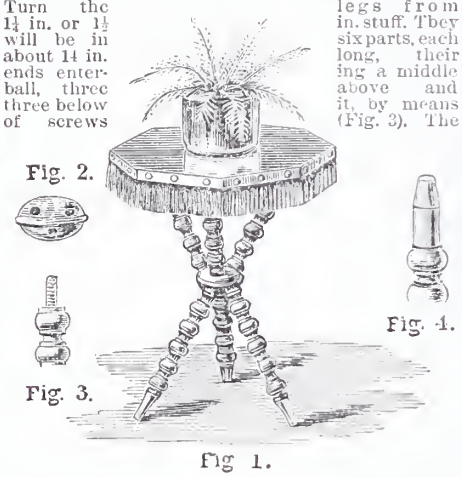


Fig. 1.—Gipsy Table. Fig. 2.—Ball to which Columns are screwed. Fig. 3.—End of Columns to screw into Ball. Fig. 4.—End of Columns to join to Table underneath Top.

ball will be one piece, with three holes forming a triangle in the top, and another three holes forming a reverse triangle underneath it. The top of the columns will be as in Fig. 4, entering holes, and being glued, underneath table top. The tops are generally covered in some fabric, and fringe secured round the edge by means of plush- or brass-headed studs. "Aspinalling" or "Foo-chowing" all over, however, will answer. Height of table should be about 27 in. or 28 in.—J. S.

Small Foundry Plant.—R. W. (*Liverpool*).—To cast from 15 cwt. to 1 ton per day, you will want a cupola 18 in. diameter inside the bricks, and about 9 ft. high. The casing will be of sheet iron riveted together, and a course of bricks a single brick deep, properly arranged as "headers," or radially, will do. The charging may be done through the open top, a couple of feet or so above a platform, thus avoiding the usual charging door employed in larger cupolas. A single tuyere from 3 in. to 3½ in. in diameter will suffice—say, 16 in. in height above the bed. The tapping hole will be 6 in. high from the bed, and the slagging hole 12 in. high. To melt a ton of metal, a bed charge of 2 cwt. of hard coke will be required, then alternate layers of 5 cwt. of iron and ½ cwt. of coke. The blast may be supplied with a fan of about 18 in. diameter, or a No. 1 A Root's blower, driven by a one-horse-power engine. You will want at least 10 tons or 12 tons of sand, Doncaster, Kippax, Snaith, Worcester, Falkirk, according to the class of work you mean to do. This may average, say, 4s. to 6s. per ton, besides carriage, which is heavy. You will also want a few tons of pig and scrap at current prices; of hard coke a few tons. Moulding flasks you can make of wood for a beginning, but had better use iron. These you can mould in open sand yourself, and they will then cost the value of the metal plus the cost of melting—say, 4s. per ton plus the value of your labour. Half a dozen sieves and riddles for sand, a water-can, a bucket, a shovel, a wheelbarrow, a sledge hammer, and small tools. You should have a small forge, because there is so much wrought iron work required about the fitting of flasks, drawback plates, clamps, and so on. There will be scales for weighing iron for purposes of mixing, ladles for casting, a small crane for hoisting the larger flasks and the heavier castings. A small stock of wrought iron for rods, clamps, etc. A loam mill if you want to do loam work, a core stone, plumbago, oil, etc. etc. The size of foundry and number of men will depend upon the class of work you want to do. Thus you may make a single plain casting that will require the full capacity of your cupola, or you may make hundreds of castings of a few ounces or pounds each. In the first case one man may suffice; in the other you may want half a dozen men and boys. Perhaps a foundry from 20 ft. to 30 ft. square would suit your requirements, and one moulder who can make his own cores, with a handy labourer and a boy to assist him. The labourer can attend to the cupola, cleaning it out in the morning, re-lining it and the ladles with sand, building the fire, breaking up the iron, and weighing it and the coke. If you make a large quantity of light castings, you will want a lad to give his whole time to fettling them, for which chisels, files, and an emery wheel are required. The building itself may be of brick or stone, and the walls should be thick and stout enough to stand the stress of a wall crane or light overhead traveller. Make it lofty, and well ventilate it to carry off the heat and fumes from the moulds and stove. The cupola may be placed inside the foundry, but is better outside, with the tapping hole and gutter coming through the wall inside the building. The prices of materials vary so much in different localities, so much depends on business economy, that I cannot go into the details of cost for all this. Roughly, you cannot put it up brand-new for less than £300. Makeshifts can be purchased, as is often done, and second-hand plant bought, and the cost reduced thus by one-third, or even one-half. All that you want reckon out in detail for yourself, according to circumstances.—J.

Superfluous Hairs.—JOHN JACK.—I am sorry for your sister, but you write on a matter that cannot be dealt with in WORK.—ED.

Alkaline Coppering Solution.—W. P. (*Liverpool*).—Dissolve from 2 ounces to 3 ounces of good copper sulphate for each gallon of solution—that will be from 20 lbs. to 30 lbs. for your 180 gallon vat—in hot rain-water. Let this cool, then add liquor ammonia with brisk stirring, until all the copper has been thrown down as a green precipitate, and all this has been dissolved by the ammonia to form a clear deep blue liquid. To this add a strong solution of best potassium cyanide until all the blue colour disappears, and the solution has the tint of old ale. Allow this to rest for twelve hours, exposed to the air, then filter through calico into the coppering vat, and add rain-water to make up the required bulk. You may make it up with more copper to the gallon if you want a quick deposit; anything from 2 ounces to 8 ounces will work fairly well. It will take about 1 quart of ammonia to each pound of copper sulphate, but it will be safer to trust to the results given above, and add ammonia and cyanide until these results are obtained, than to trust to weights and measures.—G. E. B.

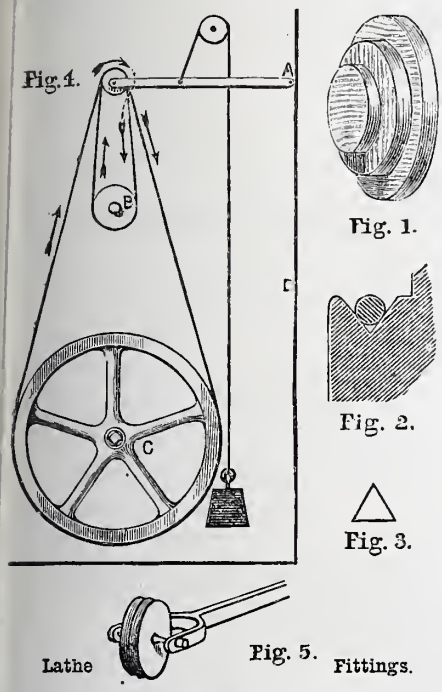
Enlarging Exposures.—E. E. (*Penge*).—You are giving too short exposures, and I do not wonder at your only getting a faint outline. In the absence of any information as to the lens or stop, I can hardly advise you. On referring to my notes of exposure, I find that using Eastman's bromide paper and enlarging to 12 in. by 10 in. from a quarter-plate negative, using F 10 stop on a dull day in November, between 2 P.M. and 3 P.M., the time required to obtain a good picture was forty-five minutes, and using the same paper in a similar manner on a clear light day in March, the exposure required was fifteen minutes, both days using the light from a window facing north. I give you these as approximate exposures, but should advise you, when using the camera, to cut a strip of the paper you are using, say 1 in. wide; put it in your dark slide, keeping it about the centre, and expose on a negative in the camera for five minutes, then push in the shutter of the slide one-fourth of the way; wait another five minutes, push in half-way, wait again five minutes, then push in three-fourths, and give five minutes longer. You will thus have on the one strip of paper four different exposures; develop the strip, and see which exposure is nearest correct, then time your pictures accordingly: this is as good a way to set about the work as any, and you will learn more from exposing and developing a strip of bromide paper in this manner than I could possibly tell you in a page of WORK. Adhere strictly to the formulæ of the maker of the paper you use, and you will not fail to get good results, as the camera you have made so successfully is all that is necessary to produce good work. Should you want your pictures sharp and full of detail, use your smallest stop when exposing, of course increasing the time in proportion. Should you still find any difficulty in getting good pictures, write to me through the Editor, and as you reside within a reasonable distance, I will try and give you an evening of practical instruction.—G. LE B.

Annealing Steel Wire.—T. B. T. (*Thurlstone*).—I do not know if this process is now commercially successful, but it has been made the subject of several patents, the particulars of which you can obtain by searching in the Patent Office lists. It is necessary to exclude the atmosphere.—J.

Hydraulic Lifting Jack.—B. C. (*Doncaster*).—I gather that you want to know how to put your jack in order. You had better get a practical man

ook at it, and show you how the packings are in, after that you will be able to tackle it your-; very likely it is only new packings wanted.—J.

athe Fittings.—F. C. (*Belfast*).—If you are ing up a 3 in. lathe, you should study my papers the first fourteen numbers of WORK on "Lathes d Turning Appliances," and particularly the one "How to Test a Lathe," as it will show you how get the headstocks in line. Now, if you want to n wood on your lathe, you should have the lleys sized for quick speed—9 to 1 would be good rate for the fastest speed. That is to say, hen turning small work in wood the mandrel ould make nine turns for every tread. Now for w speed you should have the pulley on the man-el as large as possible, because that gives more wer and prevents the cord slipping. You may t in one of 4 in. diameter. The small groove may 2 in. (if you like you can have one between them 3 in.). Multiplying 2 by 9 you get the size of the oove in the fly wheel to be 18 in.—gives 9 to 1; if is drives the 3 in. groove on mandrel you get 6 to -that would suit hard wood of 3 in. or 4 in. dia-eter and small brass work. By driving on the in. groove you get 4½ to 1, and that would suit nall pins and screws of iron or steel, which you



should be able to make on your little lathe. Your pulley on mandrel you can make of three boards of wood glued together, as in Fig. 1, the grain of the middle one to cross the grain of the two outer ones. Bore this through and drive it firmly on to the mandrel, and then turn and polish. The grooves are best cut to a sharp angle (see Fig. 2) about 50°, a little sharper than a three-square file, as in Fig. 3, 60°. The weight of your fly wheel should be from 45 lbs. to 50 lbs. There is an easy way to avoid having a second groove on fly wheel, and yet it requires only one belt. Over the mandrel about 12 in. you fix a tension pulley (see Fig. 5), which should be not less than 3 in. diameter, and be fixed on steel spindle to run between hard steel points, so that friction is almost imperceptible; there are two grooves in the pulley, as the band passes over twice, and these grooves must be exactly the same size. A weight holds up the arm of tension pulley, and cord or band may be of *cotton lay cord, long spliced*, no hook and eye to jerk. Fig. 4 is a tension pulley arrangement only suitable for small lathes. Your mandrel should be bored right through. I hope you will understand.—F. A. M.

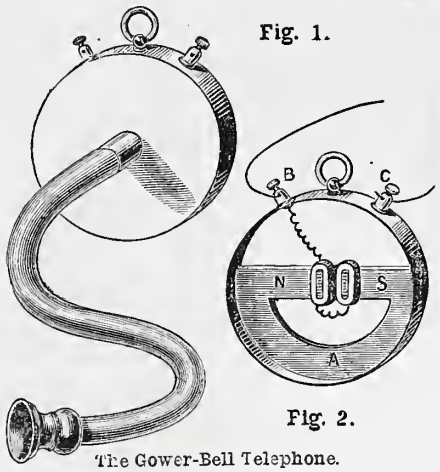
Hardening Screw Taps.—Y. A. (*Darwen*).—I am not aware that taps are so hardened. They may be. Probably you are thinking of the practice of quenching in oil, but they are let down previous to that. Taps are often heated in a bath of lead previous to tempering.—J.

Engine to drive Thrashing Machine.—WELL WISHER.—Portable engines are commonly used for corn thrashing, but horizontal and vertical engines are also employed. It is impossible to comply with your request at present. If, however, you have any specific questions to put relative to general designs, dimensions, or details, I will reply so far as I can in "Shop."—J.

Sign Writing.—E. C. (*Notting Hill*).—The articles on "Sign Writing and Lettering" appeared in the following pages of WORK, Vol. I.:—10, 19, 55, 163, 197, 259, 292, 356, 467, 530, 614, 668, 677, 691, 713, 743, 775, 805, 812.—ED.

Incubator.—F. C. (*Birmingham*).—An article on the above is in the printer's hands, and will appear as soon as space can be found for it. This, I hope, will meet your requirements.—ED.

Telephone.—MACK.—There are many forms of telephones with horse-shoe magnets. The Gower-Bell is one of them, and I attach a drawing of it. Fig. 1 shows the external appearance of it, and Fig. 2 the internal. A is a horse-shoe magnet, generally



The Gower-Bell Telephone.

built up of thin plates of steel strongly magnetised on the poles. N, S are a pair of small bobbins filled with No. 36 silk-covered copper wire. These bobbins are connected to each other and to the terminals B and C on the outside of the case. Over the bobbins is fixed a sheet-iron disc, which of course answers the same purpose as in the other forms of telephones.—W. D.

Child's Rocking Chair.—R. R. (*Walsall*).—I cannot call to mind the "old-fashioned child's rocking chair made in three pieces" to which you allude. From the sketch I here give, you could make a strong, handy, inexpensive, and—with cushions—comfortable chair. Decide upon dimensions yourself. Make all parts quite 1 in. or 1¼ in. thick—the chair will, doubtless, receive some knocking about and cutting. Join the seat A to the sides B as in Fig. 2. The back would fit

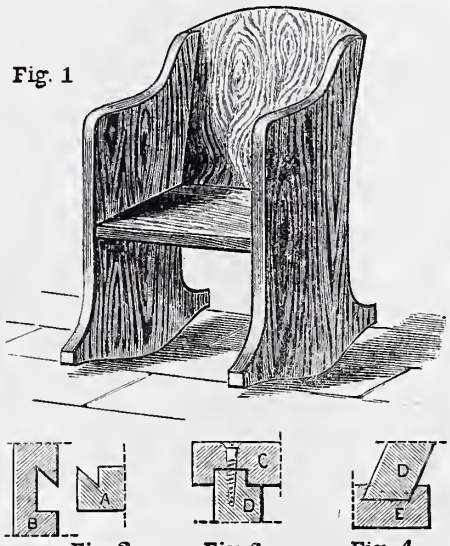


Fig. 1.—Child's Rocking Chair. Fig. 2.—Joint of Seat A and Sides B: elevation. Fig. 3.—Plan of Joint of Back D to Sides C. Fig. 4.—Elevation of Joint of Back D to Seat E.

between the sides, and be screwed there. For additional strength, the back D might connect with the sides C, as in Fig. 3, and with the seat E, as in Fig. 4. A good strong wood should be used. If you have the rockers shaped at back and front, there will be no liability of any child overbalancing either way. Have a rail across the front, if necessary.—J. S.

Jensen Electric Bell.—ELECTRICAL INQUIRER.—In my article showing how to convert an ordinary handbell into an electric bell of the Jensen pattern (see page 227, Vol. II.), you will find full instructions and rules to guide you in getting the right proportions of the various parts. Two No. 2 or middle-sized Leclanché cells should be used to ring a 3 in. or 3½ in. electric bell through a short line wire. Try Messrs. Cox & Co., 11, Fetter Lane London, E.C.—G. E. B.

Violin and American Organ Papers.—LUX.—These are expected to appear in Vol. III. of WORK. In the meantime any specific question will be replied to in "Shop."

Dog Kennel.—E P. (*Strood*).—The accompanying sketches show a simple method of making a strong kennel, suitable for a retriever or collie dog. The framework is made of 2 in. by 2 in. yellow deal, and covered with 1 in. matchboards; the joints of roof being covered with weathered fillets, the floorboards (also of 1 in. matchboards) being nailed right on top of the bottom rails of framework. The first floorboard should be knotched out to form sill. A very good and simple way of protecting the animal from draughts is to

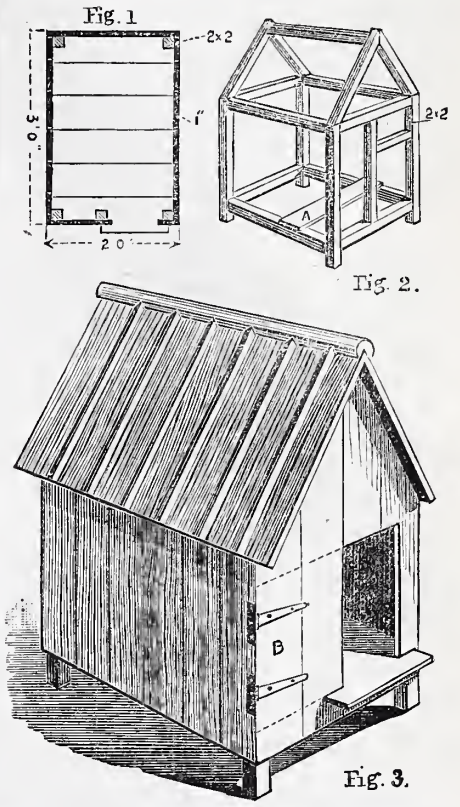


Fig. 1.—Plan. Fig. 2.—View, showing Method of constructing Framework—A, Floorboard in Position. Fig. 3.—Completed Kennel.

hang a door that will cover the hole on the most unprotected side, and keep it open at the most convenient angle by means of a light iron stay or cabin hook. A still better way would be to also hang the whole of the part of front marked B; this you would find would enable you to clean it out very readily, and the supplementary door or flap would still be available for night-time.—E. D.

Polishing Overmantel.—A. C. (*Cowell, Rochford*).—You say you do not wish to French polish, but wish for the dull appearance of some you have seen in furniture dealers' windows. This leaves wax polish as the only alternative, particulars of which have already appeared in WORK. Failing your ability to do this to your satisfaction, you must go back to French polish, for most furniture dealers have theirs French polished, the dull appearance being given by well rubbing all over with fine emery and linseed oil or water applied with felt or woollen cloth, a hard brush, such as a shoe-brush, being used for the carvings and other awkward places; the work being first well "bodied up" and prepared as for spiriting; in lieu of which, dull down as directed.—W. J. M.

Ironing Morocco.—SCRIBER.—You are correct in your supposition that at the joint the edges of the skins must be bevelled off. Practice is necessary. Experiment with bits of waste stuff. Use good strong paste, such as bookbinders use. The tooling, either gilt or plain, you had better get done for you by a bookbinder; it is not ordinarily done by an upholsterer. If you can get hold of someone who lines table tops and puts the gilt on them, he will be just the man you want. There is probably someone in your city who does this kind of work for the cabinet makers or house furnishers.—D. D.

Phonograph.—S. D. (*Lifford*).—You ask "how to make the diaphragm and mouthpiece for phonograph," and also for the sizes of all the parts, and where to buy the materials. Complete instructions are about to be given for making one, as well as sizes of the different parts. The parts are not on sale.—W. D.

Specimens of Ores.—J. C. (*Aberdeen*).—For samples and prices of ores see the advertisements in "Science Gossip," published by Chatto and Windus, Piccadilly, London, and write for price lists. Probably an advertisement in the "Sale and Exchange" column of WORK would bring a cheap collection before your notice.—F. B. C.

Folding Screen.—H. B. (*Kentish Town*).—I was about to mildly "warm you up," as the workshop phrase has it; but I have refrained from so doing by considering the fact of your being a new subscriber. The reason I was on the verge of censuring you is because you have acted similarly to bundreds of readers—you fail to explain full particulars in connection with your requirements. Your desire is for a screen upon which you wish to display a quantity of scraps at present in your possession. You ask what material, joints, and dimensions are necessary. Every item is really a matter of preference. You neither state about what number of scraps you have; whether you want a table, door, or fireplace screen; all of which are sometimes made to fold. Figs. 2, 3, 4, and 5 show different forms of joints; perhaps that in Fig. 5 (mortice and tenon) will be the best and strongest for the purpose. Of course, the bottom connections must be slightly different from some of those shown. If you carry the frames down an inch or so, you can put a foot at each end of the whole article. The use of these will be noticed when the article is straightened out in one length. It is curious, but it is a fact, that but few screens are so treated, and would tumble when in such a position.

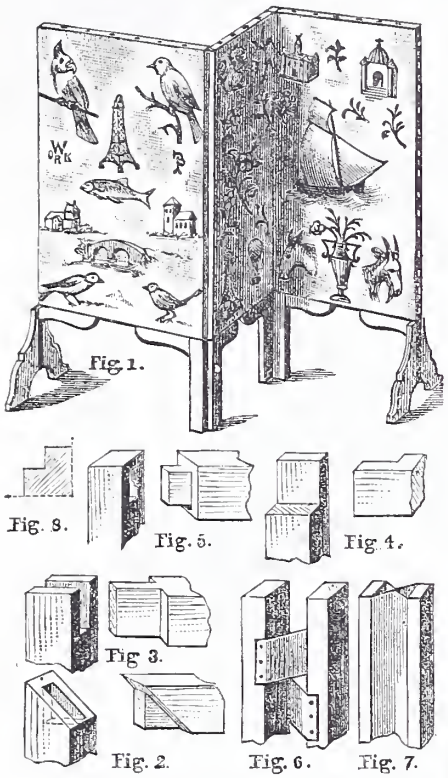


Fig. 1.—Folding Screen. Figs. 2, 3, 4, and 5.—Various Forms of Joints. Fig. 6.—The Folding Connection. Fig. 7.—Material between the Frames pleted for folding. Fig. 8.—Section.

If you want feet at the extremity of each frame, you must study the article a little, for it will be an awkward matter to fold the screen if all the feet are placed symmetrically. Personally, I should use American cloth as a good material whereon to display the scraps; but your wife, sweetheart, or sister, if you have either or two of the three, will decide upon a suitable material in this direction; put the corners as in Fig. 6, and tack the edges on the top, etc., of the screen with brass-headed studs. You will have to cut a larger piece out of the bottom corners. You will thus have two thicknesses of material on those parts—*i.e.*, the edges of that on each side of it. For folding connections you could adopt the simple method used in a "clothes horse," shown in Fig. 6; and you could also have the covering material over those parts folded as in Fig. 7, to allow all to close properly. Where necessary, glue it to the wood. There is no fixed rule respecting sizes; therefore I must ask you to please work these out for yourself. There have been a few designs of screens, and notes upon the same things, in back numbers. Obtain an Index of Vol. I. and all past numbers of Vol. II. from your nearest bookseller; you will be rewarded in a hundred directions by so doing.—J. S.

Frosting Lathe Bed.—No Name (*Kidderminster*).—Frosting is done with the scrape, carried over the surface in arcs of circles instead of straight forward. There is a little knack in this work, readily acquired by practice.—J.

Monogram.—W. J. B. (*Maidenhead*).—If you want a monogram you cannot do better than design one after your own heart and fancy. Get Vere Foster's, or any other publisher's, book of ornamental letterings. Select the style of letter you like, then amuse yourself by entwining the three letters forming your own particular monogram.—C.

III.—Questions Submitted to Correspondents.

Toy Balloons.—E. B. (*Liverpool*) writes:—"Will any reader oblige me with instructions how to make toy balloons—not paper ones—and also how to fill them with a very light gas? Also about what they would cost?"

Lenses.—Reader from Start writes:—"Is it within the scope of an amateur who has most of the necessary apparatus to make his own lenses? If so, can serviceable ones be made from ordinary plate glass? Can they be partly roughed down by a lathe tool, or is it necessary to take the whole off by grinding? Are large lenses usually cast, and what descriptions of glass are used for this purpose? What relation has the diameter and thickness of a lens to its focal length, and what are the usual dimensions of lenses for photographic and lantern work? What means are used to remedy spherical aberration, and is there no known means of making the surface truly parabolic? Any information would be acceptable."

Rotary Brush.—Reader from Start writes:—"As I have not been able to purchase a rotary brush, I propose to make one by the aid of hints in 'Shop' as to the different kind of bristles, how they are put in, and where they can be obtained. Any 'tips' will be appreciated. I have a lathe in which I can turn the cylinder."

Ice Cream Freezer.—J. R. (*Belfast*) will feel much obliged to any reader who will give him instructions how to make an ice cream freezing machine.

Lathe.—W. S. (*Stockport*) writes:—"I should be greatly obliged if any reader could give me a description and sketch of an 'easily made wood-turning lathe.' The lathe is to be made mostly of wood."

Bruises in Plate.—Apprentice writes:—"Will anyone who knows kindly tell me how bruises in plate, such as cream-jugs, hot-water jugs, with narrow necks, are removed from goods so as not to disfigure the articles outside? I should be glad of a few wrinkles, and a sketch to the best adopted stakes for the purpose."

IV.—Questions Answered by Correspondents.

Artificial Eyes.—H. V. T. writes in reply to F. T. (*London, N.*) (see page 522, Vol. II.):—"I believe there is no re-enamelling of artificial eyes, and that when the surface is roughened by the moisture or secretions, the only remedy is to have a new 'prise,' as it is called; but F. T. could doubtless get information of Messrs. Young, 50, Upper Tollington Park, Finsbury Park, N., who are specialists in this line."

Collieries.—M. writes in reply to W. G. (*Dudley*) (see page 538, Vol. II.):—"The following are some of the principal collieries in South Wales: Aberdare Merthyr Steam Coal Company, Aberdare Rhonda Steam Coal Company, Aber Rhonda Coal Company, Brynda Coal and Coke Company, Briton Ferry Coal and Pottery Company, Cardiff and Swansea Smokeless Coal Company, Oakwood Slat and Levels Colliery, Dinas Main Coal and Coke Company, Garmuntz Collieries Company, Hook Colliery Company, Raven Coal Company, and numerous others. For a full list see the 'Colliery Guide and Directory.' The *South Wales Daily News* and the *Western Mail*, Cardiff papers, have a good circulation."

Wood Carving.—R. H. W. (*Lewisham*) writes in reply to A Beginner (see page 538, Vol. II.):—"I can thoroughly recommend as useful two books lately published: 'Exercises on Wood-working.' Ivin Sickels. D. Appleton. New York. 1890. 5s.; and 'A Manual of Wood-carving.' C. Leyland. Revised by Holtzapffel (Whittaker & Co.). 5s."

Tin-plate Work.—Tinker writes:—"In answer to A. T. S. (*New Swindon*) (Vol. II., No. 85) *re* Warn's book on tin-plate work. The address in mine is R. H. Warn, 94, St. Augustine's Road, Camden Square, N.W., price 10s. 6d. But in case A. T. S. cannot obtain one from there (as the date in mine is 1884), I would refer him to the *English Mechanic*, where an occasional advertisement of the book occurs."

Weighing Machine.—Worker Bee writes to M. N. W. (*Wells*) (see page 538, Vol. II.):—"I would dissuade M. N. W. from spending his money and time on his weighing machine until he has satisfied himself that when complete it will meet the requirements of the last Weights and Measures Act. Up to December 31st of this year inspectors may stamp out old pattern machines that they are satisfied are serviceable, but after that date they are forbidden *to stamp any weight, measure, or weighing machine not previously in use that are not of a certain pattern* specified by the Act. M. N. W. will be wise to 'go slow.'"

V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—Faust up to Date; G. H. (*Walworth*); Kilometrique; Shobby; G. W. (*Brockley*); Workist; South Wales; C. T. (*Ashton-under-Lyne*); P. W. (*Leeds*); J. D. (*Devon*); G. W. P. (*Putney*); Lara; W. P. (*Cardiff*); Tee Jay; G. H. T. (*Ilfracombe*); A. C. (*Kent*); G. W. (*Plumstead*); E. E. U. (*Bushey*); Motive; T. S. (*Walsall*); H. B. T. (*Brixton*); Wrest Plank; A Subscriber from the First; P. J. A. (*Seacombe*); Idem Sonantia; A. H. E. (*London, W.*); F. C. J. (*Camberwell, S.E.*); C. J. S. (*Trimsaran, South Wales*); J. B. (*London, W.C.*); S. S. (*Salford*); Violin; H. J. C. (*London, S.E.*); Tinman; R. J. W. (*London, S.W.*); The Last Shall be First; L. S. L. (*Kirkcaldy, N.B.*); A Constant Reader; J. T.; J. H. S. (*Burnley*); A. B. C. (*Malta*); L. T. (*Marlborough*); F. L. B.; G. S. (*Burnley*); Windermere; G. B. (*Poplar, E.*); Danson (*Grasmere*); Cabinet Maker; J. M. (*Midhurst*); G. R. E. (*Manchester*); Tin-plate Worker; T. H. B. (*Wesham*); Snob.

"WORK" EXHIBITION.

NOTICE.

In connection with the "Work" Exhibition to be held at the Polytechnic Institute, Regent Street, London, W., from December 29, 1890, to January 10, 1891, inclusive, a Special Exhibition Number of Work (separate from the weekly or monthly issue) will be issued on December 31, 1890, price 3d. This Number will consist of 32 pages in a wrapper, and will contain an Illustrated Descriptive Account of the most remarkable Exhibits.

From One to Two Thousand Examples of Art, Industry, and Invention, furnished by readers of Work, will appear in this Exhibition, which for the impetus it is calculated to give to Practical Education may be regarded as one of the most important ever projected in this country.

The variety of the Exhibits is as remarkable as their character is interesting, and the very ample manner in which they are described in this Special Number will render it of value, not only to all workmen, professional and amateur, but to everyone who has at heart the progress of Technical Education in this country.

*** Subscribers desirous of obtaining this Special Number should order at once the "Work" Exhibition Number, price 3d., from their Booksellers or Newsagents.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

Terms for the Insertion of Advertisements in each Weekly Issue.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. All Other Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Waterproof Advertising Paper Letters and Figures in all colours and sizes. Best and cheapest. Liberal terms to agents. Sample sheets, gratis. Factory, 17, Arthur Street, W.C., London. [19 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is Lunt's, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [15 R

Complete Outfit for Making Real Photographs; printed instructions; ready for instant use. Carriage paid, 1s. 9d. Particulars of £500 prize competitions free to all purchasers. No fees.—"Work" Dept., Photo Novelty Co., Alvaston, Derby. [13 R

Machinery and Tools.—Largest stock in London. Britannia Co., 100, Houndsditch. Cash or hire purchase.

Gas and Steam Engines.—Engineers', Amateurs' Builders' Tools, Stocks, Dies, Forges, etc.; catalogue of new, 6d., or list second hand, 2d.—Britannia Co., Colchester.

Best Book on Lathe.—Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—Britannia Co., Colchester. [17 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—Willcox Brothers, 172, Blackfriars Road, London, S.E. [1 S

Splendid Violin for disposal; perfect condition; beautiful mellow powerful tone; first-class instrument; baize-lined case, mounted bow. Accept 17s. 6d. for the lot. Rare bargain. Worth much more.—Tew, 6, Tower Street, Ipswich. [2 S

Six Cabinet Copies, from Carte or Gallman Photo, for 3s. 6d. Originals returned uninjured.—Ethelbert Henry, Alvaston, Derby. [18 R

Sign-writing Made Easy.—Every man his own writer. Illustrated instructions for easy, cheap, simple, and rapid process by which elaborate lettering can easily be done equal to professional work. Also Diagrams for marking out eight different sized alphabets. The lot 1s., post free.—F. Coulthard, Terrace Road, Bournemouth.

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. Coulthard, Terrace Road, Bournemouth. [3 S

Bookbinding.—Complete plant; suit amateur; £5; cost £15.—Rainbird, 47, Morning Lane, Hackney, London. [4 S

Saw Benches for hand or foot power: new patent. Illustrated Catalogues free.—Lewis and Lewis, Cambridge Heath Station, London, N.E. [5 S

THE NEW SHORTHAND

Had anyone predicted that a system of Shorthand would be invented that was so extremely simple that it could be learnt in one-fiftieth part of the time occupied by any other system in existence, ninety-nine people out of a hundred would have declared it to be impossible. Nevertheless, such a system *has* been invented, and it is known as **"THE NEW SHORTHAND."** A thorough knowledge of the *easiest* of the old systems will occupy at least a year, whereas THE NEW SHORTHAND can be

EASILY LEARNT IN A WEEK

by anyone of ordinary ability, with two hours' practice per day. The cause of this extreme simplicity is that it is based on an entirely different principle from all other systems, which principle is so remarkably plain and clear that the only wonder is that it has never been thought of before.

To everyone engaged in professional or mercantile pursuits a knowledge of Shorthand is nowadays of the highest importance, and has been truly said to be

WELL WORTH £100,

and now that it can be so readily acquired, there ought not to be a single person, either man, woman, or youth, in the whole country who is ignorant of such a valuable accomplishment.

THE NEWSPAPER PRESS

are unanimous in their praise of this new system. *Public Opinion, The Athenæum, The Linguist, News of the World, Hornet, Figaro, Fun, Judy, Pictorial World, Educational Reporter*, and a host of other high-class journals, far too numerous to mention, recommend it in the most glowing terms, some of them even going so far as to prophesy that in a very short time it will entirely

ECLIPSE ALL OTHER SYSTEMS,

and be the only one in general use. Even papers devoted to other systems (which might well have been expected to be prejudiced) cannot help recognising the merits of the New Shorthand. *The Phonographer, The Phonographic Reporter, Phonographic Quarterly Review*, and *Phonographic Notes and Queries* all give long articles respecting the New system, and speak of it in the highest possible terms; while even the *Phonetic Journal* itself prints a long discussion on its merits. A large number of unsolicited

TESTIMONIALS

have also already been received, all of which, without a single exception, bear witness to the excellence of the system. A great advantage possessed by the New Shorthand is that

NO TEACHER IS REQUIRED,

it being so easy that no assistance whatever is necessary in learning it.

Writers of Pitman's, Odell's, Gurney's, or any other of the older systems should not fail to also learn the New Shorthand. It is specially valuable to Reporters and writers for the Press, as *no transcriptions are necessary*, it being so simple that almost all compositors will, in a little time, be able to read it.

ALL LADIES

also should learn it, as, besides placing them in a position (if necessary) to earn good incomes, it is rapidly becoming fashionable for correspondence to be written in this system.

Price, complete in two Books, post free 2s. 1d.

SPECIAL NOTICE.

The sole copyright of this valuable system has been secured by R. W. RITCHIE & CO., and the books can *only* be obtained direct from them.

R. W. RITCHIE & CO.,
MAPLE ROAD, ANERLEY, LONDON, S.E.

N.B.—When ordering, please state "as advertised in WORK."

RD. MELHUISH & SONS,
FETTER LANE, LONDON, E.C.
Gold Medal for Excellence of

For all Workers in Metals, also Joiners, Wood Carvers, etc.
WE HOLD THE MOST COMPLETE STOCK IN THIS COUNTRY,
And all Orders have Immediate Dispatch.
Orders for Hardware and Tools over 10s. in Value, Carriage Free.

ESTABLISHED 1851.

BIRKBECK BANK,
Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

NOW READY, price **1s.**; post free, **1s. 3d.**

YULE TIDE,

For CHRISTMAS, 1890.

CONTAINING

A Magnificent Picture in Colours, "Prince Charlie's Farewell to Flora Macdonald," after an Original Painting by GEORGE W. JOY. **A Complete Novel,** entitled, **"I Saw Three Ships,"** by Q. *Illustrated.* **Four Full-page Pictures printed in Tints, &c., &c., &c.**

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Monthly 6d. Part 1 ready Dec. 18.

A New Fine-Art Edition of

ROBINSON CRUSOE,

With **Original Illustrations,** expressly executed for the Work by Mr. WALTER PAGET, set in **Handsome Type,** and beautifully printed on good paper, with ample margins.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London*

THE WONDERFUL

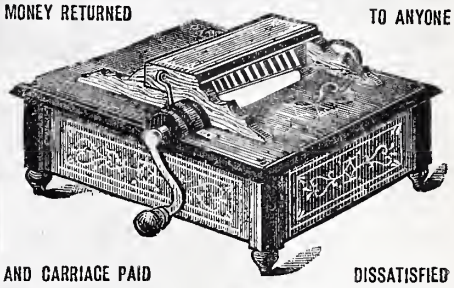
VICTORIA ORGANETTE.

The most Marvellous Musical Instrument in the World.

A £2 Organette for only £1.

N.B.—This Offer is only to Dec. 20, '90.

MONEY RETURNED TO ANYONE



AND CARRIAGE PAID DISSATISFIED

WE are the Sole Makers of this WONDERFUL and FIRST-CLASS ORGANETTE. It is a REED Instrument, and is constructed on the same principles as an organ, with bellows and full-sized reeds. The music consists of good strong perforated sheets, which are put into the Organette, furnishing either FINISHED SOLO PERFORMANCE, a RICH ACCOMPANIMENT to the VOICE, or VALUABLE ORCHESTRAL EFFECTS. They are marvels of Musical Invention, and combining all the principles upon which Automatic Organs, Organettes, &c., are now being made, requiring no skill in the performer. Any child who can use its hands intelligently can play. RANGE OF MUSIC ABSOLUTELY UNLIMITED.

We wish to introduce one of these Organettes into every town and village in Great Britain, and in order to do so quickly, have decided to sell a LIMITED NUMBER to the readers of this paper at only £1 each, but your order must be received before December 20th, 1890. We only make this unprecedented offer to introduce this FIRST-CLASS ORGANETTE throughout the Kingdom, well knowing after one is received in a neighbourhood, we are sure to sell a great number at our Regular Price. We are the SOLE MAKERS of the VICTORIA ORGANETTE, and you must order direct from us. Remember the VICTORIA ORGANETTES are LARGE and POWERFUL INSTRUMENTS, built in the most durable style (in our own works by English workmen), highly polished and decorated in gold, the reeds being so powerful that they produce sufficient volume of music for the chapel, parlour, lodge, ball-room, or picnic party. Nothing to get out of order, in fact, they produce a richer and sweeter sound after a few years' use. UNSURPASSED FOR HOME ENTERTAINMENTS.

The illustration will give you but a faint idea of STYLE and FINISH of this beautiful instrument. We will RETURN the MONEY and PAY CARRIAGE to anyone who is not perfectly satisfied after receiving it. IT SINGS ITS OWN PRAISES. With each Organette we send a Selection of Music FREE, and pack all in a strong box. Send money by P.O., P.O.O., Registered Letter, or cheque, payable to J. DRAPER, Blackburn. THOUSANDS OF TESTIMONIALS RECEIVED. For 2s. extra we will send it Carriage Paid to any part of the United Kingdom.

COUPON, No. 1041.
Entitles the holder to one Victoria Organette and Selection of Music for £1, before Dec. 20th, 1890.
(Signed) J. DRAPER.
N.B. — Full price £2, charged after Dec. 20, 1890. Time extended for Foreign Orders.

J. DRAPER, ORGANETTE WORKS, BLACKBURN.

On January 5th, 1891, will be published in Paper covers, price ***3d.***, or in Cloth, ***6d.***, the first Volume of a ***New Weekly Issue*** of Selected Volumes from

CASSELL'S NATIONAL LIBRARY.

Edited by Prof. HENRY MORLEY.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Christmas & New Year's Gifts.

CASSELL'S COMPLETE CATALOGUE, containing particulars of upwards of ONE THOUSAND VOLUMES published by Messrs. CASSELL & COMPANY, ranging in price from THREEPENCE TO FIFTY GUINEAS, will be sent on request *post free to any address.*
CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,
TOOL MAKERS,
DUBLIN.

WATKINSON & LONSDALE.

MANUFACTURERS OF
Photographic Apparatus,
NEW BRIGGATE, LEEDS.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious an Nervous Disorders, such as Wind and Pain in the Stomach, Sic Headache, Giddiness, Fulness and Swelling after Meals, Dizziness an Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shor ness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbe Sleep, and all Nervous and Trembling Sensations, &c. &c. The firs dose will give relief in twenty minutes. This is no fiction, for the have done it in countless cases. Every sufferer is earnestly invited t try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicin in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicin Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY**, imparting **NEW LIFE** and **VIGOUR**. Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores; or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEAI** the **COMPLEXION**, and is higl. recommended by the **MEDICA** Profession. Corrects all **ERROI OF DIET**, eating or drinkin Is a most pleasant effervesci morning drink, **STIMULATIN** the **APPETITE**, and giving to to the entire system.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.

The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

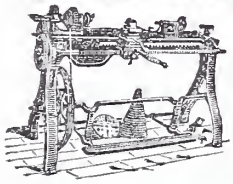
Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

C. BRANDAUER & Co.'S

CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6d. OR FOR 7 STAMPS

BIRMINGHAM.

[33

London Warehouse: **124, NEWGATE ST.**

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). *An Archimedian Drill*, with brass handle and Three Bits, will be *SENT GRATIS* with each set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. *A Specimen Sixpenny Fretwork Design* SENT GRATIS *with each Catalogue; also a list of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.* N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department. ***EAST DEREHAM, NORFOLK.***

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

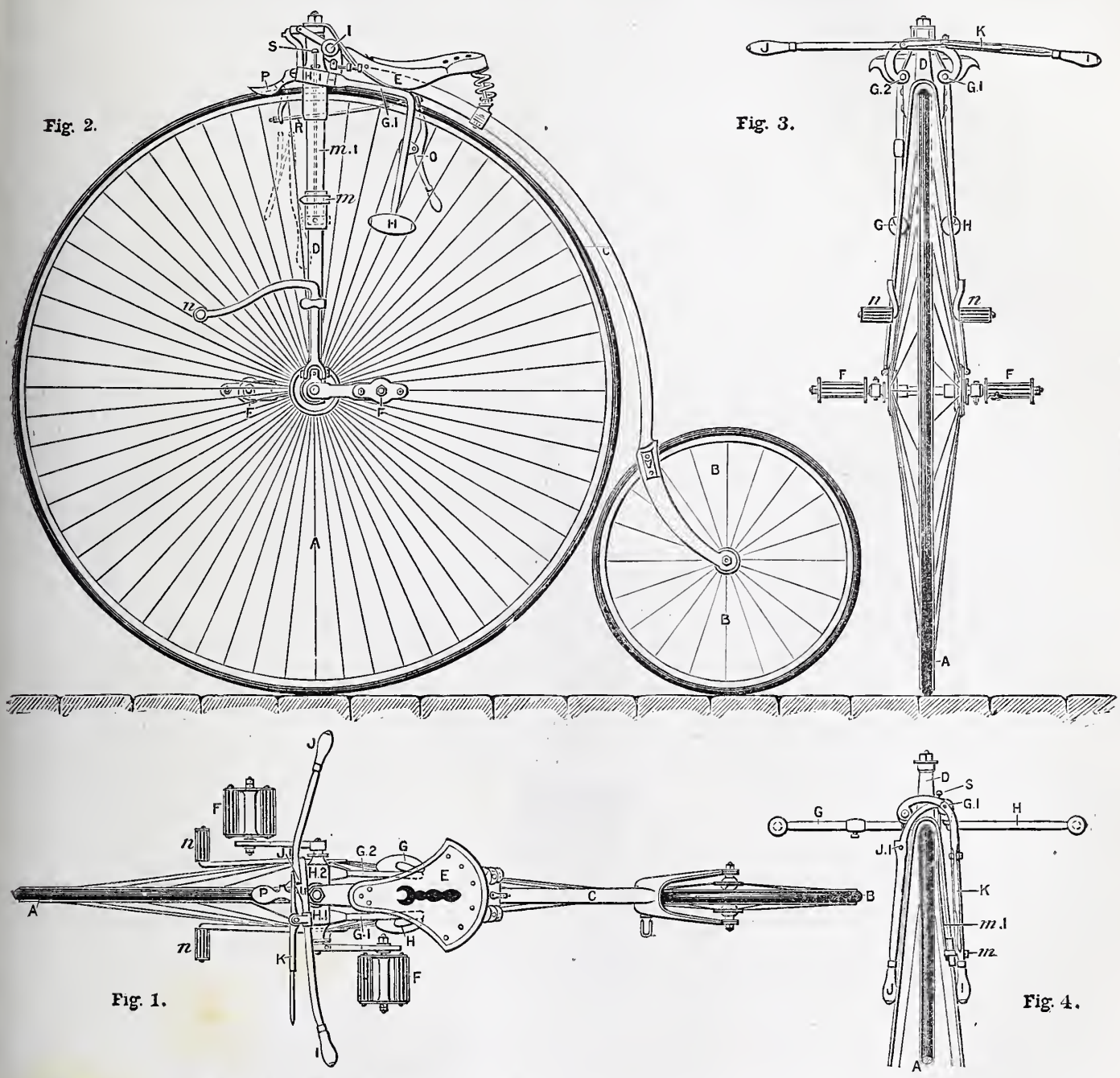
WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 91.] SATURDAY, DECEMBER 13, 1890. [PRICE ONE PENNY.



BROXUP'S PATENT INTERCHANGEABLE FORE AND REAR HANDLE-BARS FOR BICYCLES.

Fig. 1.—Bird's-eye View or Plan, showing Fore and Rear Handle-bars in same Positions as in Figs. 2 and 3. Fig. 2.—Left-hand Side Elevation, showing Fore Handle-bars locked in Position for mounting and steering, with Rear Handles depressed or hanging down so as to be of no hindrance to the Rider when mounting his Machine. Fig. 3.—Fore End Elevation, showing Fore and Rear Handle-bars in same Positions as in Figs. 1 and 2, when the Machine is required to be reared against a Wall. By depressing Fore Handle-bar (J) in the same way as Rear Handle-bar (G) is shown, it is manifest that Machine will occupy less space. Fig. 4.—Shows Fore Handle-bars locked fast and hanging downwards, and the Rear Handle-bars up in a Horizontal Position in readiness for steering with, and leaving all clear and open in front of the Rider.

BROXUP'S PATENT INTERCHANGEABLE FORE AND REAR HANDLE-BARS.

BY T. W.

BEFORE proceeding to describe the construction, object, and application of Broxup's Patent Interchangeable Fore and Rear Handle-bars to bicycles called "ordinaries," it will be necessary briefly to refer to the "ordinary" as at present constructed, and to point out its inherent good qualities, as also its most salient features.

The "ordinary," "old ordinary," or, as some of its admirers delight to call it, the "good old ordinary"—this last term seeming to indicate a desire to soliloquise and say, "With all thy faults and dangers, I love thee still," which, taking its good points into account, is not so much to be wondered at—is acknowledged to be the most graceful in appearance, and the simplest in construction, with the fewest parts liable to wear and tear of any other bicycle extant. It possesses also the important qualities of requiring little power for its propulsion, and of elevating its rider above the dust, etc., on the roads, and enabling him to have a better view of the surrounding scenery when touring through the country.

On the other hand, and notwithstanding the above enumerated advantages, it certainly possesses some very objectionable features as at present constructed, with the handle-bars rigidly fixed in an immovable horizontal position, which is the sole root and cause of the disastrous effects to the rider's limbs and to his machine, proceeding from what is termed "coming a cropper," or an involuntary performance of an acrobatic feat, brought about in the first instance by the fore wheel of the machine coming in contact with some small obstacle on the road, such as a stone, brick, or stick, etc., and by the sudden concussion that immediately follows the impact, which causes the rider to be jerked from his seat in a forward direction (and here is where the danger begins) over the handle-bars, which act as rigid barriers retarding the motion of the lower part of the rider's body and legs, and thereby compelling him to alight on his head.

Another objectionable feature is the absence of proper "foot-rests," which cannot be applied on account of the immovable handle-bars; therefore, when pedalling is not required, the rider is induced, as an alternative, to throw his legs over the handle-bars, and thus to exhibit himself in a very ungraceful and dangerous attitude (should an accident occur meanwhile): a contorted position that would supply an artist with a model for an apt illustration to the well-known nursery rhyme of "Froggy would a-wooing go."

Another inconvenient feature that is found in the immovable horizontal position of the handle-bars, is that they prevent any machine so constructed ("safeties" included) from passing through any aperture, doorway, or along any walled passage, etc., whose transverse width is less than the extreme length of the handle-bars.

Having thus pointed out and explained the good qualities of the "good old ordinary," as at present constructed, as well as its defects and the evil effects arising therefrom, it is therefore now convenient, with the aid of the accompanying drawings, to proceed with a description of the construction, object, and application of Broxup's Patent Interchangeable Fore and Rear Handle-bars, and the advantages to be

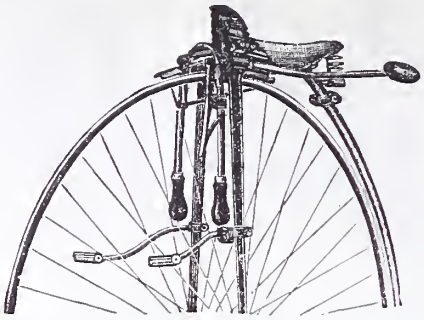


Fig. 5.—Perspective View of Bicycle, showing Fore Handle-bars depressed or hanging down, and the Rear Handle-bar up in Position for steering with.

obtained by dispensing with the immovable handle-bars now in use.

Mr. Broxup's invention and improvements consist essentially in the employment of steering handles G and H, one on each side of the machine, and occupying positions to the rear of the rider. These handle-bars are attached to short horizontal side-shafts, G^1 and G^2 (or rather they form a continuation of said side-shafts, but are bent at right angles thereto), and are made to oscillate from a vertical to a horizontal position, and *vice versâ*, in socket bearings H^1 and H^2, the sockets being cast to the head-piece at the top end of guide-fork D.

To each side-shaft at its fore end is attached the fore handle-bars I and J, which are horizontally disposed when the rear handle-bars are depressed, and *vice versâ*, to allow the rider to mount his machine; and after he is firmly seated thereon, by releasing the catch lever K, which pins the two fore handle-bars together, they immediately drop down into vertical positions, one on each side of the fore wheel, slightly in advance of the guide-fork D, to which they are locked by the lever catch *m*, at the bottom end of the vertical rod m^1, by the act of pressing downwards on the button or knob S, at the top end of vertical rod m^1. The catch lever K is released again by the act of pulling up at the button or knob S, simultaneously bringing the rear handle-bars into a horizontal position, one on each side of the fore wheel, in readiness to be grasped by the rider as a means of steering his machine, and by these means giving him a clear open space in his front, free from any obstruction should an accident occur, and with nothing to prevent him from dismounting over the wheel and alighting on his feet, still retaining his

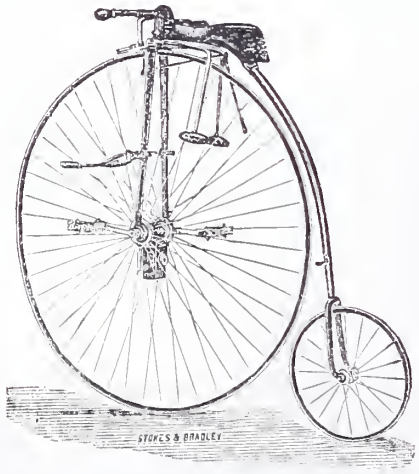


Fig. 6.—Perspective View of Bicycle, showing Fore Handle-bars up and in Position, and Rear Handle-bars depressed or hanging down.

grasp on the handles, and maintaining both himself and machine in upright positions.

The two fore handle-bars, when in position for steering with, are made to abut against each other, or rather against stoppers I^1 and J^1, forged on to the said handle-bars, thereby retaining them in a more rigid position; and in addition thereto there is a spring lever K fixed to one of the fore handle-bars, with a round hole formed at one end of said lever, which, by the action of lifting the fore handle-bars up into position, causes them to butt against the stoppers and the round hole at one end of lever K, to slip on to a projecting pin or stud, which is fixed to the other fore handle-bar, and thereby to join and secure the pair of fore handle-bars firmly together horizontally, and at the same time holding the rear handles down until released in the manner previously described.

The side shafts G^1 and G^2 are free to move laterally along with the fore wheel under the back bone C, for steering purposes, and they also serve the purpose of mud guards.

The brake lever O (see Fig. 2) is fixed to one of the rear handle-bars and connected by the wire rod R to the brake P, this arrangement adapting itself without interfering with the brake when raising or lowering the rear handles.

In dismounting from the machine whilst steering with the rear handle-bars, the easiest and safest method is to apply the brake P so that the rider may be carried over the fore wheel A, instead of dismounting at the side of ditto, as is usually practised with the immovable fore handle-bars.

Amongst a number of advantages to be gained by steering with the rear handle-bars is the application of proper foot-rests, etc., to the "ordinary," for use when pedalling is not required, equal in every respect to those attached to safety machines; also the "rake" in the "guide-fork" D and saddle E is dispensed with, thereby improving the steering qualities of the machine, and enabling the rider to sit in the best possible position so as to avoid the effects of vibration, also to "back-pedal" with greater force, and by firmly pulling upwards at the said handle-bars, at the same time pressing down with his feet on the pedals F, he can so pin himself to his seat that it is almost impossible for any obstacle coming in contact with the fore wheel to unseat the rider or overturn his machine. Another advantage is that the arms and hands of the rider are in the most easy and natural position whilst grasping the handles of the rear handle-bars, as the extreme ends of these bars are only about 2½ in. back from the centre of the fork D, which places the rider's hands at the most convenient distance in advance of his shoulders for ease whilst steering, and does away with tendency to become round-shouldered.

The chief aim and object of the inventor in designing and perfecting the improvements herein described and shown in the drawings has been to dispense entirely with the objectionable features inherent to the "old ordinary," and at the same time to retain all its acknowledged good qualities and to add thereto a number of other advantages, all of which have been fully described; and his endeavour has been to accomplish the task without in any way detracting from the symmetry of the machine, but to increase it rather than otherwise, and by these means to transform the "old ordinary" (dangerous) into a real *bonâ fide* "safety ordinary," and to make it the safest, the

most reliable, and the most rational bicycle in existence up to the present time.

How nearly the inventor has succeeded in accomplishing his aim and object must now be left to the impartial and unprejudiced judgment of all readers of WORK who are at all interested in matters relating to bicycles, and more especially to those of them who are practical users of the "wheel."

After perusing the description, etc., herein contained of the fore and rear handle-bars, if any of the readers of WORK are impressed with the idea that there is some difficulty in the manipulation of the said handle-bars, the writer may now tell them that the inventor has two sons, fifteen and twelve years of age respectively, both of whom he has supplied with "ordinaries," fitted with the interchangeable handle-bars, and to witness with what ease, and with no apparent effort, they perform the operation (when out with their machines), as I have often done, would instantly dispel any doubts they might entertain on that score. The elder of the brothers has often dropped off the side walk on to the road channel—a distance of seven inches—seated on his machine, and steering with the rear handle-bars. Another instance I will relate, to prove that there is no difficulty of the kind named, is that the writer saw Mr. W. G. Hurst (well known in the bicycle world under the pseudonym of "King of the Wheel") mount for the first time the machine belonging to Mr. Broxup's eldest son, which he had never seen before, nor any machine like it. He mounted with the fore handles in position, and did not go more than twenty yards on the road before he changed the handles and came back steering with the rear handles, and dismounted with them with the greatest ease imaginable.

Prices of machines fitted with Broxup's patent fore and rear interchangeable handle-bars, and the cost of fitting existing machines with them, may be ascertained on application to Mr. Broxup, 7, Plumbe Street, Burnley.

THE TRIUNIAL OPTICAL LANTERN: HOW TO MAKE IT.

BY CHARLES A. PARKER.

PREPARATION OF THE SLIDE-STAGES — NATURE OF THE WORK — PRICES OF TUBING, AND WHERE OBTAINABLE — MARKING STAGE-PLATE — CUTTING CIRCULAR APERTURE AND BRAZING TUBE TO PLATE—CONDENSERS—SPRING-PLATE OF SLIDE-STAGE—MAKING AND FITTING OUTER PLATE OF SLIDE-STAGE WITH DRAW TUBES—PREPARATION OF SUPPORTING PILLARS OF SLIDE-STAGE—FITTING STAGE TOGETHER—FITTING SUPPORTING PILLARS TO SPRING-PLATE—MAKING SPIRAL SPRINGS—HINGEING STAGE-PLATES TOGETHER.

HAVING in the previous papers completed the description of the carcase of the lantern, it behoves us to turn our attention to the preparation of the movable stage-plates and fittings for the front of the instrument. Before commencing the constructive details, it may not be out of place to briefly explain the necessity for some movable arrangement of the slide-stages. Supposing, for instance, that the lens system and slide-stages were to be a fixture to the front of each lantern, it would be found that the disc projected from the upper lantern would not coincide or register with that of the lower one when the two were thrown upon the screen. It therefore becomes requisite to secure their coincidence by either tilting the top lantern downwards, or by attaching the condenser, slide-holder, telescope front, and objective of each system to a brass plate or stage, which is hinged at one end to the lantern body, and provided with a spring at the other end to press it outwards, and two milled nuts to screw it back. By means of this arrangement it will be found an easy matter to secure the accurate adjustment of two, or even three, discs on the screen at the same time. The condensers are fitted into a short tube or collar, which projects from the back of each stage-plate into the interior of the lantern—the front of the plate being occupied by the slide-holder and the tubular front to which the objective is attached; the latter being formed of two tubes sliding one within the other, in order to enable the operator to lengthen the front when it becomes necessary to use long focus lenses.

The stage-plate and fronts should be made entirely of brass, with the exception of the wooden frame for the rolling curtain. The sheet brass required for this purpose will vary in cost from about 8d. to 10d. per pound, according to thickness; and the price charged for ordinary brass tubing will be about 10d. per pound, or 2s. 6d. per pound for drawn tubing. Brass tubing and sheet brass of every thickness can be obtained from either of the following London metal warehouses, cut to any size required, and charged for by weight: Messrs. Smith and Sons, 29—33, St. John's Square, Clerkenwell, and Messrs. Stanton, 21, Shoe Lane, Fleet Street, E.C.

For each of the stage-plates a piece of brass plate, measuring $7\frac{3}{4}$ in. by 6 in., and $\frac{1}{8}$ in. thick, will be required. As this will in all probability be uneven when first obtained from the metal warehouse, it will require to be flattened previous to being worked upon, and as this is a job which requires a considerable amount of care and skill, it will be found advisable to get it performed by a professional brass-worker; otherwise, a novice may make matters worse by filling the plate with a lot of hammer marks, which will cause a considerable amount of trouble before they can be removed. Having got a perfectly flat plate of sufficient size, the first proceeding will be to mark out a rectangle of the above size by the aid of a square and a sharp steel point, after which the plate should be put in a vice having leaden clams for the edges, to be carefully trued up by means of a second-cut flat file, not forgetting to occasionally test them with a straightedge. When this has been done, one side of the plate must be rough-polished by means of a lump of pumice-stone or blue-stone and plenty of water, care being taken to always rub the stone in one uniform direction until all the scratches or imperfections have been entirely removed, and the plate has been brought up to a smooth and even surface. It will only be requisite to polish one side of the plate, as the other side from which the tube projects goes inside the lantern, and is consequently not seen. After the blue-stone, the metal may be further improved by using a piece of water of Ayr stone in the same way, by which time the plate will have been brought up to a sufficient degree of finish for all present purposes.

Now drill a couple of $\frac{3}{8}$ in. holes at each of the top corners of the plate, as shown in Fig. 21, and then make a centre-punch mark in the middle, and strike out a $4\frac{1}{4}$ in. circle by means of a pair of compasses, after which the brass should be mounted on the face-plate of a lathe of sufficient size to accommodate a plate of these dimensions, with the head-centre pushed forwards until it touches the centre punch-mark in the plate, when the latter may be clamped securely in position, and the central portion afterwards cut through, where marked. It will be necessary to be particular to cut this circular aperture straight through the metal, in order to ensure the inner edge of the opening being quite square with the face of the plate. When the aperture has been cut, a $1\frac{1}{2}$ in. ring of moderately stout brass tubing, $4\frac{1}{4}$ in. in diameter, will require to be fitted into the opening in the plate, in order to form a cell or collar to receive the condensers. Each edge of this ring should first be carefully trued up in a lathe, after which it is accurately fitted into the opening in the plate, with the edge of the ring flush with the outer or polished side of the plate. Of course in actual practice it will be found advisable to get this ring before the aperture is cut in the plate, as it will then be an easy matter to fit the two together accurately; after which they must be brazed together in the manner about to be described.

Having first ascertained that the two surfaces to be joined are perfectly clean—that is to say, the edge of the tube and the circular aperture in the plate—carefully fit them together, and then paint the joint with a feather which has been dipped in a paste composed of borax ground up with water upon a piece of glass or slate until it is as thick as cream, after which a sufficient quantity of spelter should be dusted along the join. Now blow up a good fire, and then gradually apply the heat to the underneath of the plate and inside of the tube, continuing to gently puff until the borax runs, when the work should be tilted in various directions, in order that the solder, which melts about the time that the metal attains a dull red heat, may run in the required direction, using a wire, if necessary, for the purpose of guiding the solder round the joint until the latter is complete, adding a little more borax if the solder exhibits any disinclination to run.

As soon as the join appears to be well covered with the solder, the work should be removed from the fire and allowed to become gradually cool, care being taken not to shift the seams in so doing, otherwise the joint would be spoiled. It will be necessary to remove the superfluous borax whilst hot, as it becomes intensely hard when cold. For brazing large work, a small forge will of course furnish the most suitable source of heat, but for the work in hand a blowpipe worked by a foot-blower will be found quite sufficient. If a fire is employed, coke will be the most suitable fuel to employ, and this should be blown up until quite clear and entirely free from smoke, as the latter would tarnish the work and effectually prevent the spelter from adhering. It will be necessary to be particular and use soft spelter, and apply the heat gradually, otherwise the work might happen to melt at the same moment as the spelter. An inexperienced hand will do well to employ either common silver solder or an alloy composed of thirteen parts of copper and eleven parts of fine silver, using borax as a flux. As this solder melts at a much lower temperature than spelter, there will be less likelihood of the work being spoiled. Experience alone will teach the exact quantity of spelter required to make a strong joint; but it may be stated that the best and strongest joints usually have but little solder, and as this simply represents a needless waste of metal,

it is a fault which should be guarded against, as it affords no additional strength to the joint.

As the size of the brass ring just fitted to the plate has to be governed by the size of the cell in which the condensers are mounted, it will be necessary to procure these previous to cutting the apertures in the stage-plate. In a future paper hints will be given regarding the selection of suitable condensers; in the meantime, it may be stated that they should be procured from some firm of repute, and on no account should second-hand condensers be purchased, unless the reader is an expert judge of their qualities. Condensers are not very expensive when procured from a reliable firm, as a capital pair of 4 in. condensers mounted in brass cells are now supplied by Messrs. David Noakes & Sons, of Billingsgate Street, Greenwich, for 10s. 6d., and a still cheaper pair by Messrs. Theobald & Co., of Bath Place, Kensington, who charge 8s. 6d. for a serviceable pair mounted in brass cells, with ventilation apertures.

Having so far completed the stage-plate, the next proceeding will be to make the inner spring-plate of the slide-stage, which is shown in plan and section in Fig. 23. For this we shall require a piece of $\frac{1}{16}$ in. sheet brass, measuring 5 in. by $6\frac{1}{2}$ in., which must be made perfectly flat, and then brought up to an even state of semi-polish in a similar manner to that previously described for the stage-plate, after which the four corners should be carefully marked out in curves, each having a radius of $\frac{3}{4}$ in. from the corner of the plate. When this has been done, the plate must be screwed in a vice between leaden clams for the edges to be filed up quite square and true, after which the curves are roughly shaped to the form of the outline by means of a cold chisel, and then smoothed to the exact form by the aid of a half-round file. At this stage of the proceedings make a centre-punch mark in the centre of the plate, and strike out a $3\frac{3}{4}$ in. circle by means of a pair of compasses, afterwards mounting the plate on the face-plate of a lathe for an opening of the above size to be cut to the form of the outline. When this has been done, a $1\frac{1}{2}$ in. ring of brass tubing $3\frac{3}{4}$ in. in diameter should be carefully trued up at each end in a lathe, and then fitted and brazed into the circular aperture in the plate just prepared, after which the spring-plate may be placed aside for a short time for the outer plate of the slide-stage to be prepared. This plate, which should be $\frac{1}{8}$ in. thick, is shown in plan and section in Fig. 24. It measures 6 in. square, and is constructed in much the same manner as the last, with the exception of the corners, which will not require to be shaped. Previous to working on the plate it will be necessary to flatten it, and then roughly polish both sides in the manner previously described, after which the edges should be filed up until quite square and true with the face. When this has been done, strike out a 4 in. circle in the usual manner, and afterwards mount the plate on a lathe for an opening of this size to be cut in the metal. A 5 in. length of tolerably stout drawn tubing 4 in. in diameter will now be required, likewise another piece of just sufficient size is slid over the first in telescopic fashion; the latter, which forms the draw-tube of the stage front, will not be required at present and may therefore be placed aside, but the other tube should be trued up at each end in a lathe, and then fitted into the circular aperture in the brass plate just prepared, with the edge of the tube brought through the opening in the plate until it is flush with the surface on the other side, after which the two are brazed together in the usual manner.

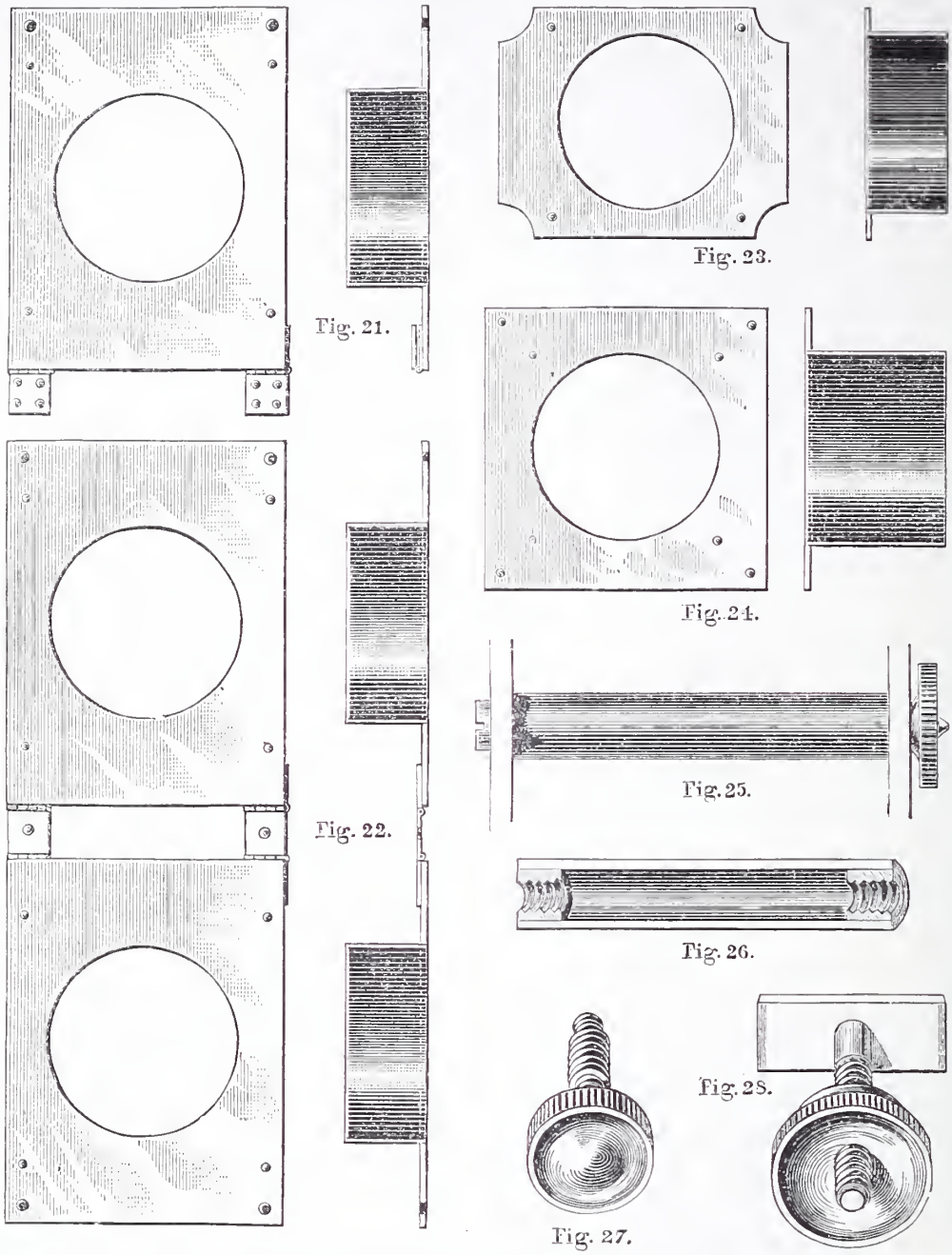


Fig. 21.—Plan and Section of Stage-plate of Top Lantern. Fig. 22.—Plan and Section of Stage-plates hinged together. Fig. 23.—Plan and Section of Spring-plate. Fig. 24.—Plan and Section of Outer Stage-plate. Fig. 25.—Section of Stage joined together by Brass Pillar. Fig. 26.—Section of Tubular Pillar. Fig. 27.—Milled Screw and Nut. Fig. 28.—Bolt and Milled Nut.

Before proceeding further, it will be necessary to prepare the four supporting pillars of the slide-stage, one of which is shown in Fig. These may be formed by cutting an $8\frac{1}{2}$ in. length of brass rod of about $\frac{3}{8}$ in. diameter into four 2 lengths, and afterwards drilling and tapping each pillar longitudinally at either end just sufficient to take the stem of a cheese-head brass screw, as shown in the c using a milled screw to one end if preferred. Should any difficulty be experienced in obtaining screws of the size, it will be found advisable to send to Morris Cohen, 132, Kirkgate, Leeds, who will supply them at 6d. per dozen, postage $1\frac{1}{2}$d. In ordering, it should be stated that brass cheese-head screws No. B are required. A skilful hand at hard soldering may form these pillars in a slightly different manner. An $8\frac{1}{2}$ in. length of stout brass, being $\frac{3}{8}$ in. diameter, may be cut into four 2 in. lengths, to each end of which the bush of a small milled screw similar to Fig. 27 is hard soldered, as shown in the section of the tube in Fig. 26. By this means the

ouble of drilling and tapping the ends of ch pillar will be avoided. Screws suitable r the purpose may be obtained from Mr. latt, Birkbeck Works, Birkbeck Road, idley Road, Kingsland, E. Order No. 60 list, price 4d. each. These milled screws ill only be required for the outside of the age-plate, as the ordinary cheese-head rews are quite sufficient for the back f the stage-plate.

When these pillars are ready, a hole must e marked and drilled at each corner of the uter plate of the slide-stage in the position ndicated in Fig. 24, after which this plate hould be laid flat on the stage-plate (Fig. 1) for duplicate holes to be marked and rilled in the latter. Thus prepared, the tages may be screwed together with one of he pillars just made placed at each corner. When fixing these pillars, it will, of course, e necessary to frequently test the stages ccurately by means of a square, in order to nsure their being put together properly, as it is of first importance to have them quite true and perfectly rigid.

The stages being fitted together, it is now time to return to the spring-plate, and fit this between them. For this purpose we want four brass bolts and milled screws, No. 69 in Mr. Platt's list, price 4d. each (Fig. 28). The small bottom plate of each of these must now be removed, and a slight shoulder filed at this end of each screw stem, in order that they may be readily fitted and riveted into holes drilled for their reception at the four corners of the spring-plate, as shown in Fig. 23, care being taken to see that they are planted quite firm and at right angles to the plate. Thus prepared, four holes about $\frac{3}{8}$ in. in diameter should be drilled in the outer plate of the slide-stage, in a suitable position to receive the stems of these screws. Previous to putting the spring-plate in position between the stages, it will be necessary to slip a short spiral coil of springy brass wire on to each screw stem, after which the plate may be inserted in position between the stage, with the stems of the screws projecting through the holes in the front stage-plate. The milled nuts may now be replaced upon the screw stems, and screwed up until the spring-plate occupies just half the space between the stages, the unused portion of the stem projecting beyond the milled nut, being removed by being grooved with a file and then broken off. Make these springs, and wind the wire round a piece of rod of the size required to produce a spring of sufficient diameter to readily pass over the stems of the screws; and as the spring is intended to act by compression, two or three wires may be wound on it at the same time, so as to form two or three distinct springs. Steel or iron wire will answer very well if it is hardened and tempered first, but hard brass wire is preferable, as it is not liable to rust and spoil if exposed to damp. Each spring should be allowed to double its length—that is to say, a $\frac{1}{2}$ in. closed spring will extend to 1 in. when released. The stage-plates should now be provided with hinges, as shown in Figs. 21 and 22. For the stage-plate of the top lantern we shall require a pair of blank back flap hinges, No. 18 in Mr. Platt's list, price $2\frac{1}{2}$d. per pair, and for the other two stage-plates which have to be joined together we shall want a pair of double blank hinges, No. 3 in the above list, price 8d. per pair. A $\frac{1}{4}$ in. hole should be drilled through each of the central leaves of the double hinges, but the other pair will require no further treatment, and may be soft soldered to the stage-plates without delay. The outer or plain leaves of each hinge, also the under corners of the stage-plates, must first be scraped until quite clean, and afterwards tinned by moistening them with a little chloride of zinc soldering fluid and sprinkling a few scraps of soft solder on the metal, which is then held over the flame from a Bunsen burner or spirit-lamp until the solder has melted and covered the allotted space, when the fluid may be washed away by means of an old tooth-brush and some water. Some fresh fluid is now applied to the tinned surfaces, which are then held in close contact over the flame until the union is complete, when they are again rinsed in water, and the join afterwards trimmed up by means of a file.

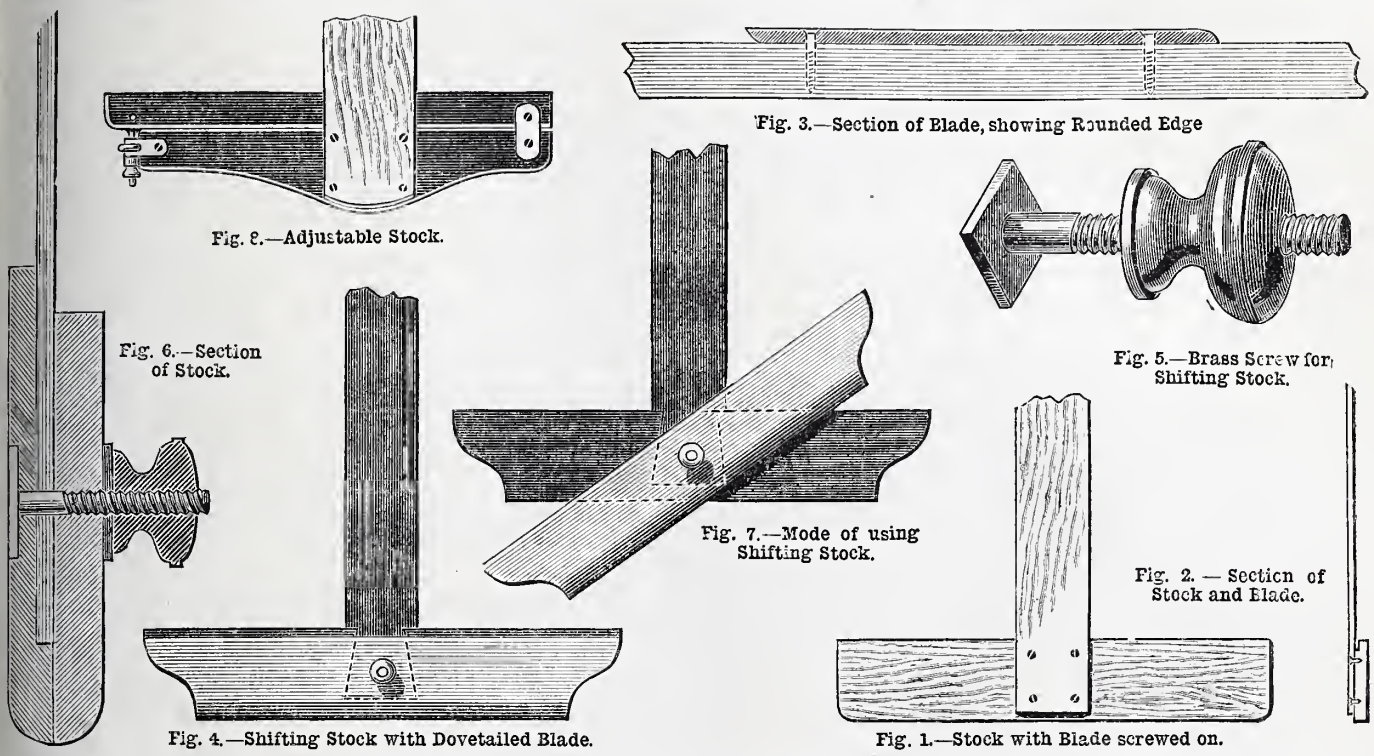
HOW TO MAKE A T-SQUARE.

BY G. LE BRUN.

A T or drawing-square is an appliance that is in continual requisition by all classes of the *genus* mechanic, whether professional or amateur, and as it is of the utmost importance that it should be correctly made and of good material—two features that are often lacking in those purchased at shops—I have thought that a few hints as to its construction would be of service to those readers of Work who do not as yet possess one, or who do not care to pay the high price that is often demanded for a really good square.

As to the material to be used, any non-warping wood is suitable, and in using the expression "non-warping," I am aware that I am not strictly correct in my term, as all woods are liable to warp under certain conditions, but there are several that will warp in spite of all precautions, and these are to be avoided. In this category I would place birch, beech, elm, ash, and woods of a similar texture, and, avoiding them, choose a wood of a clean straight grain, preferably mahogany, cedar, or American walnut; personally, I prefer teak, but, unless you are in a shipbuilding district, it is sometimes difficult to procure. Whatever wood you may fix on, choose a piece free from knots or fancy markings, for, however beautiful in themselves, they will only prove a source of trouble after your square is made, and keep you continually stripping and correcting it.

I will deal first with the simplest form of square—that shown in Fig. 1. It consists of a stock and blade only, and presents not the slightest difficulty to the merest tyro. The size of the square required will, of course, to a certain extent, govern the thickness of the stock and blade, and I will suppose that the one in hand is to have a 28 in. blade, a very useful size, and not too large. The stock for this square, then, will be 10 in. long, and $2\frac{1}{4}$ in. wide, the thickness being $\frac{5}{16}$ in. The inner edge is rebated next the blade, as in Fig. 2. The blade is 28 in. long, $2\frac{1}{2}$ in. wide, and slightly under $\frac{1}{8}$ in. thick; it is



rounded on the edges, in the way shown in Fig. 3, and is simply fixed on the stock by means of four ⅜ in. fine screws (Fig. 1).

Fig. 4 shows a more useful form of square, in which the stock is in two pieces, thus enabling it to be used for drawing angle lines, as one piece is loose, and adjustable by means of a turnscrew. The sizes of the wood used are similar to that of the previously described square, and, in finishing, the ends are cut to an o.g. shape, to improve the appearance. The blade is sunk flush, by means of dovetailing, in the inner side of the fixed piece of the stock. The movable piece of the stock is ¼ in. narrower than the fixed piece, and is held in position by means of a brass screw (Fig. 5), the diamond-shaped head of which is let in flush with the stock on the fixed side. This is shown in section, full size, at Fig. 6.

In using this square for drawing angles, the movable stock is shifted to the required position and the screw tightened (Fig. 7); it can then be used with the same facility as a set square, and will be found to be an appliance of much service in drawing bevelled work.

Of course, it is understood by all who know the use of a square, that, to be of any service, it must be perfectly just—near enough will not do; the greatest care, therefore, must be used when finally fixing the blade to the stock. There are many ways of assuring the truth of the blade; but one of the simplest is to take a drawing-board (a smooth table top would do), with a perfectly straight edge, and, applying the square to it, draw a line down the blade with a very fine-pointed pencil; then, turning the square over and keeping the stock exactly parallel with the edge of the board (when turned you cannot apply it to the edge, as the blade interposes), see if the blade and the line coincide: if they do, your square is just; if not, you must keep on correcting and trying till they do, and then firmly fix the blade to the stock.

There is an adjustable T-square made by a firm in Holyoke, Mass., and patented in the United States. I am not sure if it has been introduced into this country; at any rate I have never seen one here, but it deserves notice on account of the ingenious arrangement for adjusting the blade. The stock is made in two pieces, to one of which the blade is attached, the other, and inner piece, being adjustable by means of a set screw and lock nut. A drawing of this square is given in Fig. 8, a study of which will show its construction and advantages, and perhaps lead some budding genius to still further improve upon the idea. Certainly the maker seems to have overcome the difficulty of adjusting the square after the blade is finally fixed—a job which those who have tried it know to be very troublesome.

When the square is finished, of whatever form it is made, you can either French-polish it or oil it. Polish, after constant use, gets scratched and looks bad. Oiling fills the pores of the wood to the exclusion of damp, and tends to prevent any tendency to warp, therefore I would say—oil your square. Raw linseed oil is the kind to use; it must be well rubbed in with a soft rag, and allowed to dry thoroughly before each fresh application.

By continuing this treatment you will, in time, bring up a fine and lasting polish, and have the satisfaction of being the possessor of a tool that defies the changes of weather, and that can always be depended on to act on the square.

DESIGNING FOR WORK: HOW TO GO ABOUT IT.

BY J. WHITFIELD HARLAND.

I HAVE previously referred to the fact that a certain amount of beauty results from strength of construction, and that strength is capable of being combined with beauty in design. Weakness and poverty of design so mar the effect, that beauty in other respects is lost sight of, even if it exists, in the aggregate finished result. It will be as well therefore to point out how to avoid this weakness, which is of two distinct kinds. Firstly, in construction, if evidences are visible that the design has been carried out in material too slender for commensurate strength for its purpose, and that consequently it looks weak and fragile, the impression on the mind is of discomfort, unrest, and dissatisfaction; whilst, secondly, if the design itself, however graceful it may be, is carried out in execution in stuff of superfluous strength, the mind perceives it at once, and the result is a feeling that clumsiness, heaviness, and awkwardness are destroying all grace and beauty. The "happy medium" is found in well-considered work, carried out in its construction so as to combine lightness and gracefulness without exhibiting weakness or the semblance of it, and without showing that too much material is employed to gain strength, or that unnecessary strength for the purpose in view has been attempted.

The mind, when guided by good taste, and supplemented by an instinctive perception of right and wrong construction (the result of experience and knowledge), ceases to take pleasure in any design of a piece of work which may exhibit such incongruities. As an instance, suppose a dining-table with fine mouldings, beautifully finished, of clean and sharply cut section, with the rails well-proportioned to support the top, carried at the four corners by billiard-table legs—no matter how shapely or well carved, or moulded and panelled they might be—no one could admire it, further than to like separate parts, taken singly, apart from the whole.

Imagine the tall and elegant giraffe lifting its graceful neck high in the air, its high shoulders and sloping horse-like body mounted on the legs of an elephant! Nature knew better than to create a "giraffe-phant," to coin a name for our imaginary monstrosity. The converse, an elephant's body on a giraffe's legs, could not stand. These absurd instances are merely inserted here to enforce my contention that harmony of construction, and the true relation and combination of strength and beauty, must be fully borne in mind in all designing. They cannot be borne in mind unless previous training and thought has first put them there. Ideas that are of any use or beauty do not come of themselves—they are the offspring of cultivation and thought, and spring from the seeds we sow in the mind, just as plants grow from seeds scattered by birds, and are fertilised by the rain and the sunshine and the pollen of other flowers. As well might one expect a raw youth, fresh from the plough, to successfully undertake command of an army, as to imagine even the embryo artist being able, however much genius he may be endowed with, to design anything that involves construction without previously graduating by *some* study of the subject. It is with this thought on my mind that these papers have been delayed till those on "Constructive Strength" shall have been read in between, as it were, in the sequence in which they have appeared in WORK; and I trust that any WORK reader, who may have been interested at all in my former papers on "Design," will carefully re-read them once again, consecutively together with those above named, which have a closer connection than at first sight appears with this series.

I have often thought that a most useful book might be written on the subject of "Diseased Design—deformities, anomalies, structural weakness, congestion, indigestion, paralysis, aberration of mind, incoherency, colour blindness, lameness, etc., etc."—if an author could only be found to deal with the subject who would and could express the diagnoses and exhibit the proper remedies—a sort of M.D. in Art.

Design is far too much, nowadays, a matter of fashion, who cannot rule herself instead of nature, who rules the universe, man, or perhaps woman, or both excepted; hence the stupid pseudo-admiration for Japanese or Japanesque design, and the pretended æstheticism in house decoration. Thus the lines upon which Japanese design are based, as might be expected, partake of the character of the scarecrow, a series of angles, with but little relation to one another being the basis of their "composition," like the poses of Sarah Bernhardt in her photographs—"all legs and wings," giving the idea to the mind that there was no gradual process of growth, as in nature, but a sudden snap like the flash of a detective camera, in their origin. Where is dignity, grace, or any other of the noble sentiments to be found? Weak and puerile, semi-barbaric designs, whether original or founded upon this style, as it is called, are ephemeral and—fashionable, that is all. In nature one can delight in the curves that nature exhibits, and even the angles when they occur naturally, as they always do wherever they are met with. Traces that tell the wonderful glory and story of their origin and growth are always evident. In Japanese art (?) one sees, for instance, the head and hands and the clothes of the woman doing duty for the figure. In nature, and in art, if it is true art—that is, true to nature—one sees the woman in the effulgence of her beauty; but more than that, one sees or feels the beauty of the child-state of the woman. Transitions are marked and origin traced, former states of being and "have-beens" are forced home to one, and the mind is filled, as it were. Japanese art is, if an art at all, an art that touches no deeper than the eye. Nature controls, and natural art awakens, the heart and mind, through the eye.

Further, design fails in its purpose, unless it awakens sympathy. If it does not "fetch" you, and induce the mind to elevated thought and reflection, what function does it fulfil?

Take the highest possible instance—the interior of a church. What ought to be the aim of its designer? Japanese fans, storks, butterflies, and trees? No! and why? Because they mean nothing! No! his aim should be to awaken and soften the heart and conscience, and render the mind of him who enters amenable to religious feeling, awe, reverence, and love. Mere grandeur, as in St. Paul's. and St. Peter's at Rome, does not completely subdue one's feelings like Notre Dame at Paris, or Westminster Abbey, where grandeur has only arisen out of fulness and size, not as the chief attribute, but as a side issue half unsought. There is no "pointing upward" in the classical architecture of heathen temples, such as there is in Gothic columns, with halfway bands holding them together, the crown or corona of their blended shafts

marking the point of the final spring of the arch, as it rises upwards to meet its fellow, till they become *one* at its highest point; typical of our life on earth and our hereafter.

Descending, our homes come next to our churches. The designer of a home should aim at awakening the refined and affectionate sentiments of family relations, the restful and peaceful feeling that here, at least, outer cares and troubles cease; that, herein, repose from the labour of the day, and the comfort that labour ought to bring, are known, felt, and emphasised. Will Japanese insects and fans and "folderols" inspire these feelings? Not much! Well, it may be asked, what will? I answer that any object of art and pure tendencies that recalls to the husband or the wife, or both, the days of their own childhood, the stories they read, the songs they heard their mother sing before manhood or womanhood was reached, the times they lived in then, and the poems and pictures they then loved. These are the associations conducive to the arousing of a home feeling that designers of homes should think out and act upon. If this programme is pronounced fanciful or far-fetched, let anyone who may be sceptical go abroad, not for a few weeks, but for a year or two, until in some moment, quite unforeseen, called up by such simple things as the moonrise or the evening calm, the sunrise or sunset over the sea, in the tropics or any other of nature's reminders, you know the full meaning of "home-sickness." This is only one of the many lessons that foreign travel impresses on the mind—which never, however, so far as my own personal experience, gave the least significance to Japanese, Chinese, or æsthetic design. My remarks do not apply to other so-called barbaric styles—such as Indian, Egyptian, and ancient South American architectural design—which possess something of suggestiveness of the association of ideas formed when the heart was young, a quality I entirely miss in pretentious Japanese or Japanesque design and ornament.

The lesson I wish to bring home to WORK readers is, in short, this: that design which has no thought in it is like an empty barrel, musty and useless, no matter whether silly fashion stamps a trade mark on it or not, for fashion assuredly is unfit to be the judge.

Seriously, designing, for no matter what, ought to be undertaken and approached with something of the spirit that should inspire those who teach the young, that should fill the mind of the author of fiction and the writer of history; a real and true conscientiousness, even in the most trivial details. Such designing, even if not distinguished by much originality of conception, if not remarkable for new combinations of form and colour, possesses at any rate the sterling impress of truth, and speaks to the heart in all its efforts, doing good instead of evil to countless thousands, posthumous perhaps; whilst design for the mere purpose of mercenary ends has no intrinsic value, and carries with it none of that power—the highest given to mortals who pass over to the majority—of handing down to "this side the grave" the records of one's life-labour on earth.

[Japanese or Japanesque design and ornament seems to have much the same effect on our friend and contributor, Mr. Harland, as the proverbial red rag on an easily excited bull. What a terrible sinner Mr. Gleeson-White must be in Mr. Harland's eyes, and how sad the fact that WORK will continue to sin in upholding Japanese ornament!—ED.]

MATCHBOARDING.

HINTS ON ITS APPLICATION TO WALLS AND CEILINGS.

BY ALEXANDER MARTIN.

VARIOUS reasons may cause it to be desirable to cover the walls inside our houses, shops, or halls, in whole or in part, with wood in place of the more common material for that purpose—plaster. In days gone by, good honest oak wainscot was erected in thorough workmanlike fashion; but in these days of cheapness, less expenditure is the rule everywhere, and oak wall-panelling is not often met with in new work. Pine wood takes the place of oak, and even panelling is discarded for matchboarding (or V-jointed lining, as it is sometimes called) when cost is the factor which is weightiest of all. The result is usually a dead, plain wall-surface, with innumerable vertical lines unrelieved in their immense monotony, until the decorator comes upon the scene and leaves his mark, in the shape of sundry horizontal bands or stencilled ornaments. Why should not this matchboarding be so placed as to be decorative in itself? Why is there so little thought expended in utilising the necessary lines of the joints, so as to form a pattern or design of a suitable kind? The extra cost entailed is, no doubt, at the root of the matter; but where an agreeable effect is desired, a little extra time spent in erecting the wood will not be in the least out of place.

As matchboarding is most commonly used in lining a wall from 3 ft. to 4 ft. up from the floor, we shall, first of all, consider it in this position and to this extent, and see in what way it may be arranged to produce a more agreeable and satisfactory result than is obtained by the usual multitude of upright lines surmounted by a bead. And the first thing that seems unsatisfactory is the fact that these lines run right down to the floor; they stop naturally enough against the bead at the top, but they ought to have some other finish at the foot, and not seem as if the boards extended downwards to the room below. A skirting-board might be placed against them, running right along the floor, and thus form a base to the structure above. In such a case the matchboarding need not extend to the floor, an inch below the top edge of the skirting-board being sufficient. In Fig. 1 is shown a section of this arrangement of base.

If, however, it be advanced as a drawback to this plan that the base projects beyond the face of the boarding, the same effect may be obtained in another way. The skirting-board, still running along the surface of the floor, may be set in flush with the face of the boarding, as shown in section in Fig. 2, when the vertical lines will then stop against the bead there shown in the same way that they do against the bead on top. The result wished for is attained—viz., a suitable finish to the lines of the matchboarding before they reach the floor.

The top bead may with advantage be made more imposing than it usually is. In Fig. 3 is shown the section of the ordinary bead; if it be brought out a little further, another moulding could be set in underneath it, as shown in Fig. 4. Another arrangement is given in Fig. 5, bolder in appearance than the former one. One consideration which will help to lessen the extra cost of the mouldings in Figs. 4 and 5 is the fact that the top ends of the boards may be left rough, and do not need to be closely fitted to the top bead, as the moulding planted on the face will cover up all the deficiencies. If the same objection be taken to these projecting mouldings as was mentioned in connection with the projecting base, the difficulty may be overcome and our ends attained by using either of the plans shown in Figs. 6, 7, and 8. They all show the horizontal lines carried along the top of the vertical lines of the boarding, broader than usual, Figs. 6 and 7 being about 2 in. broad, and Fig. 8 about 3 in.

The next thing is to vary the constant perpendicular lines of the matchboarding, and this may be done in many ways. Perhaps the simplest way of all would be to form a square of upright boards, next a square of horizontal boards, and so on alternately, as indicated in Fig. 9. The grounds for fixing the boards to must, of course, be arranged to suit (see Fig. 9A, where upright straps or grounds are shown placed so as to catch the ends of the horizontal boards). This arrangement of partly vertical and partly horizontal boards necessitates some care in laying off the distances to be covered, so that a certain uniformity may be secured at the corners and where doors and windows interfere with the continuation of the work. At the corners, if the squares come in, they may naturally range themselves round the room. Sometimes, however, this may be difficult, and it may be better to adopt another method. A square may be halved on both walls in the corner, the boards running in both halves the same way, either vertically or horizontally. If, in the spacing, half of a panel does not come in exactly at the corner, repeat on both walls the same amount of pattern, either less or more than half a square, as indicated in Fig. 10. In the window recesses—if there be such in the room—the boarding may be arranged as shown in Fig. 11, where the elbows have the wood running opposite both to the window-breast and the wall outside the window-opening. Though the window-breast be lower than is shown, that does not affect the principle we are talking of—viz., the arrangement of the vertical and horizontal grooves in the matchboarding. And it is this necessary arranging of the different parts which constitutes the greatest difficulty whenever we deviate from the usual method of placing board against board all the way round a room till it is finished. The other variations to be mentioned require this same care to be taken with them, but how well worth all the extra trouble is the result at completion!

Another simple variation is given in Fig. 12, where four boards are mitred at their tops and bottoms. In spacing these groups of mitred boards it is not necessary to have absolutely the same space between them in all the walls of the room—in fact, it will often be found to be impossible to have them all exactly spaced alike. In that case, they should be placed as nearly as possible at equal distances from each other. This same remark applies to all these designs. In Fig. 12A is shown the arrangement of grounds for the design in Fig. 12. A solid piece of wood of the same thickness as the grounds is placed behind the ends of the mitred boards. The design in Fig. 13 entails more mitring than the preceding one, and the necessary grounds are perhaps best obtained by having a solid surface of rough boards behind the mitred square, as shown in Fig. 13A. The diamond pattern shown in Fig. 14 is very effective; it also requires a solid grounding, as shown in Fig. 14A.

In the next figures (15 and 15A) is shown an arrangement of upright and horizontal boards differing from Figs. 9 and 9A only in

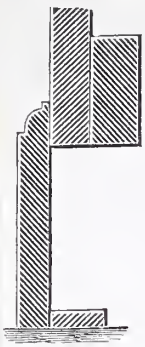


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 6.

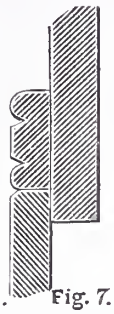


Fig. 7.

Fig. 8.

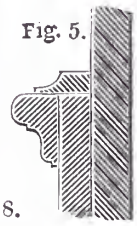


Fig. 5.

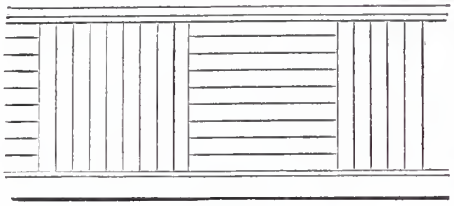


Fig. 9.

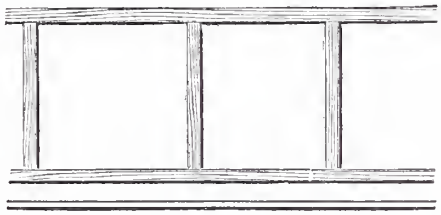


Fig. 9 A.

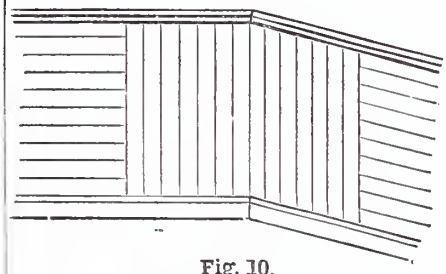


Fig. 10.

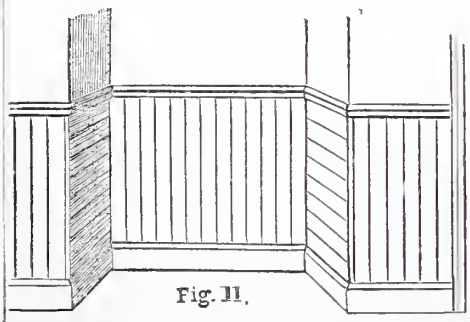


Fig. 11.

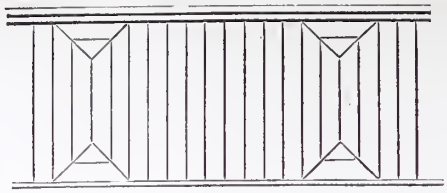


Fig. 12.

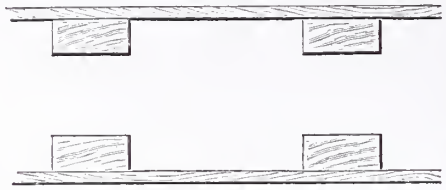


Fig. 12A.

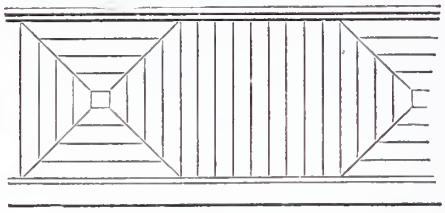


Fig. 13.

Fig. 13A.

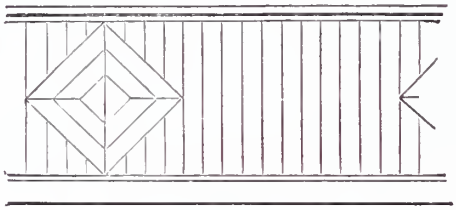


Fig. 14.

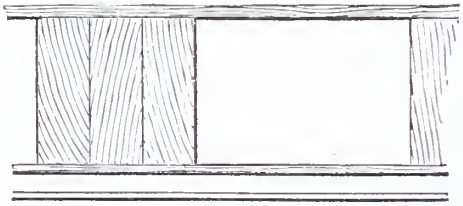


Fig. 14A.

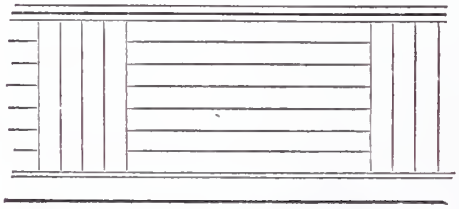


Fig. 15.

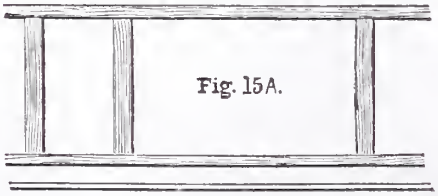


Fig. 15A.

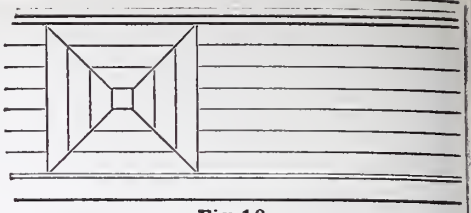


Fig. 16.

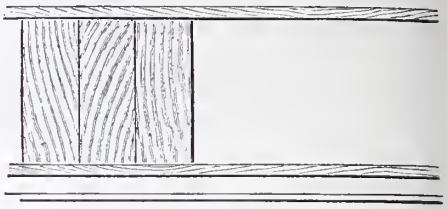


Fig. 16A.

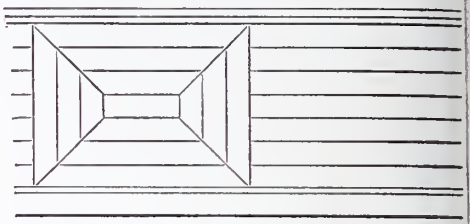


Fig. 17.

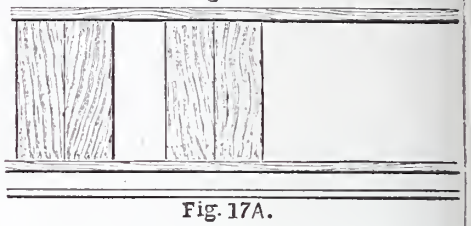


Fig. 17A.

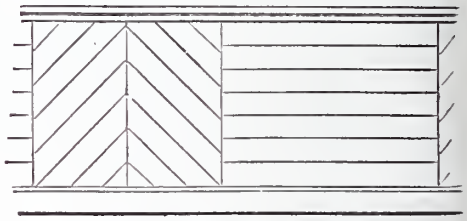


Fig. 18.

Fig. 18A.

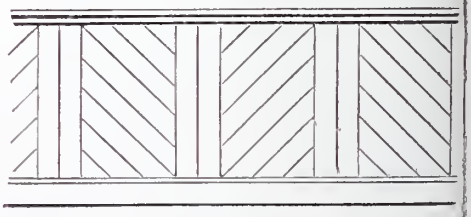


Fig. 19

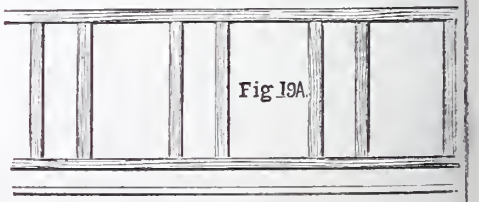


Fig. 19A.

MATCHBOARDING: ITS APPLICATION TO WALLS. Figs. 1 to 19 A.—For Explanations of Diagrams, see Accompanying Text.

the proportions of each of the directions of the boards; while in Figs. 16 and 17—with diagrams of their respective grounds in Figs. 16A and 17A—simple changes of some of the previous figures will be observed. The length of the horizontal boards in each

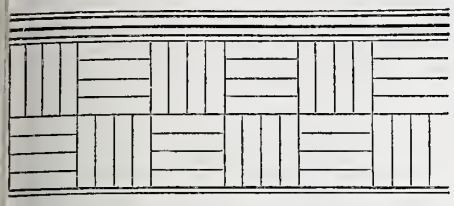


Fig. 20.

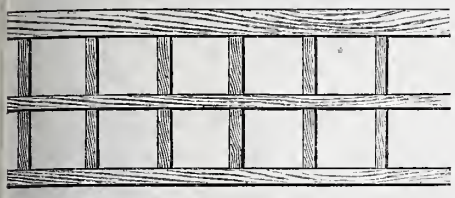


Fig. 20A.

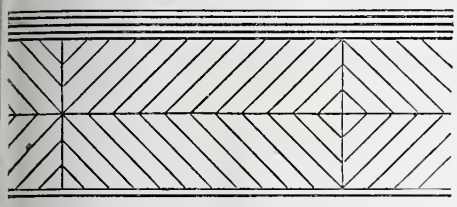


Fig. 21.

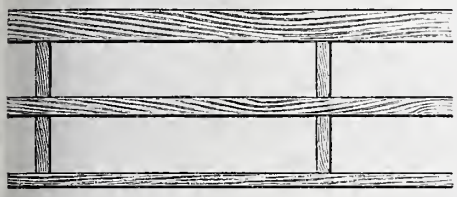


Fig. 21A.

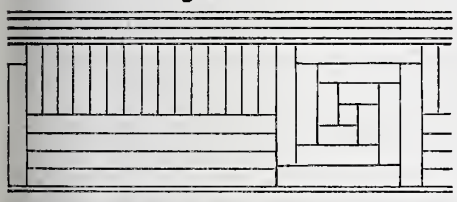


Fig. 22.

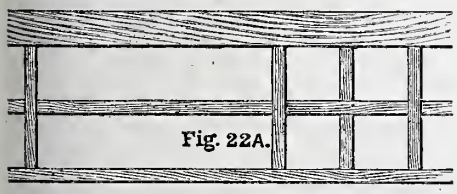


Fig. 22A.

Figs. 20—22 A.—Matchboarding on Walls.

of these may be from one and a half to twice the length of the mitred part. Our two next sketches—Figs. 18 and 19—introduce diagonal boarding alternating with straight. The diagonal boards are cut to the angle of 45°, or, in other words, to the usual mitre of any square panel moulding. They may be repeated without any square work intervening, the different directions of the boards being of sufficient contrast in themselves; but the straight bands between give a greater variety to the whole. The grounds for Figs. 18 and 19 are shown in Figs. 18A and 19A respectively.

The pattern divides itself midway between the top bead and the base in our next sketch (Fig. 20); otherwise it is a repetition of what has gone before, and a diagram of the necessary grounds is given in Fig. 20A. In Fig. 21 is shown a very effective pattern when carried out in a length; the alternate radiating lines contrasting so frequently with each other make a very pleasing result. Of the grounds or straps required a sketch is given in Fig. 21A. Of a more uncommon and quaint character is the design shown in Fig. 22. The square is formed all of square corners; no mitres are used here at all. This mode of forming a square is borrowed from the Japanese, who are particularly fond of this arrangement. The horizontal and vertical lines between the squares are in keeping with them, and the grounds or straps are shown in Fig. 22A. The boards forming the square should have their ends grooved or tongued, as required, to fit the board they butt against, so that all may be firmly bound together. If this be not attended to, the ground behind this square had better be all solid, as in Figs. 13A, 14A, and 16A.

MEANS, MODES, AND METHODS.

An Automatic Gate-fastener.

In this last summer, while wandering in the New Forest, I saw a useful contrivance for keeping gates shut. It was new to me, and as it may be of use to others I will describe it. The gate on which I saw it fixed was an ordinary garden wicket-gate, opening outwards from the garden on to the road.

About ten inches from the fastening, which was the ordinary latch, a staple was driven in, and to this staple was attached a strong iron chain, probably an old trace, or agricultural chain of some kind, about 5 ft. long, with a heavy lump of lead piping hammered on about halfway from either end of the chain. The other end of the chain was nailed on to the wall of the cottage: the chain in reality forming the hypotenuse of a right-angled triangle, the sides containing the right angle being respectively the gate and the cottage wall.

The contrivance seemed to me to be particularly well designed for its purpose. The gate, by opening outwards, could not be opened by any of the many vagrant porkers of the neighbourhood who were wallowing about close to the trimly kept cottage garden, and it could not be opened by any of the smaller children who were in the garden, the latch being outside.

The weight, which may be made of anything, from a broken flat-iron to a flint or brick with a hole in it, was well suited to shut the gate; in fact, to hold the gate open for long would require a certain amount of effort.

The idea may be as old as the hills, perhaps older than many, but I chronicle it for what it is worth. It is useful, I think, to jot down all such notions when one comes across them and get them into Work, for to many they will not fail to be like some of the odds and ends, under the impression that they are sure to be useful once in seven years, if not in less time than that.

H. J. L. J. M.

Improved Operating Table for Animals.

Veterinary surgeons, farmers, and those who keep horses generally, cannot fail to be interested in the following account of a novelty in veterinary surgery in an operation recently performed upon a horse by Dr. L. A. Anderson in his hospital—presumably at Cincinnati, as the description is borrowed from the *Cincinnati Enquirer*:—

"The remarkable feature of the operation was the table and its appliances, by which a sixteen-hand draught horse, weighing 1,200 pounds, was so secured that during the operation, which lasted only eight minutes, the animal moved not a hair's breadth.

"The table is of solid oak, and rests on a stout platform about two feet high. By means of a crank operating on cogs, the table on which the animal lies is made to move slowly upward and downward; the horse, led alongside of the table in an upright position, is securely fastened to it, and then the horse and the table lowered until

Fig. 1.

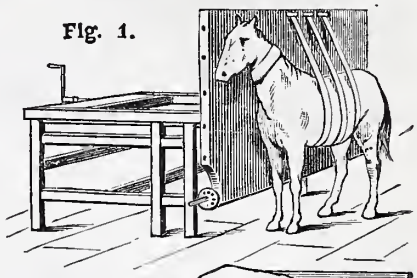


Fig. 2.

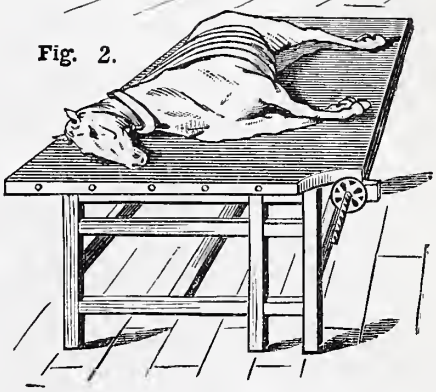


Fig. 1.—Table with Top tilted to secure Horse.
Fig. 2.—Table in Position with Horse secured.

the animal is lying so as to be operated on with ease.

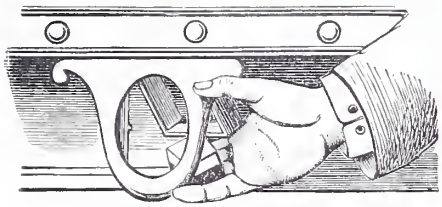
"The horse could barely walk, the spavin on the off hind foot causing such agony. The animal was led alongside of the table, and a stout inch rope fastened to the front of the table was held round the animal's legs by an attendant. The three four-inch wide surcingles were then strapped securely, tying the animal alongside of the table. The head was then fastened to the table, and it was slowly lowered to a horizontal position. The animal at first struggled, but once on the table lay as meek as a lamb. The feet were securely fastened by stout straps to the table, the additional precaution being used of tying the left hind foot with an inch rope.

"The operation is known as cuneon tenotomy, and was first proposed by Professor Lafosse to abolish lameness arising from bone spavin. It requires the division of the internal or cuneon branch of the tendon of the flexor metatarsi. The tendon that gave the trouble is a stout one, a branch of another tendon. It starts from the anterior portion of the hock and runs across

diagonally downward to where the curb generally occurs. The doctor first made an incision an inch long, and a probe-pointed instrument was inserted and the tendon raised and cut, which gave instant relief. The tendon lay in a groove and was readily found. A bony tumour was growing under the tendon, making the tension on the tendon so great that the animal could not put its foot to the ground. Five minutes after the operation the horse was eating hay, and an hour afterwards was walking, with many signs of improvement."

A Billiard Chalk Holder.

This is one of those useful trifles that add to the comfort of billiard-players where they are applied to tables. The common plan is a pocket from which the chalk is not so readily got at as with one patented by Messrs. Hennig Brothers, High Street, Bloomsbury, which is automatic in its



A Billiard Chalk Holder.

operation of dropping the chalk into the hand on touching a small box containing the chalk. The sketch will show its action. It is ornamental in its position underneath the cushion frames, with an open front, allowing the player to see if there is any chalk there, and to replace it easily.

J. C. K.

The Care of Pocket-knives.

What follows may seem to some—or to many—very trivial advice, and scarcely worthy of admission under the heading of "Means, Modes, and Methods," but being a description of a means of lengthening the existence of one of the most useful pocket tools, it may perhaps pass muster.

We all know the charm attaching to the possession of a new knife—we like to hear the business-like click it gives when opened and shut. As time goes on it requires a little force in opening, and help in shutting, and we are apt to say: "What a wretched spring—my knife used to shut in grand style at first, now it won't shut without help. What is the maker's name? Ah! I see; my last knife was just the same, and it was one of theirs too: what poor stuff they must turn out! Next time I buy a knife I'll try one of So-and-so's warranted Sheffield cutlery," and so on.

Now the thing to be remembered about a pocket or penknife is this: that it spends its life in either a waistcoat or a trousers' pocket, in the latter case in the company of a bunch of keys, possibly too a box of wax matches and a few coppers. The pocket by itself is, as we all know, a famous receptacle for dust, and the keys and the other miscellaneous articles mentioned above are bad company for a knife, as they all, and particularly the keys, harbour dirt of a more or less greasy nature. Of all the dirt that is collected in the pocket, a large portion finds its way into the knife, and much of it stays there, especially in the ends, where the spring is free. This dirt collects daily on the spring and the hasp end of the blade, and causes the knife to close with difficulty; and, in ignorance, the owner of the knife blames the maker.

A knife, like any other machine or tool, is all the better for being periodically cleaned and oiled, and it is more easily cleaned than most machines. A pin is sufficient to clean out the dirt in the knife, and will serve admirably to oil the knife afterwards. With frequent cleaning and oiling, a knife will give more satisfaction and last much longer, certainly as far as the spring is concerned.

H. J. L. J. M.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

105.—Imrie's Wood-turner's Cutting Dividers.

I have received from Mr. John Melrose Imrie, 19, Caledonian Crescent, Edinburgh, a tool for wood-turners which has been designed and made by himself, and to which he has given the name of "The Wood-turner's Cutting Dividers." It is a tool that cannot fail to be welcomed by all turners who are engaged in what I may term wholesale turning, as it cannot fail to facilitate their operations and to save them a great deal of trouble in preliminary measurements and divisions before commencing the reduction of the intervening parts with chisel and gouge according to pattern. I do not know the price of the appliance, nor if it be yet in the market, but this can be learnt from Mr. Imrie. The chief purpose of the tool is to ensure equal divisional measurements in all pieces of turned work of the same pattern, whether there be only two bits alike and of the same pattern, or any number of bits proceeding upwards from two as a starting point. Thus, in turning a couple of standards or uprights for any piece of ornamental cabinet work, or in turning the four legs of a table, or dozens of spindles, perfect equality of what I am obliged to call divisional measurements or divisions into spaces by incised rings of greater or less depth is obtained, and a symmetry of parts at the outset, as far as this work of division is concerned, is obtained without any trouble or chance of mistake through any slip in reading the measurements on the rule. Let me now endeavour, by aid of the illustrations, to describe the tool itself, and, in giving a description of it, to show its purpose. First of all there is a handle A, about 6¼ in. long, into which is placed an iron holder B, which can be inserted or removed from the handle at pleasure. The top of the holder is slotted, or made in the form of a fork, to receive an iron rod, screw cut at one end, and placed at right angles to the holder. On this central rod are placed arms D, D, divided or separated from each other to the distance required by brass rings and washers W, W, of various thicknesses, as shown in Fig. 1. The shape of the arms will be best understood from Fig. 2, in which the arm E on the right-hand end of the rod is shown, slotted like the holders to fit on to the rod C. This, in Fig. 1, is shown separated from the fixed nut on the right-hand side by three brass rings, W, W, W, and all the arms (five in number, shown in Fig. 1) are placed on the rod and held apart in the same manner. When the last washer on the left-hand end of the rod has been put on, the whole of the arms and washers are tightened and locked up by the movable nut at the left-hand end, and perfect rigidity is thus obtained, and absolute immobility of the arms, and, therefore, of the cutters as well. The manner in which the cutters E, E are placed and secured in the arms is shown in Fig. 2, from which it will be seen that they are placed in a groove cut in one side of the arm and held therein by a nut F. Now, it is manifest that the end arms, or stops, as they may be, and, I believe, are, called by Mr. Imrie, which, it will be noted, are longer than the rest, indicate the extreme points of the length over which these and the intermediate cutters will act, and the utmost extent to which the stops can be placed apart is governed by the length of the

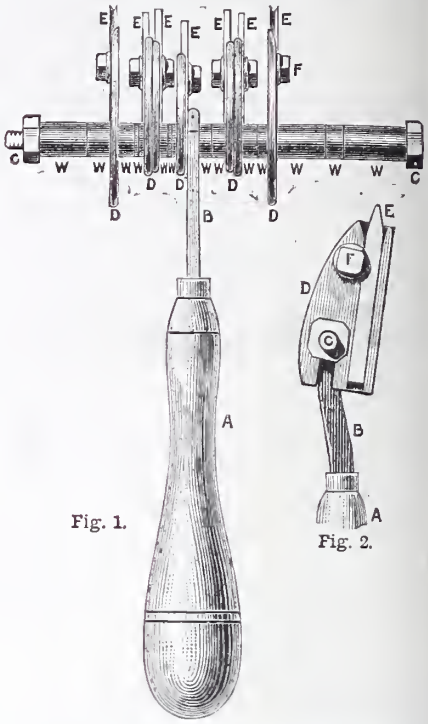


Fig. 1.—Imrie's New Composite Cutting Tool for ensuring Equal Measurements in all Turned Work of two or more Pieces of the same Pattern: Front View of Tool as seen from above. Fig. 2.—Side View of Right-hand End of Tool, showing Mode of securing Arms on Rod and Cutters on Arms.

rod C C. If anyone is inclined to say, "Oh, but this tool is not long enough to cover the whole length of a baluster," I can only reply "No; but by the aid of two or three, or even more, dividers, if necessary, you can set out the different parts of a baluster with a minimum of trouble." Now, see how this tool affects turned work of the same pattern done in large quantities. Possibly some dozens of spindles are wanted, and, in the ordinary way, when the first spindle has been turned, it must be copied, or replicas of it, so to speak, must be formed, involving much care and accurate measurement. But, with Mr. Imrie's invention, as soon as the arms have been set to the necessary distances one from the other, and the cutters regulated for the necessary depth of the incisions, no more measurement from spindle to spindle is necessary, but as soon as one is completed, another piece of wood is placed in the lathe and the preliminary incisions are at once made without any measurement at all. The regulation of the arms is effected on a rule board supplied with the tool for this purpose. End arms, or stops, of different patterns are supplied with the tool; thus for balusters that have a square at each end, pulleys or rollers of hard wood are attached, to protect the sharp corners and prevent them from breaking, as the pulley revolves when it touches the baluster. Mr. Imrie has sent for inspection several beautifully turned spindles in wood and ivory, showing in all cases the wood with the divisional rings incised before the turning is commenced, and the finished spindle. It is equally well suited for elliptic work, as an oval spindle is included among those sent.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Stanley's Portable Saw.—E. R. (*Crouch End*) writes, in reference to Stanley's Portable Saw, noticed in page 502 of this volume:—"Being a subscriber to Work, which in many cases I find of great utility as an amateur worker, I hope you will not think it out of place if I point out to you what appears to me an erratic statement in No. 83 of your valuable Magazine. It is in connection with Stanley's Patent Portable Saw. The idea is by no means novel, for during the American war I was employed in a Paris shipping firm, and we used to ship to America hundreds of dozens of the very same saws, which were intended for amputating legs and arms in the battle-field. Those saws were supplied by M. Charrierè, the most prominent surgical tool maker in Paris."—[It seemed to me from a humane, as well as from an editorial, point of view, that it would be very hard on wounded men who were compelled to submit to the amputation of a limb to have the bone sawn through by a flexible saw instead of the rigid straight saw that is ordinarily used for such a purpose, and I wrote to my correspondent to ask him how the saws did their work, and if they were much used and in any way commended by the profession; and when I was writing I pointed out that the idea of the surgical instrument maker was to enable one man, or at the most two, to do the work of four or five, as in ordinary operations, but that his notions of the manner in which amputations are performed must have been hazy in the extreme, as no man in his sober senses would think either of recommending or resorting to such a plan. The following was his reply:—"Yours of the 17th inst. to hand. I cannot tell you much more about the 'chain saw.' It was about 9 in. long, blued, and the two handles were exactly similar to those shown in the drawing in Work. Of the size of the tenons I have but a dim recollection; they were very flat and the saw extremely sharp, so much so that our office chairs found themselves amputated in the twinkling of an eye: to our great satisfaction, if not to that of the governors. My opinion is that a chain saw for amputating purposes is a clumsy tool, answering its purpose on an emergency, but certainly not to be compared with the regular surgical saw. I may add that a quantity of them were returned to us at the close of the war in a very rusty state, and that Charrierè took them back at a very low figure compared with the original invoice price."—[This was very much the sort of answer that I expected to receive. The saws were in no way suited for the purpose for which they were intended, and although they might have been very effective when used for the dismemberment of office chairs, they were found altogether wanting for parting asunder the bones of men. Whether or not M. Charrierè had a French patent for them I do not know. Possibly not; and I do not think Mr. Stanley need fear vitiation of his own patent through prior claims. Had my correspondent and his friends been in my employ, and tried their pleasing little game of saws *versus* seats, they would have got what is popularly known as "the sack." But I daresay the "governors" were quite as equal to the occasion as I should have been.—Ed.

Fountain.—A. H. (*Brighton*) writes:—"Allow me to thank Mr. C. Maynard Walker for his article and design of Hero's fountain in No. 69 of Work, page 265. I had heard of the fountain, but never could see it or a design of it. When it was published I was spending my spare time in making one to work with a pump driven by an electromotor, but I set to work and tested the plan there and then with three small canisters and some compo pipe, and found it worked first-rate, so I intend to make a large one attached to an aquarium for gold-fish. I should not have written now, but I see F. H. (*Streatham, S.W.*), in No. 69, page 445, thinks he has an improvement, but which, as far as I can see, is just the reverse. When he is filling the chamber A with water, he must wait until the air that is contained in the funnel F is forced out of the jet at the top, which will take a considerable time, according to the size of it, as the fountain won't play until the air is out; and then, again, when the air from B, through D, has forced the water in A down to the bottom edge of F, there will be a spluttering set-out, caused by the air in A and the water in F changing places, which the plan of Mr. C. Maynard Walker does away with."

Electric Light and Electrical Engineers' Sundries.—G. E. B. (*London, S.E.*) writes:—"I have received from the secretary of the Electrical Engineering Corporation, Limited, a copy of their illustrated catalogue, from which I learn that the firm of J. G. Statter & Co. has amalgamated with the United Electrical Engineering Co., Limited, under the above name. The new firm have their engineering works at West Drayton, and their electrical supply works at 36, Albert Embankment, London. They are manufacturers of the Statter-Brunton Patent Dynamos and Electro-motors, and are prepared to undertake the complete installation of electric lighting plants and the erection of electric tramways. I am also in receipt from the same firm of the following samples of electrical engineers' sundries. Tinned steel staples for electric bell and telephone work: these sharp-pointed staples need no bradawl to make holes for them, and they are sold under the name of 'Yankee Jacks,' at the low price of 1s. 3d. per lb. Brass saddles for securing main electric leads to beams and other woodwork: these neat little saddles are secured by brass screws, and are sold at from 3s. 6d. to 4s. 2d. per lb. 'Chatterton's compound,' an insulating substance resembling shoemakers' 'heel-ball,' which is warmed, and then moulded around a wire joint to ensure its insulation. This compound is sold at 8s. per lb. Fine and thin strips of easily running solder for soldering wire joints, sold at 1s. per lb. Copper binding wire, tinned and annealed soft, at 5d. per ¼ lb. bobbin. Various widths of prepared tape for binding around joints to complete their insulation, price 1s. 4d. per lb.; and pure rubber strip for making the insulation more secure, price 10s. 8d. per lb. Any other electric light and electrical engineering sundries of good quality can also be obtained from the above-named firm."

Fretting Banjos.—J. G. W. (*London, N.W.*) writes to B.A.B. (see page 546):—"I was very pleased to see your able criticism of my method of fretting banjos, mandolines, etc. You have made rather a curious mistake in giving Mr. Gleeson-White the credit (if there is any credit attached to it) of writing the directions for making a mandoline, also how to fret banjos, etc.; it should have been yours truly, John Geldart Winder, banjo specialist. I do not agree with you about dividing with the compasses being a formidable undertaking; I think nothing of setting out a scale by the method I give. I do not think that it requires more patience than anything else that has to be done well. Suppose it takes one hour to set out a scale (I can do it in something less than that), what is it? once it is done, it is there for a lifetime for that particular size of instrument. The method you give with the pieces of iron is not new to me, but was suggested to me by a pupil of mine, who is in the piano trade, and who had been experimenting in setting out a scale from my instructions. I should never have given the instructions in 'Shop' if I had not been sure the method I gave was for all practical purposes (playing in tune) correct. When I first commenced the manufacture of banjos, etc., one of the most essential things I wanted was a method for correctly setting out a fretting scale, and our capital paper Work not being published at that time, I had no one to whom I could inquire for instructions how to do it, but had to find out the best way I could. I tried the compasses, and found they worked out the result all right, so have stuck to them ever since. Many other makers may use the same method, and may have used it long before I thought about it; whether any of them do so or not I cannot say. I may tell you that I am pretty well known as a player and teacher, as well as a maker of banjos, therefore I think that I may be considered fairly competent to test an instrument. When I gave the method in 'Shop' I expected someone would attack it; but knowing that the result attained by the method was for all practical purposes correct, I did not care much about that. If you live in London, I should be pleased to let you test a small piccolo banjo with *raised* frets. The shorter the string the more likely it is to expose any defects to the ear."

Riddles.—C. T. C. (*Brockley*) writes:—"Your correspondent J. S. (see page 553, Vol. II.) evidently doesn't know that there is an imperial standard wire gauge, which became a legal measure on March 1, 1884, by order in Council, August 23, 1883. This is gradually being used by many firms, but still more sensible firms work on the decimal part of an inch."

Oval Drawing.—J. W. H. writes, in reply to F. C. (*Leytonstone*) (see No. 84, page 519):—"I am too busy just now to answer you fully, nor do I wish to treat you with disrespective silence; in the meantime, may I just ask you to think out and reply to this? I turn, on a lathe, a brass ellipse, as true as the chuck will do it. Cutting out the middle of the plate—say ½ in. thick, on a bevel or angle of 45°—I turn the edge of the plate elliptical also, and this on a bevel also of 45°; the top face of the plate then forms a frame (without the middle piece, which has been cut out), with two bevelled edges or soffits. Now, which of these four curves is the true ellipse? and which of them is parallel thereto? and whether any other than the true ellipse *is* a true ellipse? and if so, which, and why?"

Exhibition Memorial Number of Work.—Subscriber writes:—"I have several friends in our colonies who take a great interest in Work, and, doubtless, will in the approaching Exhibition. As it strikes me the 'Memorial' number will soon run out of print, I intend ordering at least six copies from my bookseller at once, in order to send them abroad. Perhaps some of my fellow 'chips' may like to be put up to this precautionary wrinkle, as there is sure to be a speedy run on this Memorial number."

II.—Questions Answered by Editor and Staff.

Flatting Plates for Fenders. — Fender-maker.—The main thing is to be able to see where the plate requires hammering, as sometimes a plate that seems far from flat will only require a few blows judiciously placed to put it right. If your plates are thin, it is more difficult to flatten them than if they are fairly stout. If the plates seem fairly straight along the edges, but seem to rise in the centre, the main force of the blows should be towards the edges—that is, commence with light blows in the centre, and work outwards with heavier ones, noting carefully the result of each few blows, so as not to overdo it in any one place; if the plate seems twisted and sprung, it will probably require more hammering in the centre parts. I should advise you to practise on odd pieces and carefully note results; use a flat anvil stake, and a hammer also perfectly flat, but with a rounding edge, to avoid marking the plate.—R. A.

Solder.—T. E. D. (*Northampton*). — Solder for metal pots. Take ½ lb. of lead, 1 lb. of tin, and 2 oz. of bismuth; for a flux, use resin or resin and oil.—R. A.

Circumferences of Circles.—A. U. G. (*Chippenham Road*).—For all practical purposes the ratio of the circumference to its diameter is taken as 3·1416 to 1, or in the nearest vulgar fraction, 3½ to 1, or, in whole numbers, 22 to 7. Thus to find the circumference of a circle, multiply the diameter by 22 and divide by 7. The circumference of a circle 5¼ in. diameter is $\frac{5\frac{1}{4} \times 22}{7} = 16\frac{1}{2}$ in. The *exact ratio* of the circumference to the diameter has never been determined, but some enthusiastic mathematicians have worked it out to some hundreds of places of decimals. You can buy tables of circumferences and areas of circles at any technical bookseller's, such as Batsford's, in High Holborn.—F. C.

Condensation of Steam.—Aqua (*Sheffield*).—From Regnault's "Tables of Density and Temperature of Steam at Various Pressures," we find that at a temperature of 385° F. it has a total heat (including latent heat) of 1231·5° F., and therefore, to reduce it to 208° F., the heat abstracted must be 1231·5 less 208°, which leaves 1023·5° F. To raise the condensation water from 56° F. to 208° F. we must add 152° F.; hence, for equal weights the ratio of condensation water to steam will be that of 1023·5 to 152, and, dividing the former by the latter, we get 6·73 lbs. of water per lb. of steam. One quarter of a cubic foot of steam at 385° F. weighs 0·1035 lb., therefore the condensation water required will weigh 0·1035 multiplied by 6·73, equals 0·696—say, 0·7 lb. Taking water as weighing 62·5 lbs. per cubic foot, this will be equal to about 19½ cubic inches.—F. C.

Marine Glue.—Busy Bee.—Dissolve by heat one part of pure indiarubber in twelve parts of mineral naphtha or coal-tar; when melted, add twenty parts of powdered shellac. Pour out on slab to cool; when used, to be heated to about 250°, or slightly above boiling water; the application of too much heat would set the mixture on fire.—P. B. H.

Oval Chuck.—A. W. D. (*Colingus*).—The answer to your query only awaits its turn in "Shop," which is still overcrowded.—Ed.

Tricycle Hut.—Busy Bee.—In Work, No. 64, there appeared an article, with sketches, entitled, "How to build a Tricycle House." If this article will not answer the purpose, Busy Bee must say what the *difficulties* are in the roof, and state also if he wants the pieces to pack exactly square with each other, as in this case. The sides in the above mentioned hut are not square, but slope towards the back, so that the water may run from the roof: which is very necessary. The parts can be packed on the roof, and it can be taken to pieces, without help, in about half an hour, and put together with the help of a single person in about the same time. Probably the dimensions might be reduced and the house made lighter if the machine were of small dimensions.—P. B. H.

Replies in "Shop."—J. McA. (*Barrow*).—If your query has, as you say, been briefly acknowledged in "Shop," there can be nothing very "disrespectful" in the treatment you have received. Hundreds of letters come every week for "Shop," and each one has to be sent into a different direction to be replied to by a specialist; thirty per cent. of the questions need an illustrated answer, which means time for the artist to draw and the engraver to cut; there is about one-third of what there should be in the way of space available each week in Work for "Shop"—hence the arrears, among which, doubtless, is yours. To meet these arrears the publishers are, at periodical intervals, presenting, without charge, four-page supplements of "Shop." What more can be done? Be a little more patient.—Ed.

Simple Circular Saw Machine.—Sawyer.—You find the labour of sawing wood "laborious," and wish for assistance to make a simple machine for the purpose. Now there is a good deal of power required to saw wood, even under the best conditions, and you cannot avoid that by using a circular saw instead of a hand saw. All that you can do is to see that you have a suitable saw with the proper number of teeth, properly set and sharpened, and then apply it well. If the work you have to do is short, and most work is so, then a saw on the principle of the Britannia Co.'s (see page 29 of Vol. I.) will help you. Here you have simply a powerful fly-wheel running at a good speed; you have to work away at the treadle till you get

up a good speed, and then you have enough power stored up to rip a plank 3 ft. long. Of course, it can't give out any power but what you have yourself put into it, but it is easier to apply the force gradually and allow the machine to store it up and give it out when wanted. Sawing is *intermittent*, that is the secret of the power of that saw. Perhaps you could fit up a circular saw on a long spindle having a 50 lb. fly-wheel on the end of it, sufficiently far off the saw (say 2 ft.) to be out of the way in most work. Or could you not manage to buy your wood from a saw mill, where they would rip the planks by steam to the widths you require? Or, again, are you using a suitable saw in your work? It would be very hard and tiresome work to rip up deal planks with a panel saw of nine points to the inch. If you have much sawing to do, I advise you to get a rip saw and keep it sharp: let it have four points to the inch, and you will be surprised to see how it will walk through an inch plank.—F. A. M.

Unmounted Lenses.—MILL will doubtless obtain what he requires from Messrs. A. Coiffier, of 13, Hatton Garden, London, E.C.; or Messrs. Joseph Levi & Co., 2, Dyer's Buildings, Holborn, and 10, Hatton Garden, London, E.C.; both of these firms are importers of foreign goods. Mr. E. S. Platt, Birkbeck Works, Birkbeck Road, Ridley Road, Kingsland, London, N.E., can supply the material called "Imperial cloth," used for camera bellows making. It is perfectly waterproof and unaffected by the extreme changes of climate, and may be washed with soap and hot and cold water if required. This material is the nearest approach to leather at present made, and can be had in morocco or cross-grain at 3s. per yard of 45 in. wide. A special quotation will be given if you require a considerable quantity.—C. A. P.

Blueing Gun Barrels.—URGENT.—I am not able to say how the trade blue their barrels, but you might try the following:—Dissolve ½ oz. hyposulphite of soda in 1 lb. of water, and to it add ½ oz. acetate of lead, previously dissolved in ½ lb. of water; place the articles to be blued in this solution and heat it to nearly boiling, but it should not quite boil. A sulphide of lead is formed and deposited on the articles; if of iron, a steel blue colour is the result.—R. A.

Varnish.—A. P. (*Halifax*).—I cannot help you in your difficulty, as your varnish (or rather polish) seems to be made all right, though for pure polish you might as well leave the resin out. Possibly the ingredients may not be good, but it is more probable that the dulness arises from some defect in working. Are you sure the dulness is not caused by the varnish or polish sinking into the wood, and that the work was done in a warm, dry place?—D. D.

Hutch, etc.—WHOG HITMSDLOG.—(1) I cannot recommend you to use cane instead of wire netting for any hutch. For one thing, it will be more troublesome to use cane; and for another, cane is not as durable. (2) For a mouse-cage, have an oblong box with part of the front enclosed by a wire door, and a smaller part enclosed by a wooden door and separated from the other by a partition with a hole in it. Size is not of much consequence, and must depend on your own wishes. Keep the cage clean, and, if you prefer it, have a sliding tray or false bottom. (3) Quite impossible to give designs for all sorts of stencils in "Shop."—D. D.

Lantern Slide Painting.—SUBSCRIBER asks what varnish is used in painting slides in water-colours. There is a special varnish prepared by Messrs. Rowney & Co., London, which is all that can be needed. Any dealer in artist's material can supply it. In purchasing, it should be stated that it is to use with water-colours.—O. B.

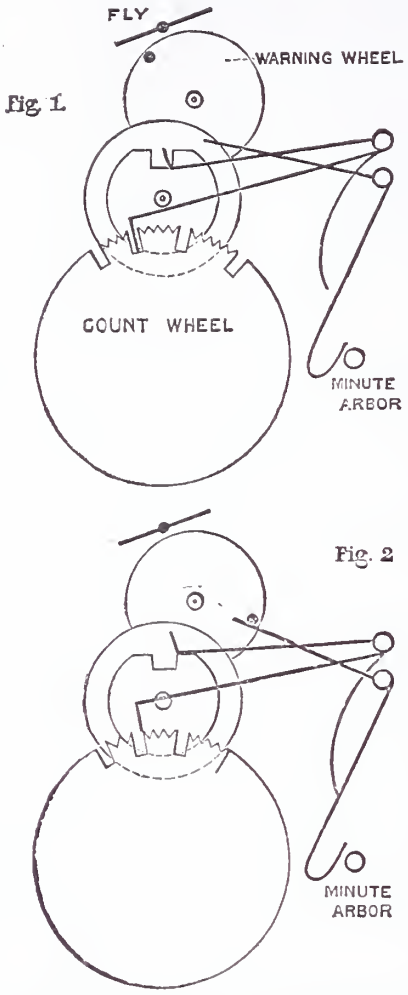
Taking Out a Patent.—INQUISITAS.—No one is obliged to employ a patent agent, and when the inventor has the skill to make his own drawings, and the intelligence to write his own specifications, there is no occasion for employing one. The regulations with regard to drawings are strict—too long to be given here. Our correspondent will find them in the official "Circular of Information," which he will get, post free, by writing to the Patent Office, 25, Southampton Buildings, Chancery Lane, E.C. By all means, get and study this circular; also read the article on "Taking Out a Patent," in WORK, No. 35, Vol. I., page 545.—C. C. C.

Model Locomotive.—R. F. (*Newton Heath*).—To deal sufficiently with this subject would require a series of many papers for which I have no available space at present.—ED.

Wiring Tinware.—E. J. B. (*Chesterfield*).—The general run of pieced tinware made by ordinary tinmen is usually wired in the flat; if it were wired after being formed it would be more difficult. I should think you have not used the machine very long. Perhaps you do not take up fold enough for the wire. Try again, and if you cannot succeed, give full particulars as to your mode of working.—R. A.

Staining.—W. B. (*Inchinnan*).—Try and make your joints so good that they do not necessitate stopping. If you want to make some, melt resin and beeswax together. This may be either run into the cracks while hot, or kept in sticks similar to sealing-wax, and melted with a hot piece of iron into the joints. Colour the mixture to suit the wood it is being used with. As you are evidently a novice at painting and graining, do not make your first attempt at the latter on such a conspicuous piece of furniture as you name. Paint it nicely in one uniform colour, relieved, if you can manage, with lines of another shade or colour, after the manner in which so much art furniture is finished nowadays.—D. D.

American Striking Clock. — AMBITIOUS HEIGHT.—The pin on the minute arbor is quite right, and should begin to lift the other wire at about ten minutes to the hour; the wire that it lifts has, or should have, another piece on it, beside the one that touches the wire on the minute arbor; and that piece should come up high enough to catch the pin in the wheel next to the fly, and should hold it until the wire drops off the hook piece on the minute arbor. The piece that is lifted by the minute arbor, after rising a short distance—say, ⅛ in.—comes against an arm of the piece that drops in the count plate, and also in the notch of the disc on the second wheel from the fly; now when the arm has fallen in a long notch in the count wheel,



American Striking Clock. Fig. 1.—Striking Part when at Rest. Fig. 2.—Striking Part whilst on the Warn, and waiting for the Arm to drop off Minute Arbor Pin or Hook.

the arm in the disc should fall down to the bottom of the notch nearly; but when the arm is in a shallow notch of the count wheel, the arm on the disc should be just free of the top of the notch; it will then strike till it falls in a long step or notch. You have, very likely, bent the wire that catches in the warning pin (that is, the pin in the wheel that drives the fly) up too high; or, it may be, too low. That is evidently where the fault is. When the striking is at rest, arrange the wires as in Fig. 1; then put the hand up to the Figure XI. on the dial, and see that they are as in Fig. 2.—A. B. C.

Triunial Optical Lantern.—N. (*Kilburn*).—Fig. 1 is not drawn to scale, and merely gives the appearance of the lantern when completed. Figs. 2, 3, 4, 5 and 8, are ⅛ in. of the real size, therefore, every ⅛ in. in these cuts will represent 1 in. in the full-size plans. Fig. 9 is full size, but the remaining diagrams are not to scale.—C. A. P.

Drawings and Specifications.—A. C. (*Peterborough*).—You should advertise your name and address, and willingness to undertake such work, in "Sale and Exchange" columns of WORK.

Lathe Matters.—R. N. (*Grays*).—There is no periodical devoted solely to this work.

Wiring House for Electric Light.—AMATEUR (*Putney*).—Your two diagrams of wiring for electric lights are both wrong. If you run a wire from the dynamo and return the other end to the machine, so as to form a loop, as shown in your sketch, the current will traverse this wire, but will not pass through the lamps which form bridges across the loop. The outgoing lead must terminate entirely at the end of the run, and the incoming lead must start independent of the other, not be connected to it, as shown in your diagrams. The circuit is completed through the lamps. If you have one or two, or more, leads from the dynamo to various parts of the house, one of which feeds lamps in an electrolier, these must either be connected in parallel—that is, so as to form bridges between the leads as on the other circuits—or, if connected in series, as shown in your sketch, their combined resistances must be balanced by a resistance placed in the other circuit. If this is not done, the lamps in the electroliers will not get sufficient current to light them. For instance, in your first diagram you have four 15-volt lamps on one circuit in parallel. These will offer a resistance of about 4 ohms. In the other circuit you have two electroliers of three lamps each, the lamps connected in series. These will offer a resistance of 23 ohms, and you would not get sufficient current through them unless you interposed a resistance of 19 ohms in the first circuit so as to balance the resistance of the second. In your second diagram the arrangement is worse still, with an additional electrolier bearing five lamps in series on the same circuit with one of three lamps. In planning the wiring of a house for electric lights, you must first take into consideration the output of the dynamo, and arrange the lamps to suit its ability. If it gives a current of high voltage, the lamps must be arranged in series. If the volume of the current is large, but of low voltage, arrange the lamps in parallel. You will find full instructions in the series of articles on "Model Electric Lights."—G. E. B.

Small Dynamo.—ARMATURE (*Walsall*).—To light up two 10 c.p. incandescent lights, you will want a machine of the Siemens type, of the following dimensions:—Field magnet cores, 5 in. by 4 in. by ⅞ in., wound with 4½ lbs. No. 22 cotton-covered copper wire; laminated H girder armature, 4 in. by 1¾ in., wound with 10 oz. No. 20 double cotton-covered copper wire connected in shunt with the field magnet coils. Drive at 2,500 revolutions per minute. See the articles on "Model Electric Lights" for more detailed information.—G. E. B.

Small Storage Battery.—M. NSD (*Wigan*).—You are wrong in your "list of things wanted to make a small storage battery." I suppose you have read about a battery made up with "half-round porous cups," but I have no idea where they can be obtained, unless you have them made for you at a pottery. Sulphate of soda and sulphuric acid can be had of any druggist at a low price. What do you want with sulphate of copper cells? These are simply the cells of a Daniell battery. You do not need these to make a small storage battery. I advise you to read all that has appeared in "Shop" respecting accumulators, and to also read carefully the articles now being published on "Model Electric Lights." You will then have a clearer idea of the things required to make a "storage battery," which is only another name for an accumulator.—G. E. B.

Lineff Tramway.—R. R. Y. (*Cananoque, Canada*).—In the Lineff Patent Electric Tramway, a magnetic conductor is employed, buried in a channel running along under the central rail, which is laid flush with the surface of the roadway. An electro-magnet on the car attracts the magnetic conductor, and completes the circuit through an iron wheel which runs on the central rail. As the flexible iron ribbon, which forms one conductor, is only drawn into contact with the central rail when the car with its powerful electro-magnet passes along over it, there cannot be any danger from an accidental shock either to horses or human beings. A full illustrated description of the Lineff Electric Tramway is given in the *Electrical Engineer* for October 10th, 1890. The address is, the Lineff Electric Traction and Lighting Syndicate, 11, Queen Victoria Street, London, E.C.—G. E. B.

Address Wanted.—Will DEAN FOREST (see page 519, Vol. II.) kindly send his full name and address to the editor of WORK, as a letter awaits him at the office of WORK?

Fret Saw. — AMATEUR.—There is nothing to prevent a circular saw being fitted to the Britannia Company's No. 8 fret machine. You might have ascertained what you wanted to know by writing direct to the makers. The thumbscrew must be used every time when fixing a saw in a fresh hole in wood. In this respect the machine in question does not differ from any. You cannot get a better fret machine than the No. 8 of the Britannia Company.—D. A.

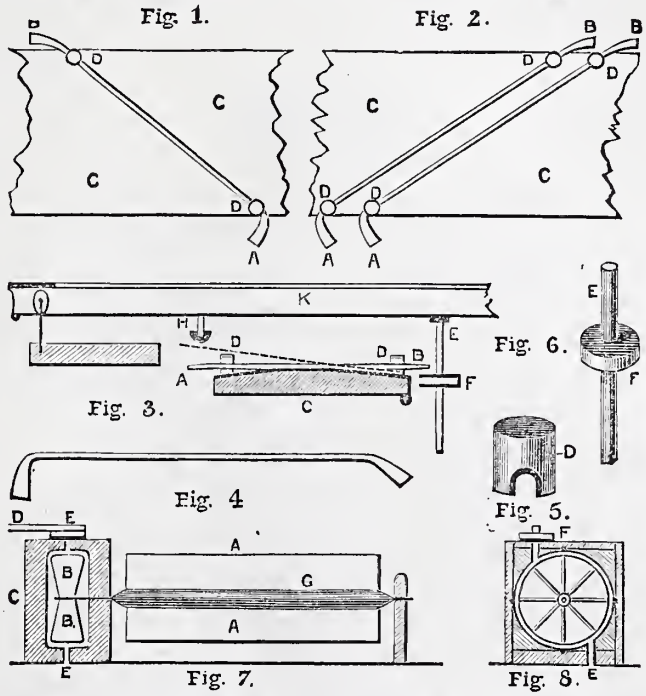
Frames.—W. J. W. (*Whitehouse*).—The frames can be purchased from any of the factors or manufacturers who supply the trade. There are many of these in London. Without being acquainted with the class of goods you supply, it is impossible to recommend any particular firm as likely to suit you. Those who are in any particular trade have no difficulty, even if travellers do not call on them, of ascertaining, through ordinary trade channels, the sources of supply.—D. D.

Weights of Metals Book.—J. B. (*Louth*).—You should get Penn and Ryberg's "Tables, showing the Weights, etc., of Iron, etc." 2s.; J. Blackwood, 8, Lovell's Court, Paternoster Row, London.—K.

Carpenters' Brace. — F. F. (*Leytonstone*).—I have used a brace made on what is called the American pattern for some years, and I find they will hold almost any bits firmly and fairly true, the

only exception to firmness of grip being in the case of stout stems, such as large centre-bits have, but, for the great majority of bits, the brace leaves nothing to be desired; as to truth of centring, that depends on the bit; but the stock or brace made on the American pattern by Sorby, of Sheffield, with ratchet, which is very useful in corners, beats, both for quality and price, any American article of the kind. The cost is but 4s. 6d. with ratchet.—B. A. B.

American Organ Coupler and Vox Humana.—COUPLER.—I am not much acquainted with the practical work of American organ construction, but I give you such information as I can, which will, I think, enable you to add couplers and vox humana to your instrument. But I must first caution you that if your organ is without stops the bellows may not be sufficiently large to supply couplers. As regards the coupler, it merely consists of pieces of wire about ¼ in. thick bent and flattened at the ends, as shown in Figs. 1, 2, and 4, fixed loosely at each end on a platform, marked C, by means of two round pieces of wood, marked D, and of which a view is given in Fig. 5. Figs. 1 and 2 show a plan of the platform and wires, the first coupling downwards, the other coupling upwards. Fig. 3 gives a section showing how the coupler is placed with regard to the keys—A B is the coupler wire; C, the platform; D, the pinch-pin; E is the plunger which the key presses down to cause the note to sound. On this is fixed a wooden collar F, covered with soft leather on the top. On the underside of the key K is a little peg of wood H, with a button on the lower end covered with leather on the underside. When the coupler is in action, and the key pressed down, the peg H presses on the A end of the coupler wire, causing the wire to partly revolve, the B end of the wire presses on the button on the plunger of the key an octave higher or lower, as the case may be, and causes that note to sound also. The sketch shows the coupler out of action. When the draw-knob is pulled out it causes the front end of the platform to be drawn up as shown by the dotted line, so that the A end of the wire is close under the peg, and the B end close down on the collar of the plunger. The platform should be slightly rounded on top, so as to lessen friction on the wires, and the underside of the grooves in the pinch pins should be lined with leather or cloth, so that there may be no noise in working. The platform may be either hinged or centred at the back. Any stop action (such as a square or a lever) that will raise the platform will answer the purpose. Fig. 6 gives an enlarged view of the button on the plunger. The platform will only be about 2 in. wide, ½ in. thick, and long enough to carry all the wires required to be actuated by one draw-knob. This coupler action can be placed in a small space, as it requires but little room for working. As regards the vox humana, or fan tremulant, Fig. 7 gives a general view of the fan and a section of the box in which the motor wheel is enclosed to be actuated by the wind. The construction is very simple. The spindle G is a round rod of wood 12 in. or 15 in. long, and ⅜ in. thick, grooved by a thin tenon-saw cut on two opposite sides to receive the fans A, which are simply two pieces of thin cardboard about 2 in. wide and nearly as long as the spindle, into the grooves of which they are glued. The axes on which the spindle turns are pieces of steel wire (pieces of a knitting needle will do well), great care being taken to insert them truly in the centre of the spindle. The left-hand axis is sufficiently long to pass through the wind-box C and to receive the motor wheel B. The axle hole in the wind-box must be bushed with cloth, to prevent inrush of wind. The motor wheel, of which a front view is given in Fig. 8, is made with six or eight leaves of thin wood or tin, and the box in which it is enclosed may be made of thin veneer bent round, built up square, or turned out of a solid piece of wood with a circular hollow sunk in it to receive the wheel. Probably an amateur would succeed best by the second method, building up a square box 4½ in. high and the same width, and 1½ in. or 2 in. deep in the clear. As the space in which the wheel works must only be large enough to allow the wheel to clear, corner pieces must be added, as shown in Fig. 1, so as to form the circular hollow for the wheel. The wind comes in from the top through a small hole F, so that it strikes on the wheel in the position shown in Fig. 8, and is drawn out through the hole at the bottom marked E, which communicates with the bellows. Of course you know that in the American organ the bellows acts by suction and not by pressure, so that the wind is drawn through the hole into the bellows, and is not blown from the bellows and through the top of the wind-box. The hole F is about ½ in. diameter, countersunk on the top, and covered with a valve of wood or leather which may be connected to a rod D as shown, which will be lifted when the draw stop is pulled out. Any other stop action that will lift the valve clear of the opening when the stop is drawn will answer equally as well. It must be understood that the wheel is entirely enclosed in the wind-box C, the left-hand end being screwed on, and the fan and wheel must be made as light and true as possible, or it will not work. Place the whole affair at the back of the treble tube board, over the bellows, boring a hole through to connect the hole in the bottom of the wind-box with a similar hole in the bellows. You will notice that the holes in the wind-box come in the centre of the wheel, as seen edgeways in Fig. 7, and in opposite corners, as seen sideways in Fig. 8.—M. W.



American Organ Coupler and Vox Humana. Fig. 1.—Coupling down. Fig. 2.—Coupling up. Fig. 3.—View of Coupler, showing its Position under the Keys. Fig. 4.—Coupler Wire. Fig. 5.—Pinch-pin (full size.) Fig. 6.—Plunger with Collar. Fig. 7.—Front View of Vox Humana. Fig. 8.—End Section of Wind-box and Motor-wheel.

Triple Optical Lantern.—OPTICUS AND OTHERS.—*Re* lowest cost of the condensers, objectives, jets, etc., required for a triple lantern, as described in WORK, No. 83. The cheapest house from whom to obtain these requisites is Messrs. J. Theobald and Co., 4, Bath Place, Kensington. This firm will supply 4-in. compound condensers, mounted in brass cells, at 9s. each; rack and pinion double combination portrait objectives, 12s. 6d., or the same with flashers and extra large-faced lenses, 14s. 6d. Well-finished blow-through jets, 9s. 6d. each, or with cog-wheel lime-turners, 12s. 6d. each. A dissolver will also be required, and, as a triple dissolver is an expensive affair, it would be cheapest to fit a six-way dissolving tap on to the twin lantern, and a four-way tap to the third or top lantern. These taps will cost 12s. 6d. and 10s. 6d. each respectively. Second-hand dissolvers and jets can very frequently be purchased cheaply. A short time since Mr. Tyler, of 48, Waterloo Road, London, S.E., offered some jets in good condition at prices ranging from 4s. 6d. to 12s., likewise some dissolving taps at 6s. 6d. to 10s. 6d. each, and ready taped 9-ft. screens for 7s. 9d. As the above will constitute the chief items of expenditure, it will be an easy matter for you to calculate the cost of the materials required in the construction of the lantern. In a manufacturing town like Sheffield you should experience no difficulty in obtaining the sheet-iron required for the lining of the lantern, or the brass tubing and brass plates for the stages; and as for the wood, it is always possible to pick up a couple of dining-table leaves cheaply at any second-hand dealer's. You could lessen the cost of the instrument considerably by making a biunial or twin lantern, as this would answer all ordinary purposes for dissolving views, and for a certain class of effect slides. You would then require a pair each of condensers, objectives, and jets, together with one six-way dissolver.—C. A. P.

Drawing-board and Materials.—APPRENTICE MECHANIC.—You can purchase all drawing materials of any artist's colourman, and most stationers and booksellers will procure them on your order.—ED.

Boiler and Bridge-making.—ANXIOUS INQUIRER (*Wednesbury*).—"A Treatise on Steam Boilers," by R. Wilson, C.E., 6s., and "Materials and Construction," by F. Campin, C.E., 3s.; both published by Crosby Lockwood & Son, London.—F.C.

Hard Rubber Tyre.—T. H. N. (*Cockermouth*).—You cannot soften hard rubber tyre. If it was good rubber it would be soft. Hard tyres are made of a composition having a certain percentage of rubber—how much or how little depends on the price it is sold at, or on the honesty of the seller. I paid a good price for a tyre not long ago; I hung it on a nail in the wall, it broke at the nail by its own weight. It seemed to be composed mostly of red clay.—A. S. P.

Transmitter.—M. A. C. (*Glasgow*).—I cannot trace your former query. If you want to set up two or more telephone stations you cannot make an instrument that will work satisfactorily as transmitter and receiver.—W. D.

Charcoal Iron.—J. S. R. (*Burton Latimer*).—The ordinary ferro-type plate would suit your purpose well enough. There are not many firms who deal in this class of stuff. "Tinfoil of about 15 square feet to the pound." Any chemist will supply this.—W. D.

Spiral Chuck, etc.—OVERHEAD.—As to *mechanical movements*, there is a series of articles on the subject, with illustrations, in Vol. XI. of the *English Mechanic*, continued from the *Mechanic*, which the *English Mechanic* absorbed; these articles are taken from a useful little work on "Mechanical Movements," by Mr. Henry J. Brown, Editor of the *American Artizan*. You might get this book through an American publisher in this country. I have just found a cover containing ten sheets of "Diagrams of Natural Philosophy" in quarto, and a pamphlet explaining them in a popular manner, published by James Reynolds, 174, Strand; no price is marked: these are pretty good, though about thirty years old. You wish to know whether a notice of the spiral chuck will appear in WORK: I hope that nothing of real use on the lathe will escape notice; but we are yet at an early stage. You can very easily dispense with a spiral chuck by marking the change wheels, and then, between each strand of your spiral, lowering the wheel-plate and passing the correct number of teeth. For instance, say you wish to cut a spiral of ten threads or strands; then have on the mandrel a wheel with, say, 100 teeth (any multiple of 10 will do); you cut one strand, then, since you wish to turn the work one-tenth before you cut again, mark with chalk the 100 wheel, and the one it gears with at the point of juncture; then loosen the wheel-plate, and, turning the 100 wheel, pass ten teeth and lock in again; continue so till you get round. Another plan is simply to use the click wheel of the eccentric chuck for dividing the strands. A spiral chuck *should* fit on the tail end of the mandrel, not in front where it is often put. Get Nos. 863 and 901 of the *English Mechanic*, you will find full descriptions of both plans.—F. A. M.

Voltmeter.—CYMRO DEWI.—At some future time I hope to describe a voltmeter. The following will do as a make-shift, and give tolerably accurate results. Get a pocket compass, and fix to a disc of wood a little larger so as to form a stand for the compass. On each side of the compass, and close to it, fix a small telegraph pattern binding screw or small brass pillar. Stretch a piece of fine brass or German silver wire exactly across the centre of the compass, close down to its face, and connect the two ends to the two pillars. Turn the stand around until the compass needle lies in a line with the wire. If, now, a current of electricity is sent through the wire, the compass needle will deviate from the line of the wire in proportion to the strength of the current passing through the wire. By connecting up one cell of a Daniell battery to the wire, and noting the deviation of the needle, we may put this down as representing one volt, and any number of volts may thus be determined by coupling up Daniell cells in series, and sending their current through the wire.—G. E. B.

Advertisements.—BATHONIAN.—I can only repeat to you what I have told many other subscribers: that while you regard the advertisements in WORK as a blemish and eyesore, other readers look upon and consider them as useful for reference, and always ready at hand if occasion requires.

Soldering and Staining.—D. T. (*Chatham*).—If you and any other new subscribers will buy the Index to Vol. I. of WORK, you will find therein a host of references to both soldering and wood staining. Then purchase the requisite back numbers of WORK.

Cold Brazing.—A READER.—Cold brazing is a delusion and a snare as regards any practical work; it is not suited for the job you want it for, nor for anything else where strength is required; nothing beats the old-fashioned fire and spelter, or blow-pipe and ditto. The receipts you speak about are simply catchpennies; they have been published in various journals. If, however, you should care to try the process, here is a receipt and directions for cold hard soldering:—Melt 10 dwts. of tin in a crucible, and add in the following order as soon as the tin melts, bismuth, 1 dwt.; fine silver, 8 dwts.; platinum foil, 1 dwt. When melted and mixed together pour into a mould. Reduce this to filings, and reserve till wanted. To use this solder, prepare the article for soldering by scraping and cleaning

as for ordinary soldering. "Tin" the surfaces to be united with a little of the following flux:—One part metallic sodium to fifty parts mercury; let this flux be prepared by a chemist, and kept in a closely stoppered bottle. Mix three parts of the solder filings with one part of mercury in a mortar till reduced to a paste, smear it on the surfaces to be united, and press firmly together: it will set hard in a very short time. Suitable only for articles that cannot be exposed to the heat necessary for brazing in the ordinary way, and that are not likely to get strained or knocked about.—R. A.

Hydrostatic Bellows.—HYDRO.—HYDRO has made a hydrostatic bellows; the sides or connection between top and bottom are of American cloth, with the inside coated with boiled linseed-oil, which arrangement answered until the water began to ooze through small cracks. If I purposed making such an instrument I should use stout waterproof cloth from a rubber manufacturer: this would be much better. Another difficulty is that the present cloth is fastened with copper nails ½ in. long, driven close together, and he asks, how can they be removed? This ought to be no serious difficulty. Supposing the circular top and bottom were turned in a lathe, re-mount them, and cut off, say, ½ in. each side down to the nails, and then when the head and part of the shank are exposed they can be easily withdrawn. Or if they were simply sawn out, then cut away the wood with a chisel down to the nails. —O. B.

Chamber Organ Drawings.—POOLE.—Too long an answer would be needed to deal with this in "Shop." Wait until the Organ Building articles appear in WORK.

Spelter.—BRAZING.—You have not gone wrong. You had not the right kind of spelter. Spelter is certainly not "brass borings," and if he said it was, he either does not understand his business, or he deliberately sold a lot of rubbish. In future, if you want to braze anything very particular, and are not sure of your spelter, try a piece first on some of the same kind of metal that you wish to braze. If you want good, easy running spelter, apply to Messrs. Warner & Sons, Crescent Foundry, Cripplegate, or to Berham & Froud, Chandos Street, W.C.; you should state what you want it for, and you will get a good article.—R. A.

Shocking Coil.—C. A. B. (*London, N.W.*).—We have not yet published any articles on shocking coils, or on motors for revolving vacuum tubes, but a series of articles on these subjects is in course of preparation for WORK.—G. E. B.

Gilding Jewellery.—T. G. P.—A short series of articles on this subject is now being prepared. You will learn better how to gild your few "odments" of jewellery from reading an article on the subject, than from a few brief directions in "Shop".—G. E. B.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Cardboard Models.—J. F. (*Mullingar*) writes:—"I shall be glad if any reader will let me know of any work published instructing how to prepare models in cardboard. I should like to have address of publisher and price."

Wire Gauge.—J. G. (*Glasgow*) writes:—"Could anyone give me some information anent the new legal standard wire gauge—if it was instituted by Act of Parliament, or otherwise; also if the Birmingham wire gauge is now abrogated? My warm thanks to HERR SPRING for his simple, yet clear, demonstration of how watch hands can be turned back without affecting the movement. The gauge, also, I now understand, and will be of use."

Blacksmithing.—G. A. T. (*Ilfracombe*) asks for addresses where he could obtain designs for wrought iron gates, suitable for a gentleman's villa.

Carvers' Tools.—J. D. (*Tiverton*) writes:—"Will any reader furnish me with the addresses of good carving tool makers?"

Fire-proof Safes.—J. D. (*Tiverton*) writes:—"Having discovered that some silver plate, which had been deposited in a fire-proof safe, had taken rust, I asked a silversmith about it, and he told me that it was owing to damp, which was often, if not always, the case with articles placed in above-named chests. Might I ask if other readers of WORK have had similar cause to complain, and if there is any remedy? Would lime absorb the damp and keep the air dry and sweet?"

Punt.—W. P. (*Cardiff*) writes:—"Would any reader kindly instruct me as to making a small 'punt?' I have a great liking for a punt."

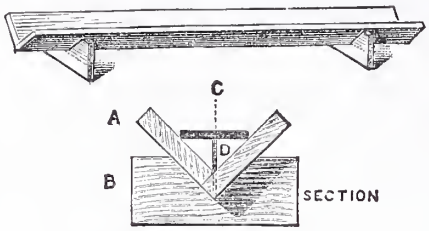
Rabbit Skins.—IDEM SONANTIA writes:—"Will some kind reader give me instructions how to cure rabbit skins for domestic use?"

Appointment.—A. T. (*Eastbourne*) writes:—"Would it be possible for me to obtain a situation under the British East African Company as smith; and if so, where could I apply?"

Window-cleaning Chemical.—C. T. (*Ashton-under-Lyne*) writes:—"About twelve months ago I saw a man in Leeds washing windows with some kind of liquid preparation which he kept in a gutta-percha or indiarubber bottle; he put some of it in a bucket of water, brushed it on the glass, and washed it off with clean water, and it cleaned all the dirt from the glass without doing any harm to the paint or putty. Can any reader oblige me with particulars of this preparation? Would it be a chemical acid?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Venetian Blind Painting.—E. C. (*Norwood*) writes:—"In reply to your appeal for co-operation from correspondents, I beg to forward subjoined sketch of trough for the rapid painting of Venetian blinds. I have painted many of them, and for the benefit of ASPIRANT, who writes under the heading of 'Venetian Blinds,' page 522, Vol. II., I give the following details:—The trough is made out of any kind of wood, ¾ in. by 5 in floor-board answering the purpose first-class, about 4 ft. 6 in. being most convenient for length, and the two pieces nailed together at an angle of 45°, and resting on two bearers, each fixed about 6 in. from each end; a nail is then driven perpendicularly into the bottom of the inside of the trough, as at D, about 3 in. from one end, which acts as a stop for the lath while under the brush, without which the lath would slide out of the trough. The nail should not be above the level of the lath, or it will cut the brush in the centre—only just sufficient to answer the



Trough and Parts.—A, Trough; B, Bearer; C, Lath in Trough; D, Nail Stop.

purpose. The first finger of the left hand is placed against the other end, and performs the same office against the brush in its opposite course, and is also ready to assist in the turn-over to paint the other side, which I should add is done with the two first fingers of each hand, without laying down the brush. I don't know if it would be trespassing for me to say that to paint a Venetian blind, say of thirty laths, in a trough of this description, would take me about twenty-five minutes; but to paint the same blind as I paint them now—that is, with one end resting on a box of a convenient height and size, with the end of the lath resting against a tack for a stop, and the first finger of the left hand in the hole nearest the other end, and turning it with that finger and thumb—would take me about thirteen minutes; it is well to practise that way: it is easy to get into it, and you save time in not having to walk to and fro to set down the laths."—[Thank you for your able reply. There must be every week many points which suggest themselves to you and others, and for the expression of which the "Shop" columns of WORK are specially designed. Let me hear from you, and others too, often.—ED.]

Magic Lantern.—W. B. (*Maidstone*).—You will find a paper on "How to Make a Triunial Optical Lantern" in No. 83 of WORK. There is no paper in hand at present on the construction of so cheap a lantern as you suggest.

Water-pipes.—W. B. (*Maidstone*) writes to GLASGOW (see No. 86, page 551, Vol. II.), who is a sufferer from water-pipes bursting, and who would like to know of a regulator to prevent same:—"I might say that GLASGOW is not the only sufferer, for we are subject to the same complaint. The only safe, and cheapest in the end, and effectual regulator that we advise is to fix, or have fixed, a 'stop-cock' on the service in the cellar or other convenient place to be easily got at. I think GLASGOW will find that he can regulate the pressure to what he likes, or he can shut it off altogether. No doubt there are other regulators in the market GLASGOW could use, but as I have found that the 'stop cocks' do their work effectually, I have not troubled myself about any others. I hope the above is plain enough for GLASGOW to understand."

Blueing Swords and Guns.—W. B. (*Maidstone*) writes:—"I should like to ask a question through 'Shop.' If there are other methods to blue swords and gun barrels (to come within the scope of the amateur) besides the elaborate process of the heating apparatus?"

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. F. S. (*Hammersmith*); J. M.; H. E. (*London, N.W.*); LEGHORN; W. H. H. (*S.E.*); A. B.; R. E. (*Kensington*); L. A. C. (*Wigan*); H. E. (*West Bromwich*); CLERK; ECONOMY; H. J. (*Upper Holloway*); £ s. D.; CORNICE; VAPORIFER; JOINER; W. H. T. (*Hanley*); M. L. (*Rochdale*); F. F. (*Cardiff*); J. W. (*Sheffield*); J. S. (*Ramsbottom*); B. C. (*Poplar*); G. H. M. (*Camberwell*); CHARITY; J. H. E. (*London, W.*); J. T. G. (*Edinburgh*); JABEZ; W. W. (*Brixton*); W. S. (*London*); G. H. (*London, E.C.*); H. B. T.; F. W. H. C.; J. S. (*Barnet*); BOSWORTH; R. W. (*London, W.*); W. H. R. (*Liverpool*); E. A. S. (*South Norwood*); H. A. C. (*Plaistow*); A YOUNG BEGINNER; SECRETARY; J. W. (*Homerton*); A. S. (*Newport*); DANS EMBARAS; W. W. (*London, N.W.*); H. A. (*Leeds*); APPRENTICE; A PLAYER; C. W. (*London, N.*); AMATEUR; W. AND L. (*Leeds*); F. R. H. (*Manchester*); W. F. (*Lindhurst*); UNOLE; H. D. (*Suffolk*); G. A. (*Liverpool*); IMMOT; CAPUT NIGER; R. S. (*Bow, E.*); F. C. (*Swanley Junction*); C. H. S. (*Nottingham*); J. H. F. & Co., (*Birmingham*); R. J. D. (*Edinburgh*); A. W. (*Wakefield*); M. R. (*Kerry*); A. B. (*Suffolk*); G. P. (*Elgin*); SHEET METAL WORK; LANCASHIRE LAD; RAINFORD; A. H. (*Southport*); E. D. (*Royston*); YOUNG SIGN WRITER; J. F. P. and others; W. M.; T. C. (*Sunderland*); TOM.

"WORK" EXHIBITION.

THE Proprietors have the pleasure to announce that the

EXHIBITION

WILL BE OPENED TO THE PUBLIC,

AT

THE POLYTECHNIC INSTITUTE,

REGENT STREET, LONDON, W.,

ON

MONDAY, DECEMBER 29th, at 2 p.m.,

BY

SIR JOHN LUBBOCK, BART., M.P.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Beit's Patent Enamelled Adhesive Waterproof Advertising Paper Letters and Figures in all colours and sizes. Best and cheapest. Liberal terms to agents. Sample sheets, gratis. Factory, 17, Arthur Street, W.C., London. [21 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [15 R

Machinery and Tools.—Largest stock in London. BRITANNIA Co., 100, Houndsditch. Cash or hire purchase.

Gas and Steam Engines.—Engineers', Amateurs' Builders' Tools, Stocks, Dies, Forges, etc.; catalogue of new, 6d., or list second hand, 2d.—BRITANNIA Co., Colchester.

Best Book on Lathe.—Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA Co., Colchester. [17 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. At WORK Exhibition, Groups V. and VIII. [1 S

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured.—ETHELBERT HENRY, Alvaston, Derby. [18 R

Sign-writing Made Easy.—Every man his own writer. Illustrated instructions for easy, cheap, simple, and rapid process by which elaborate lettering can easily be done equal to professional work. Also Diagrams for marking out eight different sized alphabets. The lot 1s., post free.—F. COULTHARD, Terrace Road, Bournemouth.

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [2 S

Rubber-tyred Mail Cart Wheels complete, with axles and brass caps, from 4s. per pair. Odd sets Perambulator Tyres reasonable.—WALKER BROS., Cycle Depôt, Leeds. [3 S

Model Bolts, Nuts, and Screws.—Large new illustrated list, 3d.; 2,800 varieties, material, screw plates, taps, spanners.—BUTLER BROS., Bentham Road, South Hackney, London. [4 S

Just Published by Britannia Co., Colchester, the Buyers' Guide, containing notices of 749 books on mechanical subjects, with table of contents, price, etc. The most complete catalogue yet published. Post free, 6d. In cloth, 1s. 6d.—BRITANNIA Co., Colchester. [20 R

A Barnes' No. 4 Foot Lathe, price £6, been used a few months only.—H. MILNES, Ingleby Lathe Works, Brownroyd, Bradford.

Macmillan & Co.'s Science Publications.

Machine Construction.

The Mechanics of Machinery. By Prof. A. B. W. KENNEDY, F.R.S. 12s. 6d.
Kinematics of Machinery. By Prof. REULEAUX. Trans. by Prof. KENNEDY, F.R.S. 21s.
Steam Engine Design. By Prof. J. M. WITHAM. 25s.

Sound, Light, and Heat, and Elementary Physics.

Examples in Physics. By Prof. D. E. JONES, B.Sc. 3s. 6d.
Elementary Physics. By BALFOUR STEWART, F.R.S. 4s. 6d. Questions, 2s.
Questions and Examples on Experimental Physics: Sound, Light, Heat, Electricity, and Magnetism. By B. LOEWY, F.R.A.S. 2s.
A Graduated Course of Natural Science for Elementary and Technical Schools and Colleges. Part I. FIRST YEAR'S COURSE. By the same. 2s.
An Elementary Treatise on Sound. By W. H. STONE, M.D. 3s. 6d.

Magnetism and Electricity.

Elementary Lessons in Electricity and Magnetism. By Prof. S. P. THOMPSON. 4s. 6d.
Practical Physics. By BALFOUR STEWART, F.R.S., and W. W. H. GEE, B.Sc. Vol. II. Electricity and Magnetism. 7s. 6d. School Course. Vol. I., Electricity and Magnetism. By the same. 2s. 6d.
Absolute Measurements in Electricity and Magnetism. By Prof. A. GRAY. In Two Vols. Vol. I. 12s. 6d.
Elementary Book for Beginners. By the same. 5s. 6d.

Steam.

Steam: An Elementary Treatise. By Prof. J. PERRY. 4s. 6d.
On Heat, in Relation to Steam and the Steam Engine. By G. SHANN, M.A. 4s. 6d.

Botany.

Primer of Botany. By Sir J. D. HOOKER, F.R.S. 1s.
Elementary Botany. By Prof. D. OLIVER, F.R.S. 4s. 6d.
A Course of Practical Instruction in Botany. By Prof. BOWER. 10s. 6d.
The Student's Flora of the British Islands. By Sir J. D. HOOKER, F.R.S. 10s. 6d.

Metallurgy.

Practical Metallurgy and Assaying. By A. H. HIORNS. 6s.
A Text-Book of Elementary Metallurgy. By the same Author. 4s.
Iron and Steel Manufacture. By the same Author. 3s. 6d.

Geology.

Class Book of Geology. By ARCHIBALD GEIKIE, F.R.S. With 200 New Illustrations. New and Cheaper Edition. 4s. 6d.
Outlines of Field Geology. By the same Author. 3s. 6d.

Physiography.

Physiography. By Prof. HUXLEY, F.R.S. 6s.
Primer of Physical Geography. By ARCHIBALD GEIKIE, F.R.S. 1s.
Elementary Lessons in Physical Geography. By the same. 4s. 6d. Questions, 1s. 6d.
Outlines of Physiography—The Movements of the Earth. By J. NORMAN LOCKYER, F.R.S. 1s. 6d.
Elementary Lessons in Astronomy. By the same. 5s. 6d.

Animal Physiology.

Primer of Physiology. By Prof. M. FOSTER, F.R.S. 1s.
Lessons in Elementary Physiology. By T. H. HUXLEY, F.R.S. 4s. 6d. Questions, 1s. 6d.

MACMILLAN & CO., LONDON.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME

SOLD EVERYWHERE.

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of *Muscular* and *Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,* etc. Also most efficacious in *Bronchitis* and *Throat* and *Chest Affections.*

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes: "Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

From all Chemists, 1s. 1½d. *and* 2s. 9d. *per Bottle, or* 3d. *extra for postage, from*

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A Work on the "Home Use of Pumiline" sent free on application.

Price *4d.*
CASSELL'S
TIME TABLES.

ESTABLISHED 1851.

BIRKBECK BANK,
Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Christmas & New Year's Gifts.

Cassell's Complete Catalogue, containing particulars of upwards of ONE THOUSAND VOLUMES, published by Messrs. CASSELL & COMPANY, ranging in price from

THREPENCE TO FIFTY GUINEAS,

will be sent on request post free to any address.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

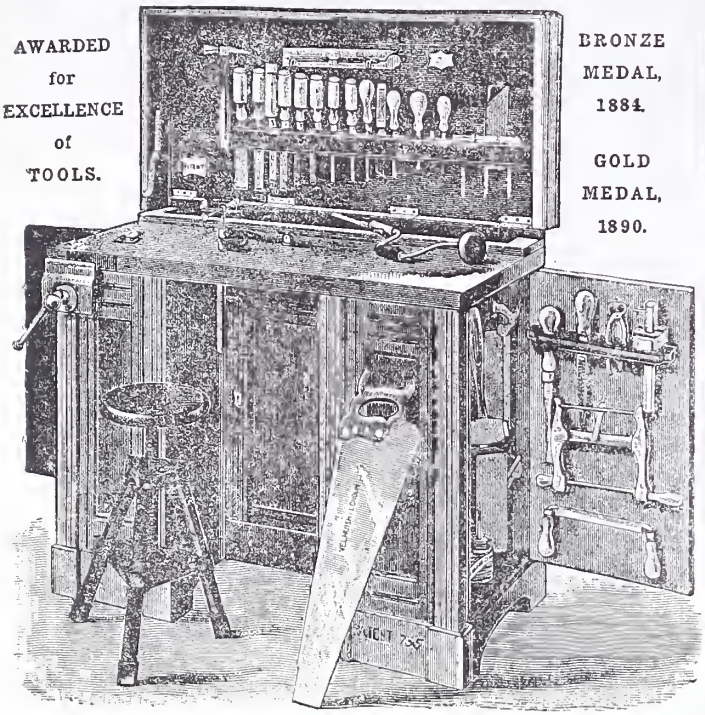
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

LOCKWOOD'S

HANDYBOOKS FOR HANDICRAFTS

NEW VOLUME. NOW READY, 2s. (POST FREE).

The Cabinet Worker's Handybook: A Practical Manual, embracing information on the Tools Materials, Appliances, and Processes Employed in Cabine Work. By P. N. HASLUCK. *With 100 Illustrations.*

By the Author. Now Ready.

THE CLOCK JOBBER'S HANDYBOOK, 2s.
THE MODEL ENGINEER'S HANDYBOOK, 2s.
THE MECHANIC'S WORKSHOP HANDYBOOK, 2s.
THE PATTERN MAKER'S HANDYB OK, 2s.
THE WATCH JOBBER'S HANDYBOOK, 2s.
THE WOOD TURNER'S HANDYBOOK, 2s.
THE METAL TURNER'S HANDYBOOK, 2s.

London: CROSBY LOCKWOOD & SON, 7, Stationer's Hall Court, E.C

For Christmas Decoration!!

USE

JUDSON'S LIQUID GOLD

6d., 1s., and 5s. per Bottle.

(READY MIXED).

SOLE MANUFACTURERS,

DANIEL JUDSON & SON, LIMITED.

SOUTHWARK, LONDON, S.E.

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasire in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores; or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

NOW READY, price 1s.; post free, 1s. 3d.

YULE TIDE

For CHRISTMAS, 1890, containing—

A Magnificent Large Presentation Plate, suitable for framing, entitled **"Prince Charlie's Farewell to Flora Macdonald,"** after an Original Painting by GEORGE W. JOY, reproduced in the highest style of Chromo-Lithography.
A Complete Novel entitled **"I Saw Three Ships,"** by Q, Author of "The Splendid Spur," "Dead Man's Rock," &c. Illustrated throughout by WALTER PAGET.
Four Full-Page Pictures Printed in Tints, &c. &c. &c.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

PICTURE FRAME MAKING.

FOURTH EDITION. Enlarged and Revised.

THE FRAME MAKER'S INSTRUCTION BOOK.

150 *Diagrams, Designs, and Patterns.*

Instructions in Joining, Fitting, Mount Cutting, &c. Also Prices of Mouldings, and every requisite for the Trade. Post Free, **6 Stamps.**

GEO. REES, 115, Strand (Corner of Savoy St.);

Moulding Dept., 41, 42, 43, Russell St., Covent Garden, London.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket, Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* re offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,000 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Fortnight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill,** with brass handle and 4 Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design **SENT GRATIS** with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

A Four Page Supplement is issued Gratis with this Number.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

Vol. II.—No. 92.] SATURDAY, DECEMBER 20, 1890. [Price One Penny.

THE ARTISTIC TREATMENT OF HAMMERED METAL.

BY F. ROPER HALIDAY.

The combined arts of chasing and embossing, the means by which the ductile metals are decorated with raised or beaten ornament—*repoussé*, beaten up, as the French name the process—are of the remotest antiquity. The Egyptians were past-masters in the art of working the precious metals, and in the time of Moses the candlesticks and altar vessels used in Jewish worship were covered with beaten work.

The various examples of *repoussé* work which have come down to us are stamped in a marked manner with the individuality of the producers, and the characteristics of the times in which they lived. Volumes might be written on this fascinating subject, but the object of this paper being the practical one of indicating the means whereby students may, at a small cost, obtain suitable examples for their own use and private study, and of giving some instruction in the use of the tools and appliances necessary, I will confine myself to a few cursory remarks on some of the principal styles.

Fig. 6.—Shield (German) of 16th Century. (Diameter, 21½ in.)

Modern design, it has been said, is entirely retrospective, and imitative of some one previous style adopted as a model.

Bearing this in mind, let us look for a moment at the grace and beauty of what is called the Classic period. At this time humanity was deified; all the beauty of the human form was developed. Hercules was distinguished by his robust frame and massive limbs; Apollo by his graceful shape. Venus and Juno disclosed the loveliness of feminine beauty, while all that was ornamental in style and beautiful in form reached the highest degree of excellence.

An example of this period is shown in Fig. 1—a patera or tazza from the Hildesheim collection. In this example the Goddess Minerva, the initiatrix of agriculture, leans one hand upon a curved staff, in which has been recognised the primitive plough. The draperies and all the parts in relief have been gilt, whilst the ground and the flesh have been left of the colour of silver. In the same way, the light and elegant palms which adorn the neck of the patera, in relief so low as to allow the figure to predominate, are raised in gold, upon

Fig. 3.—Tankard and Cover (German) of 17th Century. (Height, 7½ in.; diameter, 5½ in.)

Fig. 1.—Patera (Roman) from Hildesheim Collection. (Diameter, 9¾ in.)

Fig. 4.—Tankard and Cover (German) of 17th Century. (Height, 12½ in.; diam., about 6 in.)

the unwrought ground of silver; an arrangement of the most happy effect, which is still more marked by the light which strikes with various intensity upon every part, according to the difference of relief. It is singular to note the resemblance which this figure bears to that of Britannia on our copper coinage.

After the Classical period came the Gothic, which for our purpose it is unnecessary to touch upon. Upon the decay of the Gothic arose the Renaissance, or, as it may be called, the resurrection of Classic art, modified of course by the different religion which then prevailed, and by the other circumstances of the time.

The Renaissance arose in Italy during the 15th century, where it was in general use nearly a hundred years before its adoption by other countries. Its chief characteristics are the embodiment of Classic details with previous styles. Mr. Digby Wyatt says—

"A remarkable feature in the Renaissance artists was their combination of the talents of sculptor and architect, from which cause figures, foliage, and conventional ornament were so happily blended with moulding and other structural forms, as to convey the idea that the whole sprang to life in one perfect form in the mind of the artist." Examples of this period are given in Figs. 2, 3, and 4.

Fig. 2 is a salver, embossed with wide scroll foliage border, from South Kensington Museum. French; date, 1698.

Fig. 3, a tankard and cover, decorated round the base and on the sides with perforated *appliqué* work. The cover surmounted with a cockatrice. German; 17th century.

Fig. 4, a remarkably fine tankard—*repoussé* work: Mercury and other mythological figures surrounded by foliated scrolls and fruit. German; date, 1605.

Of the Moresque, and other styles originating in Mohammedan countries, it may be said that they follow the precepts of the Koran, no representations of the human figure or of natural objects being allowed, hence the ornamentation is purely linear. This work is often interspersed with inscriptions, usually of a pious character.

No. 5 is a good example of the English style of the last century. It is a chocolate pot on three legs capped by satyr masks, with festoons, flowers, foliage, and bands of beading; date, 1777.

Lastly, to show the effective manner in which figure subjects are grouped on a curved circular surface, is given the example No. 6, a shield, designed and made for Diana of Poictiers, and presented by her to Henry II. of France. Now in the possession of Prince Karl of Prussia. German; 16th century.

At the Art Congress held at Edinburgh in November last year, the council of the National Association for the Advancement of Art and its Application to Industry appointed a committee of artists to select suitable examples of the artistic treatment of hammered sheet metal, for the use of "Home Art" students and others, and after careful study of numerous specimens, the following thirty-two objects were selected; they form what is known as the "Edinburgh Set," and are published by Messrs. Elkington and Co., to whose courtesy I am indebted for the foregoing illustrations.

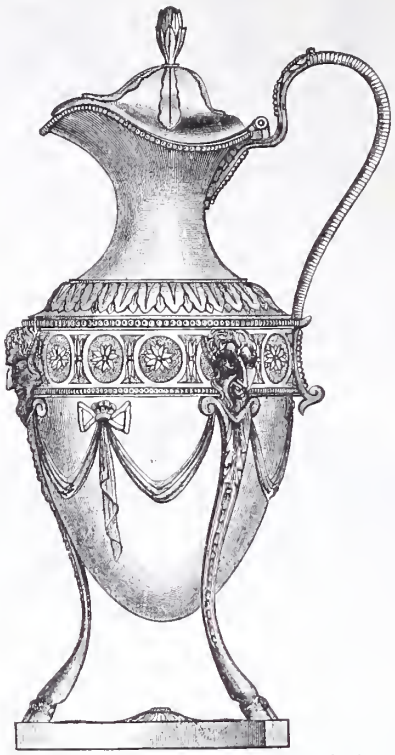


Fig. 5.—Chocolate Pot and Cover (English), 18th Century. (Height, 12⅞ in.; diameter, 5½ in.)

They are produced in copper, and, as they are prepared by the electrotype process, give the exact form of the originals, the minutest mark being reproduced. The sizes and published prices are here given, in order that students may select such examples as they think suitable:—

1. Portion of antique vase from Hildesheim Treasure, silver *repoussé* (Berlin), 15¾ in. long. 40s.
2. Bowl with twisted lobes in hammered silver, English, 17th century (South Kensington Museum), 10 in. diameter. 50s.
3. Dish for eggs, from Hildesheim Treasure. Hammered silver (Berlin), 10½ in. diameter. 20s.
4. Portion of beaker, scale pattern, Russian, 16th or 17th century, silver (South Kensington), 10¾ in. long. 8s.
5. Foot of candlestick, Italian, 17th century, brass (S. Kensington), 5¾ in. diam. 8s.
6. Small plate, *repoussé*, with floral design, silver, 7½ in. diameter. 6s.
7. Salver, English, Queen Anne period, silver (South Kensington), 9 in. diameter. 15s.
8. Paten with Tudor rose, English, Hall mark 1562–3 (South Kensington), 10½ in. diameter. 15s.
9. Bratina, Hungarian (?) 14th century, silver *repoussé* (Buda-Pesth), 6 in. diameter. 20s.
10. Silver bowl or plate, French, about 1330 (South Kensington), 7½ in. diameter. 15s.
11. Four specimens of Ashantee ornament, gold *repoussé*, 4 in. diameter. 20s.
12. Brass bowl, Moresque (South Kensington), 10¾ in. diameter. 15s.
13. Bowl in hammered silver, Rhodian or Venetian (South Kensington), 9¾ in. diameter. 15s.
14. Antique head of Medusa silver (Berlin), 3¾ in. diameter. 6s.
15. Portion of cover of cup, with bosses, German, 6 in. wide. 5s.
16. Silver salver, *repoussé*, French, 1618 (South Kensington), 13½ in. diameter. 20s. This is shown in Fig. 2.
17. Plate, Malay workmanship, 11¾ in. diameter. 15s.

Nos. 1 to 17 are especially recommended for beginners. The following are more ambitious:—

A. Dish, brass *repoussé*, Flemish, 17th century (Musée Cluny, Paris), 2 feet 2 in. diameter. 40s.

B. Figure of Minerva, from antique silver patera, Hildesheim Treasure (Berlin), 7 in. diameter. 15s. This is the centre of the patera, Fig. 1.

C. Medusa head from shield, iron *repoussé*, Italian, early 16th century, (Musée d'Artillerie, Paris), 10½ in. diameter. 18s. A good example of bold and effective treatment.

D. Portion of cuirass, iron *repoussé*, Italian, 16th century (St. Petersburg), 9½ in. across. 12s.

E. Portion of antique silver cup, found at Herculaneum, a charming example of Classical art (Naples), 5½ in. high. 10s.

F. Small plaques, gold *repoussé*, antique Greek, and Greco-Scythian (St. Petersburg), 2 in. each. 15s.

H. Border of salver, chased silver, Irish, 1784–5 (South Kensington), 9 in. diameter. 15s.

J. Portions of cup and cover, silver *repoussé*, German, 16th century (St. Petersburg), 5 in. diameter. 20s.

K. Portion of silver vase, English, about 1770 (South Kensington), 4½ in. 8s.

L. Frame in silver *repoussé*, French (?) 17th century (South Kensington), 8 in. long. 10s.

These examples, when silvered or gilt, form very handsome decorative pieces for drawing-room, dining-room, or study.

Many of the specimens, it will be noticed, are from the Hildesheim Treasure. A few words about these may be interesting.

Fig. 2.—Salver (French), 17th Century.

In October 1868, some Prussian soldiers, working at the foundation of a firing butts on the slope of Mount Galgen, which overlooks the town of Hildesheim, came across some fragments of metal at the depth of about three yards, which proved to be of silver, blackened by age. An officer coming up, caused a search to be made, and they then found, beneath two large, overturned,

bell-shaped vessels, a variety of articles, and numerous fragments, the whole having suffered greatly by damp and corrosion.

The treasure, having been carried to the barracks, was entrusted to a sculptor of Hildesheim, who restored the former appearance of the various articles. By careful scrutiny he could distinguish, through the marks which the solder had left beneath or on the sides of the cups, etc., the form and size of their feet and handles, and could replace these accessories. They are all now in the Berlin Museum, and are called the Hildesheim Treasure. They have been proved to be of antique Roman workmanship, probably dating from the second century of our era, and several of the pieces bear the names of the Roman silversmiths. They are supposed to be the booty of some barbarian robber chieftain, who vanquished one of the Roman Legions at the break up of the empire, and comprise a wonderful variety of artistic vessels, together with solid silver stewpans, and other domestic articles of the precious metals, in use during the time of the Roman emperors.

Chasing is especially suitable for home work, and regarded as an occupation—a means of gaining a livelihood—is at present in high favour. Fashions run in cycles, and the plain severity of the Queen Anne style, as adapted to objects of daily use, such as tea services, dish-covers, and the multitude of smaller articles, is rapidly giving way to the renaissance of chasing; the result being that chasers are in great demand, wages have risen considerably, and competent men are sure of plenty of employment at good rates.

The advantage of this occupation is that it is suited to all capacities. The ordinary workman with no soul above his daily labour, and with an "off on the drink" interlude occasionally, can obtain work whenever he chooses, while for the art workman, the man who can draw well, and who takes advantage of the many educational advantages at hand to cultivate his talents, the scope is practically unbounded. One has only to mention such names as world-wide fame as Ghiberti, Cellini, Morel—men who have advanced metal working to the dignity of a high art—to see the possibility of distinction in this line. One of Morel's works, the Milton Shield, illustrating "Paradise Lost," was purchased by the Government some years ago for £2,500, and is now in the South Kensington Museum. In this, as in other branches of the fine arts, a knowledge of composition and of the proportion of the human figure are of paramount importance.

The process, briefly described, is as follows. The pattern, or design, is first drawn with pencil on the surface to be decorated, and then with a snarling iron the prominences are raised from the back. The snarling iron, Fig. 7, is a long rod, the upper end, which reaches into the tankard, or other object, being curved: the rod slides through an iron ball B, and is fixed firmly in the vice, the ball resting on the top, as shown. The work is now pressed against the curved end of the rod, which is struck with a hammer at A, the effect being that the vibrations of the rod raise the prominent parts to the desired height. The work is now filled with a mixture of pitch, with a little resin and plaster of Paris, poured in hot, and when quite cold, is ready to be operated on from the front.

The jug, dish-cover, or whatever article is being operated upon, may now be said to be solid; the pitch having hardened, gives stability to the article, and yet yields sufficiently to enable the metal to take the impressions of the various punches with which the work is finished from the face.

This solid block is now laid on a sand-bag, and a cord passed round it, through a hole in the bench, and under the foot of the operator, who can now work with ease, the cord holding the article firmly, while the sand-bag prevents undue vibration.

Some of the punches used are shown in Fig. 8.

A, the matting tool. This usually has a square or oblong face, cut with diagonal or other lines, and is used for the groundwork; it gives the matted or dead white ground, which contrasts so effectively with the fluted or other polished portions of the work; it is made in a variety of patterns, coarse and fine, to suit the style of work required.

B is called the cutting punch, and in its variety of shapes is used to indent the many outlines of the work.

C, C, are variously shaped fluting punches.

D, one of the many beading punches required — most useful tools, beads being largely used in chased work.

E, E, shaped punches. Several of these are required. The student, when he has the example before him, will soon see what particular effect has to be produced, and will procure the punch which makes the corresponding mark on the metal.

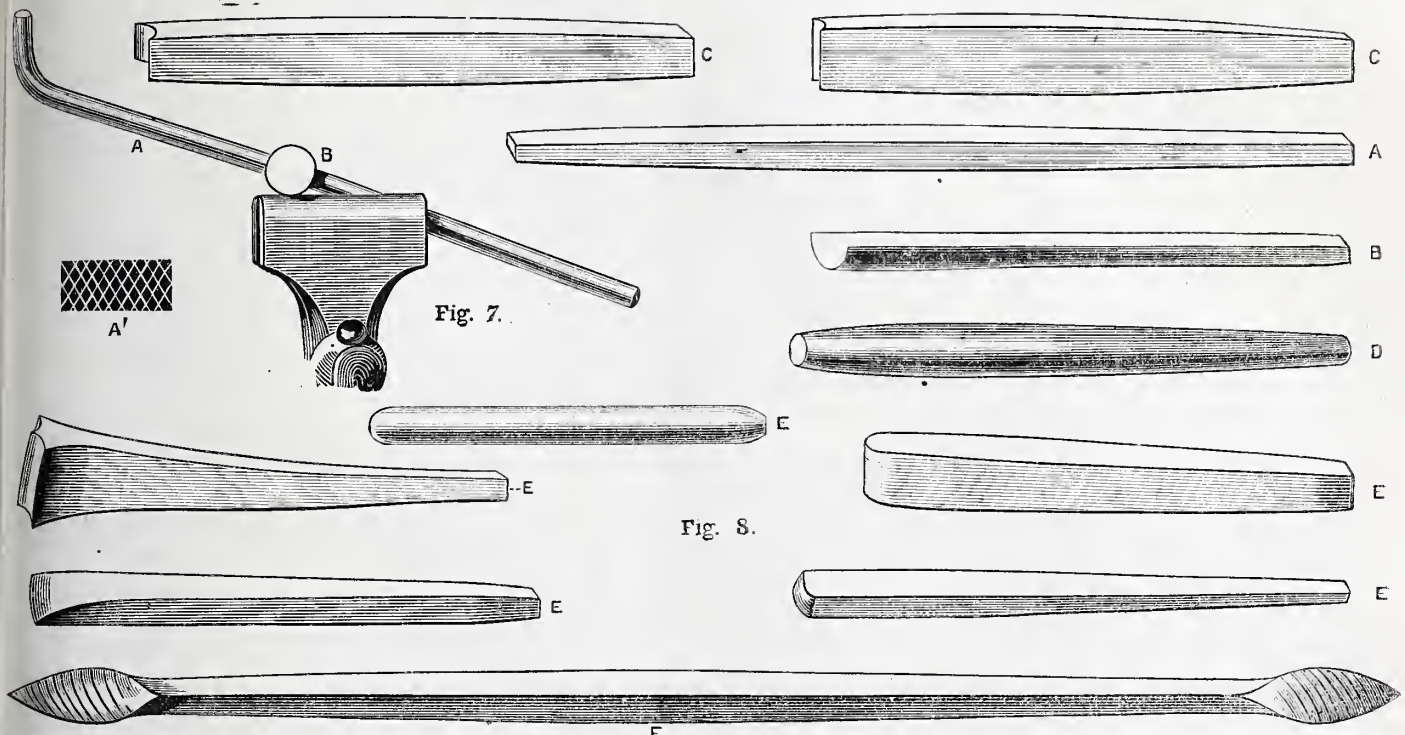


Fig. 7.—Snarling Iron fixed in Vice. Fig. 8.—Chaser's Tool: actual size—A, Matting Punch: A′, End of ditto, enlarged; B, Cutting Punch; C, C, Fluting Punches; D, Beading Punch; E, E, E, E, E, Variously shaped Punches; F, Riffler.

The process is naturally somewhat of a slow one, especially at first, but speed will come with practice, and the best advice that can be given to a student is to obtain one or more of these examples, and faithfully copy every detail. There is one advantage in practising this art—the student is not troubled either with colour or light and shade; form and finish are the only things to be considered. For the former, the snarling iron and punches suffice; for the latter, the riffler is used. This is a tool with a species of file at either end, shaped so as to reach all parts of the work, and is used to eradicate punch marks and give a smooth finish where desired. This tool is largely used for finishing cast work also.

In *repoussé* work generally, and in modelling the human figure in particular, it is well to avoid too high relief, as this in general gives vulgarity to the work. The figure of Minerva in the Hildesheim patera errs somewhat in this respect. In the works of the greatest masters, this is carefully avoided: roundness and fulness are given to the limbs without the metal being forced

up to an undue height. Bas-relief—low relief—is more suited to *repoussé* work than alto-relievo—high relief, such as we usually see in ivory carvings. The mask or face will require very careful attention, as well as the hands and feet; these are important points. Drapery should be cut sharp and clear, falling in graceful folds, showing the contour of the body beneath. There should be no indefinite outlines; the figures should be crisp and sharp, in contradistinction to painting, where this effect is avoided. A study of the best works, however, do more for the student than any written directions, and although in themselves they are very costly, fortunately, by the electrotype process, copies can be had which answer every purpose. A word as to flat chasing. This, as the term implies, is the decoration of flat surfaces without the use of the snarling iron. The article to be operated on is filled with pitch, or if a tray or salver, as is often the case, embedded on the same, and chased in the usual manner, but, of course, without any embossing or *repoussé* work.

THE ART AND PRACTICE OF SCENE PAINTING.

BY WILLIAM CORBOULD.

Necessary Tools and Appliances.

Introduction.—The principal object that I have in view in writing this and the papers which follow it is to give the readers of WORK, if they care to have it, some knowledge of a very agreeable and pleasing subject—"The Art and Practice of Scene Painting." Assuming that the reader has a fair knowledge of freehand drawing and perspective, and a taste for colouring, he may attain, after a little practice and carefully following out the instructions to be given, no small proficiency in this attractive work. I shall treat the subject in regular stages, commencing with the materials to be used—which may be purchased at small cost—and proceeding by taking a simple scene, and describing the method of painting it from the first step to its finish, thus giving some practical hints on the subject, the following of which, I trust, may lead to pleasant and profitable employment, either for leisure hours, or even as a means of adding to one's income, if not of making a living by the prosecution of the art.

Brushes.—The first thing to be taken into consideration is the brushes that the scene painter will find absolutely necessary, their several kinds and sizes, and how to choose them. Fortunately, from a pecuniary point of view, not many will be required to begin with, but they must be good. Brushes also require care, both in using them and in washing them clean; and, more than this, when work is done for the day, the hair of each brush should be placed straight in the proper form before putting them away. One or two large brushes will be needed for priming and laying-in purposes—painters' stock brushes, as they are called, will answer the purpose—such as is shown in Fig. 1. Then it is desirable to have a one-knot distemper or oval brush—as shown in Fig. 2—and about six sash tools of different sizes. Of these, Fig. 3 represents a string-bound sash tool, to be got in different sizes. Fig. 4 is a long-hair sash tool; these will be found useful as foliage brushes. Figs. 5 and 6 are quilled under the binding, Fig. 5 being a long-haired and Fig. 6 a short-haired tool. Fig. 7 is a flat hog-hair tool in tin, with polished handle; these, it may be said, can be obtained round or flat in different sizes. Fig. 8 is a flat, bevelled, hog-hair lining brush. I shall explain the way in which the various brushes are used further on.

Palette Board.—This is an important article, and I must tell you how to make it, and prepare it for work.

First, get about 20 ft. of $\frac{3}{4}$ in. floor-board: cut four pieces 2 ft. 6 in. long, and five pieces 2 ft. long; take the five short pieces, and lay them as in Fig. 10. Now place the four longer pieces lengthways on the top of the five short pieces, as in Fig. 11; screw them together with $1\frac{1}{4}$ in. screws. It is better to screw the boards together by turning the whole over, and screwing from the bottom. Of course, the rough sides of the boards would be put together inside, leaving the palette board smooth at top and bottom, and the best of the wood should be used for the top pieces. Then take another piece of board 2 ft. $4\frac{1}{2}$ in. long, and plane up the rough side, and saw it down the middle, as in Fig. 12. Next take another piece 3 ft. 8 in. long: plane it, and saw it down the middle in the same way; then cut the two lengths in half, and you will have four pieces 1 ft. 10 in. long. Take the two longest pieces and fix them on the back part of the board, leaving $\frac{3}{4}$ in. at each end, so that when you put on the end pieces the box will be the same length as the board. Take two of the four pieces you have 1 ft. 10 in. long, and cut 4 in. off one end of each of them. You will now have two pieces 1 ft. 10 in. long, and two pieces 1 ft. 6 in. long; place the long piece as shown by the dotted line A in Fig. 13, and the short piece as shown by the other line, B. The longest pieces close in the two ends of the long box, and the short pieces form the inner sides of the short boxes. Plane up another piece, and cut down the middle, as in Fig. 12, and cut up the two lengths thus obtained into square pieces about 3 in. each way. Divide the larger boxes with these pieces, thus forming smaller boxes about 3 in. square. Two pieces $4\frac{1}{2}$ in. long will be required to close the end of the short boxes. Put the boxes together with wire nails; round off the two front corners, and the board will have the appearance of Fig. 9. Now give it a coat of oil priming, which you can get made for you at any oil and colour shop, should you be a novice in the matter. When this is dry, stop well with white-lead putty, and give the whole a coat of oil-paint of a light drab colour, well doing the inside of the boxes, to prevent the different colours from running one into the other through the crevices or joints of the boxes. When this coat is dry and hard, paint it again with a lighter colour—nearly white—putting a little gold-size into the last coat of paint, that it may dry quicker and hard. The several colours used in scene painting are then rubbed up with the palette knife on the marble slab, with water only, into a paste, and put into the boxes—covering the surface of each colour with a little water, as often as required, to keep them fit for use. In using any colour, take a small piece out of the box with palette knife, and place it on the board wherever you may think fit. You will have some hot size by the side of you—put a spare brush into it, one you are not using for the time being, so that when you require "medium" for your colours, lift the brush out of the pail, and let sufficient run off on to the colour. By this means the medium is kept clean; whereas, if the brush that you are using for the colour were dipped into the medium, the colour in the brush would discolour and spoil it. I may as well explain that the medium should be about half size and half water, and when making it hot for *use*, never let it boil.

Marble Slab.—This may be got from any marble mason who makes tops for wash-stands: the round piece taken out for the basin makes one of the best slabs you can have.

Palette Knife.—Get as large a palette knife as you can: they are made of the best steel, and have a particular shape of their own, as shown in Fig. 14.

Flogger.—This is an appliance used for dusting off the charcoal lines after they are of no more use, and are painted in with Vandyke brown. It is made by cutting strips of cloth or canvas about 2 ft. long and 2 in. wide. These strips must be fastened strongly to a piece of wood about 2 ft. long, after the fashion of a cat-of-nine-tails, as shown in Fig. 15.

Compasses.—A pair of these, with one leg fitted with a tin tube to hold a piece of chalk or charcoal, the other leg to have a pin inserted so that the point will have a hold in the canvas, may be bought at any educational depôt. But I will tell you how to make a pair about 18 in. long. Take two pieces of clean wood, free from knots, 18 in. long and $1\frac{1}{2}$ in. square; cut a mortice in one and a tenon in the other, as in Fig. 16, so that they may fit one in the other. Put in a screw, as at A; when the square parts are cut to the proper shape, as in Fig. 17, and put together, and the screw inserted, you have the tool as shown in Fig. 18.

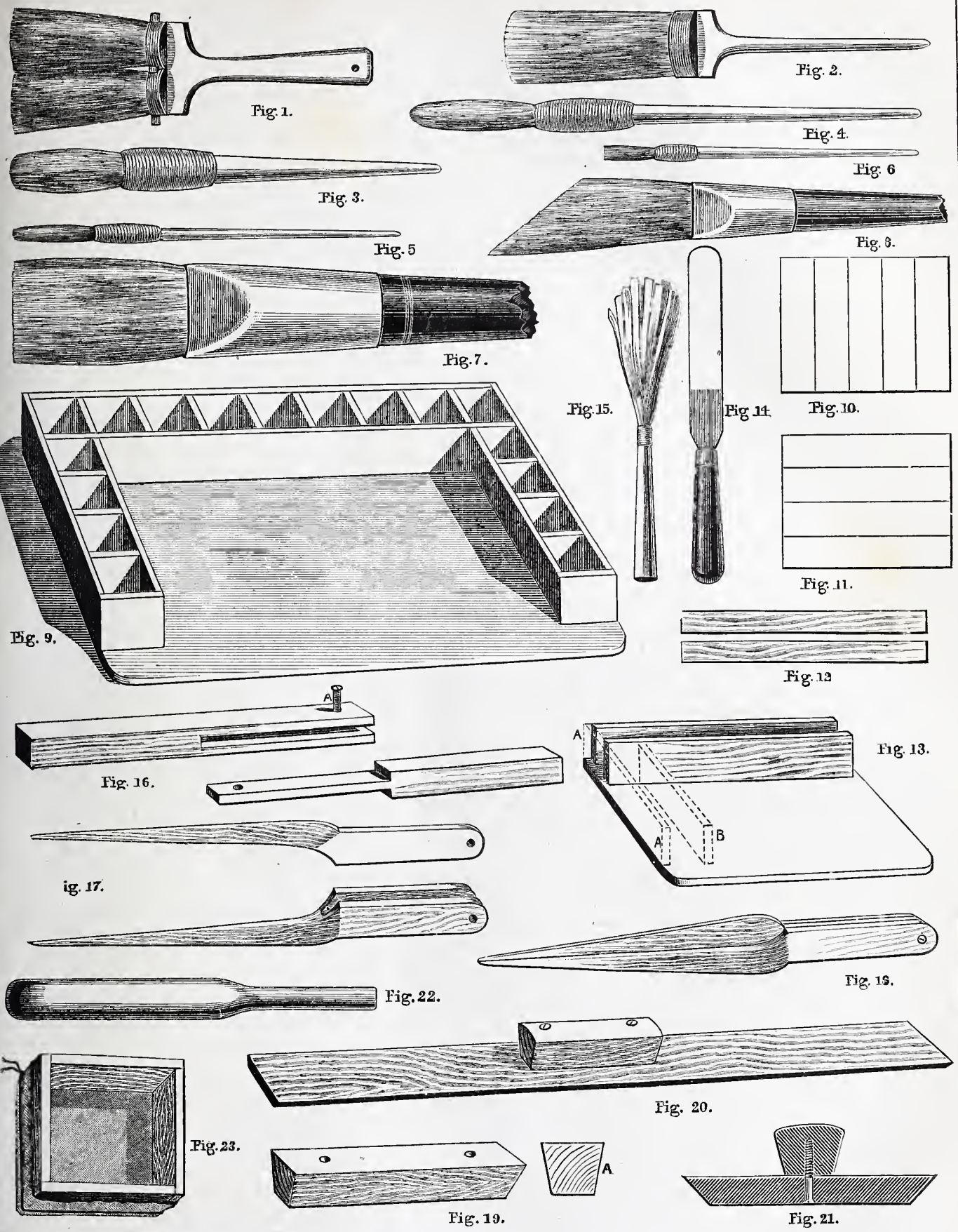
Straightedge.—This is another tool which is absolutely indispensable, but easily made. Take a piece of wood about 5 ft. long, $2\frac{1}{2}$ in. wide, and $\frac{3}{4}$ in. thick: plane it up nicely; bevel it on the two inner edges, about 1 in. from the centre, and bevel it so that the edge will be about $\frac{1}{4}$ in. thick, and finish off the edge by one shoot of the plane, so as to ensure a perfect straightedge. Now take a piece of wood about 2 in. square and 5 in. or 6 in. long; cut or plane two edges off, as shown in Fig. 19, the shape of the section or end being shown at A; screw this piece on the back of the straightedge, putting the narrow side on the back of the straightedge, and if you slightly round off the square edges at the top, it will form a good handle, as shown in Fig. 20. Fig. 21 shows section of the straightedge and handle, with the bevels, which are done to prevent the colour on the edge from touching the work.

Horizontal and Perpendicular Lines.—These and perspective lines are generally made by the aid of a piece of whipcord and a pear-shaped piece of lead, known technically as a "plumb-bob." Should you not have a lead bob, anything in the shape of a weight—say about half a pound—will do, fastened to the end of a line.

Spatulas.—Make three or four of these. They are merely pieces of wood for making and breaking up colours. A piece of wood, 15 in. long, 9 in. wide, and $\frac{3}{4}$ in. thick, will, if sawn down, make four. After the pieces are sawn out, cut and trim them up as shown in Fig. 22.

Zinc Pails.—The scene painter should provide himself with three or four small ones. One should be kept expressly for size, and a large one for straining purposes.

Straining Sieve.—This may be purchased, or you may make a very good substitute with four pieces of wood—say 12 in. long and 3 in. or 4 in. wide—nailed together to form a square frame, as shown in Fig. 23. Tack or tie with string a piece of coarse cloth or canvas round the box. After



TOOLS AND APPLIANCES FOR SCENE PAINTING. Fig. 1.—Painter's Stock Brush. Fig. 2.—One-knot Distemper or Oval Brush. Fig. 3.—String-bound Sash Tool. Fig. 4.—Long-hair Sash Tool. Fig. 5.—Quilled Long-hair Tool. Fig. 6.—Quilled Short-hair Tool. Fig. 7.—Flat Hog-hair Tool. Fig. 8.—Flat, Bevelled, Hog-hair Lining Brush. Fig. 9.—Palette Board. Figs. 10, 11.—Disposition of Pieces to form Top and Bottom of Palette Board. Figs. 12, 13.—Mode of forming Boxes to contain Colours. Fig. 14.—Palette Knife. Fig. 15.—Flogger. Figs. 16, 17, 18.—Compasses. Fig. 19.—Handle of Straightedge—A, Section. Fig. 20.—Straightedge with Handle complete. Fig. 21.—Section of Straightedge and Handle. Fig. 22.—Spatula. Fig. 23.—Straining Sieve.

straining any colour, wash the strainer clean. If you leave the colour to dry on, it would be more difficult to clean for another tint. The canvas can be replaced when worn out. This is intended only for large quantities of colour, such as is used for priming or sky colour; but if care be taken to have the whiting clean, and the size perfectly melted—though on no account must it be permitted to boil—the trouble of straining may be saved. In making any colour such as blue-colour for sky, after soaking the whiting, pour off as much of the water as possible, and then put in some blue celestial or azure blue and emerald-green, and beat them up well together with a spatula before thinning with the size. This way of mixing colour, as it has been said, saves the trouble of straining materials.

Canvas: How to Choose and what to Use.—There is a fine flax linen canvas, 2 yds. wide, at about 1s. 1½d. per yard, which can be bought at any large linendraper's. This answers the purpose well, as it is free from dressing or any foreign substance detrimental to colours. Many amateurs use brown calico, which is very objectionable on account of the lime and other matter used in its manufacture, which has a tendency to destroy all colouring in a short time, no matter how well the work may be done.

Size.—This is the medium used for mixing colours and other uses in scene painting. It can be obtained at any oil and colour shop; but should you not be able to do so, try to get some parchment clippings, which must be well boiled. To do this, put the clippings into an iron saucepan, fill it with water, let it stand twenty-four hours till the pieces are well soaked through, then boil them for five or six hours, taking off the scum as it rises to the top. When it has melted to a liquid, take it from the fire, and strain it through a piece of canvas. If you are making a quantity to last for some time, you must add about three ounces of powdered alum, dissolved in boiling water, to every pail of size. If you cannot get parchment clippings, get some of the palest-coloured glue you can, break it up into pieces, and put it into cold water—best in a small pail—for twenty-four hours; when well soaked, place your small pail into a large one, and put as much water into the large pail as will not run into your small pail when boiling. When the glue is all well melted, you may add as much water in it as you think will leave it a soft jelly when cold. One thing more: whichever kind of size you use, in heating it for using do not let it boil again, for boiling spoils it. As soon as you see it is liquid take it off the fire.

Whiting.—The mixing and preparation of whiting, which is called "distempering," is a term applied to all colours mixed with water, with the addition of size or glue. The first thing to be done is the mixing for priming the canvas, when it is ready for that process. To make a good pail of priming, take about one dozen of whiting—that is, about five balls—break it up, and pour sufficient cold water on it to cover it. After about half an hour—when it will be well soaked—rub it well with the hands, or beat it with a spatula, until it becomes a nice smooth paste. When done, take some melted size, which should be hot, in readiness for use, and pour it into the whiting, lightly stirring it till both whiting and size are well mixed together. When this is cold it ought to be of the consistency of castor-oil. It would be as well, perhaps, before leaving it to cool, to strain it through a hair sieve or coarse piece of cloth or canvas.

Charcoal.—This you may purchase at any oil and colour shop, or, perhaps, of any artists' colourman; but should you not be able to do so, get some stout willow wood, cut it into pieces about 6 in. or 8 in. long, put them in the fire, burn them until there is no flame—the sticks assuming a dark red tint—then take them from the fire; when cold they will be fit for use. I mention the willow, because it is the best possible wood for this purpose.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

LIGHTING BY MEANS OF CURRENT FROM DYNAMO-ELECTRIC MACHINES—WHAT IS A DYNAMO-ELECTRIC MACHINE? — SIEMENS' DYNAMO-ELECTRIC MACHINE—THE FIELD MAGNETS—THE ARMATURE—THE COMMUTATOR AND BRUSHES—THE BRUSHES—WINDING THE ARMATURE.

Lighting by Means of Current from Dynamo-Electric Machines.—The area in which we can work to light up electric lamps with current derived from primary batteries is somewhat circumscribed by defects in this method of generating a powerful electric current. To get a sufficiently high E.M.F. to overcome the resistance in the lamps, *we must use a large number of cells* connected in series, and, to provide a large volume of current, *we must use large cells*, or the battery will soon run down. When a current of three ampères or more is required from a battery, the wear and tear is considerable; hence it is costly and inconvenient to lower the resistance of the lamp circuit (as by placing the lamps in parallel), since by so doing a greater demand for current is thrown on the battery, and as this extra current passes through the cells, their contents are heated, with the result that they are more quickly worn out. Then comes the costly, dirty, and laborious job of cleaning and recharging the cells, and this in itself is enough to make us wish for some better method of generating the current. For small model electric lights, such as night lights, occasional lights of low power, and those mentioned in my last paper, a small bi-celled chromic acid battery, or even a Fuller bichromate battery, will give every satisfaction. But when we wish to extend the area of lighting, we must have recourse to such generators of current as that of a dynamo-electric machine. With these machines, and ample power to drive them, the area is so much widened as to become practically unlimited. In this field we are only held back from large operations by a want of power to drive the machines. Given an abundance of power, supplied by any motor, and we can then make a machine capable of supplying sufficient current to light up a whole village.

What is a Dynamo-Electric Machine?—A dynamo-electric machine is a machine for converting dynamic energy into electric energy. Dynamic energy is shown when matter is set in motion by propulsion, as when the piston-rod of a steam-engine is propelled by the force of steam behind it, or that of the gas-engine by the ignited gas. We are all familiar with the methods adopted to convert mere propulsive motion (*i.e.*, thrust and pull motion) into circular motion by means of cranks and wheels, but all are not so familiar with the method adopted to convert this form of motion into that of intense vibration as represented by electricity. To do this, a special machine has been invented, and since its function is to convert energy from the dynamic to the electric form thereof, it is named a dynamo-electric machine.

Since the invention of the first dynamo in 1832, by Pixii, the machine has passed through many phases of evolution. It began under the name of a magneto-electric machine, and continued to bear this name whilst permanent steel magnets were employed in its construction. It was then as truly a dynamo as any one of its successors, since the permanent magnets only acted when moved by dynamic energy. They had no power in themselves to move themselves. Those of my readers who may wish to trace the evolutions of the machine from Pixii's invention to Ferranti's monster dynamos at Deptford, may do so in the pages of "Electricity in the Service of Man," now being issued in sixpenny monthly parts by Messrs. Cassell & Co., Limited. It is not in my province to give a history of the machine, but to show how those are made which are most suitable to the subject now under treatment. The machines now in general use by amateurs for electric lighting purposes may be arranged in classes named according to the types of armatures, or of field magnets used in their construction. In the first class we may place the Siemens machine, so called because in its construction we use the Siemens H armature in either its original solid form or built up of laminated iron plates. In the second class we may place the Grammé machine, so called because we use in its construction both the form of armature and the field magnets invented by M. Grammé. In the third class we may place the Manchester machine, so called because we use in its construction field magnets of the Manchester type. In the fourth class we place the Simplex machine, so called because it has only one simple core to receive the wire intended for the field magnet. All these machines work on the magnetic induction principle—that is to say, their field magnets are not made up of pieces of steel permanently magnetised, but are constructed of soft iron, containing just a trace of residual magnetism, which is induced (by dynamic energy imparted to the armature) to exert its influence on the armature coils, and create in them a current of electricity. This current is then sent around the field magnet coils, with the result that a stronger magnetism is induced in the cores of the field magnets. Being thus strengthened, they induce a stronger current in the armature coils, and thus the full electric power of the machine is worked up. We will take each of the machines in order, and briefly give a few details concerning their construction.

Siemens' Dynamo-Electric Machine.—In 1857, Dr. Werner Siemens invented the simple form of armature now known as the Siemens H girder, or cylindrical armature, so called because a cross-section of it resembles the section of an H iron girder with cylindrical sides. This is shown in the illustration (Fig. 14). As this form of armature, together with the field magnets, are easily made, wound, and set up, it has become a general favourite with amateurs. The form of the machine in general use is shown in section at Fig. 15, whilst Figs. 14 to 33 show in detail the forms of its several parts. The diagram Fig. 15 shows the position of the parts composing the skeleton frame, or carcase, of the machine; A being the armature; M, M, the field magnets; C, C, the field magnet cores; and Y, the yoke to which the field magnet cores are bolted or attached by screwed studs.

The Field Magnets.—These are made to the form shown at Fig. 16, or in that shown at Fig. 17, in various sizes, to suit the other parts of the required machine, as shown in the annexed table. They are made in malleable cast iron, and are sent out annealed soft, ready for use, by men who make the trade in these things a speciality. A full set of castings for a Siemens pattern machine of the smallest size can be obtained for five shillings, and this will make up a 5 c.p. machine. The castings for a machine of 120 c.p. will cost about thirty-five shillings. It will therefore be seen at once that it will not pay the amateur to make his own patterns and get the castings made to them. It must be understood, however, that all castings received from vendors of those things are in the rough as they come from the foundry, unless otherwise ordered, and an additional price paid for the labour of shaping and fitting them ready for winding on the wire. I will suppose, however, that the castings are received in the rough, and we will now set about preparing the field magnet castings. These should be soft enough to allow a file to "bite" the iron easily; for if hard enough to resist the action of the file they are too hard for this purpose, and are not properly annealed. The first job will be to clean them and true them up—that is, remove any rough ridges left on the edges, or nodules of iron, from the armature channel. This may be done in a lathe or by means of a half-round coarse file. The two castings for the field magnets must be a pair, and when stood side by side on a level bench, the armature tunnel between them should be of regular form throughout, the cores of one height and size, and be parallel to each other when upright. If slight irregularities appear on the sides of the tunnel, take them off with the rounded face of the file. The corners of the cores should also be rounded and filed smooth, to prevent abrasion of the wire covering whilst the wires are wound on. If the castings are shaped as shown at Figs. 15 and 16, holes must be drilled and tapped at *a*, *b*, Fig. 16, to receive screwed studs to hold the yoke in its place on the F.M. cores. Small holes ($\frac{1}{4}$ in.) must also be bored in the lugs at *c*, *d*, *e*, *f*, to receive screwed studs or small bolts securing the armature bearings to the lugs. Two $\frac{1}{2}$ in. holes must also be drilled in the feet of the castings at *g*, *h*, to receive short coach screws used for bolting the castings to their wood base. The yoke to connect the F.M.'s, shown at Fig. 15, is merely a rectangular piece of iron supplied for the purpose with the castings, and this must be fitted truly on the top of the F.M. cores, holding them in the position they must occupy when the machine is at work. In the small Siemens machines supplied by Mr. Jones, of Lambeth, this yoke is dispensed with, as the top of one of the castings projects sufficiently to bridge over the space between the two, and thus form the yoke. In the castings supplied by Mr. Bottone, also, the two projections have turned-up flanges, as shown at Fig. 17, and these are bolted together to form a yoke. It must be distinctly understood, however, that the two F.M.'s must be connected in this or in a similar way by an iron bridge, so as to form a horse-shoe magnet, between the poles of which the armature is made to revolve.

The Armature.—The solid H girder form of armature used in these machines is shown at Fig. 18. It is a casting of soft well-annealed iron, and is supplied with the other castings for the machine. It is most important that this also should be annealed soft. The channel for the wire should be true and smooth, and the ends of the web (marked w on Fig. 14) be rounded and smoothed to prevent abrasion of the wire covering. The rounded faces of the cheeks must also be free from nodules, and they must also be true from end to end. The ends must be filed or turned true to form faces for the spindle holders shown at Figs. 19 to 21. These are secured to the ends of the armature by screwed studs, and holes must be drilled and tapped to receive them, as shown at *a*, *b*, *c*, *d* (Fig. 14). In the larger sizes of machine, the armature is built up of soft iron laminated plates, or punchings of sheet-iron shaped as shown at Fig. 22. These are also prepared and sold by the dozen and by the gross, by men who make it their business to produce them, the prices ranging from 3s. 6d. to 10s. per gross, according to size.

The armature is built up by stringing these punchings on a steel spindle, as shown at Fig. 23, after which they are placed in their proper position, and secured there by running nuts threaded on the steel spindle at each end, so as to pinch the whole series of plates between them. The result is to form a channel for the wire and faces for the cheeks of the armature similar to that of the solid H girder form. This laminated form of armature has been invented to lessen as much as possible the tendency of the H girder armature to heat, and form cross currents in itself whilst working. The laminations are divided from each other by narrow air spaces, and these help to keep the armature cool. The spindle of this form is made long enough to pass through the end bearings or journals in which they run to drive the armature. The solid form of armature requires two spindle holders bolted or screwed to the armature. These holders are made of brass, either cast with a projecting boss, or made up of a disc of brass with a piece of brass tube fitted in the centre to give holding power on the spindles. The spindles should be of steel, turned true and smooth, and fitted tightly in their respective holders. The projecting bosses of these spindle holders running against the bearings, prevent end shake of the armature; but when a laminated armature is employed, the ends of the spindle must be turned down a little to form a shoulder for this purpose.

The bearings for the smaller sizes of machines, shown at Fig. 17, are cast in gun-metal to the form shown at Fig. 25, or cut out of sheet brass to the form shown at Fig. 29, and are secured to the ends of the F.M.'s by long bolts resting in the slots shown in the lugs. They then clamp the front and back bearings together, as the bolts run the whole length of the sides of the machine. The bearings for the other forms are similarly made, but they are secured to the lugs of the F.M.'s by screwed studs, or by small bolts passing through holes drilled in the lugs. Whichever form of bearing is employed, or however it may be secured to the machine, we must be sure to have the holes exactly coincident with the centre of the armature tunnel, so that the cheeks of the armature may not run nearer to one side than the other. They must also be fixed, to ensure the armature being hung in the centre, between the opening at the top and the space at the bottom of the tunnel. This being secured, we may now bolt the F.M.'s together, put on the bearings, and test the fit of the armature in its channel. It should be so centred as to leave just the space of from $\frac{1}{16}$ to $\frac{1}{20}$ of an inch between the *cheeks* of the armature and the sides of the tunnel, or just the thickness of a piece of stout brown paper. If the space is less than this, the cheeks may strike the sides of the tunnel as the armature revolves, and so render the machine non-effective. If more space than this is allowed, part of the power will be lost, because the armature will be removed from close proximity to the magnetised poles. If there appears to be any danger of touching the sides at any particular part, mark the place, and ease it with a file. A very effective way to test the fit of the armature is to paste a piece of paper neatly all over it, and then revolve it in the tunnel. On taking it out carefully, the abrasions on the paper will mark the prominent parts, and these may then be eased.

The Commutator and Brushes. — As this form of armature will be wound with only one coil of wire, the commutator will be what is known as a "two part commutator"—that is, one divided into two sections, one section for each end of the wire coil. These sections must be insulated from each other—that is, they must be divided by a substance practically incapable of conducting electricity—and must also be insulated from the rest of the machine, for if the electric current generated in the armature is allowed to traverse the armature coil only, there will not be any current available to do work outside the machine. The cheapest and handiest insulating substance available is boxwood well soaked in melted paraffin. Ebonite, or vulcanised fibre, will also serve the purpose, but are more costly. In the first place, therefore, we get a chunk of boxwood, out of which can be turned a wheel or pulley $1\frac{1}{4}$ in. in diameter and 1 in. across the face. The smallest sized machines take a commutator $\frac{7}{8}$ in. in diameter. Turn this up true, and bore a hole exactly in the centre to tightly fit one of the spindles when driven on. Then get a piece of brass tube with a diameter to exactly fit the boxwood boss, cut off a one inch length, smooth the interior of this brass ring, and force it tightly on the boxwood. If now this brass-bound boxwood boss were forced on the spindle as shown at Fig. 21, it might work loose in course of time, so to prevent it from slipping around, we turn down the hub of the spindle holder enough to get a good face for the boxwood boss to fit against, then bore two $\frac{1}{8}$ in. holes in the holder, and fit therein two short brass pins. When we have determined how the commutator shall go on the spindle, two shallow holes may be bored in the inside face of the boxwood pulley to exactly fit those pins, and so keep the pulley from slipping. The ring of brass must now be divided, and upon the way this is done will depend—all other parts being right—the proper working of the machine. If divided into two equal sections, by cutting straight across the tube, the current from the armature would be interrupted abruptly, and sparks would be caused, which would soon burn away the brass ring and also the brushes. The division must therefore be made obliquely or diagonally across the ring. But here, again, we must guard against making the division as shown at Fig. 27 (A), for this would be too oblique, and the interruptions would, in consequence, not take place at the proper time. To obtain the proper direction for this division, turn the boss on one end and draw a mark across the centre (as to find its diameter); $\frac{1}{8}$ in. on each side this line draw two other lines. Now turn the boss on its end, and scribe two fine lines across the brass on one side exactly coincident with the two lines

on the end. Turn the boss over, and scribe two similar marks across the other side. Now scribe a mark diagonally across the space between these two lines on both sides, from the right-hand end of the top line to the left-hand end of the bottom line. Next, drill and countersink two small holes on each side of the line to receive two very small brass screws, as shown at Fig. 27 (B), and put in the screws, driving them well home. When this has been done, the ring may be divided by cutting it through to the boxwood on both sides along the diagonal lines. A hack saw will be found to be the best tool for this purpose; failing this, a fret saw may be used; but the division should be widened a little, and cleaned out well with a thin file, or it is apt to get choked and bridged with fine particles of metal worn off from the brushes. The holes for the fixing pins may now be bored, and the commutator fixed in its place on the spindle, having determined that the dividing line of the commutator ring shall be on the side of the coil nearest the left-hand cheek of the armature. Two small holes may be now drilled through the spindle holder (as shown at A, B, Fig. 19) for the ends of the armature coil to come through, and be securely fastened to the commutator ring.

The Brushes.—These are long thin pieces of springy brass, copper, or phosphor bronze, fixed to brush blocks insulated from the rest of the machine on each side of the commutator. Their duty is to pick up the impulses of the interrupted armature current from off the commutator sections, and convey those impulses to the field magnet coils and to the outer circuit. In the machines of some makers they are attached to boxwood blocks fixed to the bearings of the armature spindle (as shown at Fig. 29); in other machines they are attached to brass pillars (shown at Fig. 34) screwed into the wooden base of the machine on each side of the commutator. I must express myself in favour of wooden blocks, as shown at Fig. 29, with an adjustable brush holder attached to each block. When the brushes are fixed, as they generally are in small machines, their adjustment becomes a tedious task. The brush holder need only be a small brass bracket with a set-screw, as shown at Fig. 30. The brushes can then be slipped to and fro, and adjusted at any angle required, by placing wedges of brass above or below the back ends of the brushes. A very good material for the brushes of small machines is fine wire gauze cut into strips, and soldered (two or three thicknesses) to the ends of stout brass springs to ensure proper pressure on the commutator. I have shown three forms of brushes in general use at Figs. 31, 32, 33. That shown at Fig. 31 is merely a piece of thin spring brass, shaped as shown, and fixed to a pillar brush holder (Fig. 34). This is an objectionable form, as it is often getting out of order by wear, and cannot be easily replaced or adjusted. Fig. 32 is an improvement on the form shown at Fig. 31. It is composed of thin sheet brass, or hard hammered copper cut to the form shown, with one end (to the length of 2 or $2\frac{1}{2}$ in.) slit into fingers, and a slot cut at the other end to facilitate adjustment. The fingers soon wear away, and must then be replaced. I am indebted to Mr. S. Bottone, of Carshalton, for the idea shown at Fig. 33. It consists of a piece of hard spring brass, to one end of which is soldered a pad of copper wire gauze. This bears on the commutator, and is kept in contact with it by the strip of spring brass to which it is soldered, the strip being curved (as shown at Fig. 29) for this purpose. This pad is most effective as a brush; it does not cut away the commutator like spring brass and copper, and it is easily adjusted or replaced if fixed in a brush block with clamp, as shown at Fig. 30.

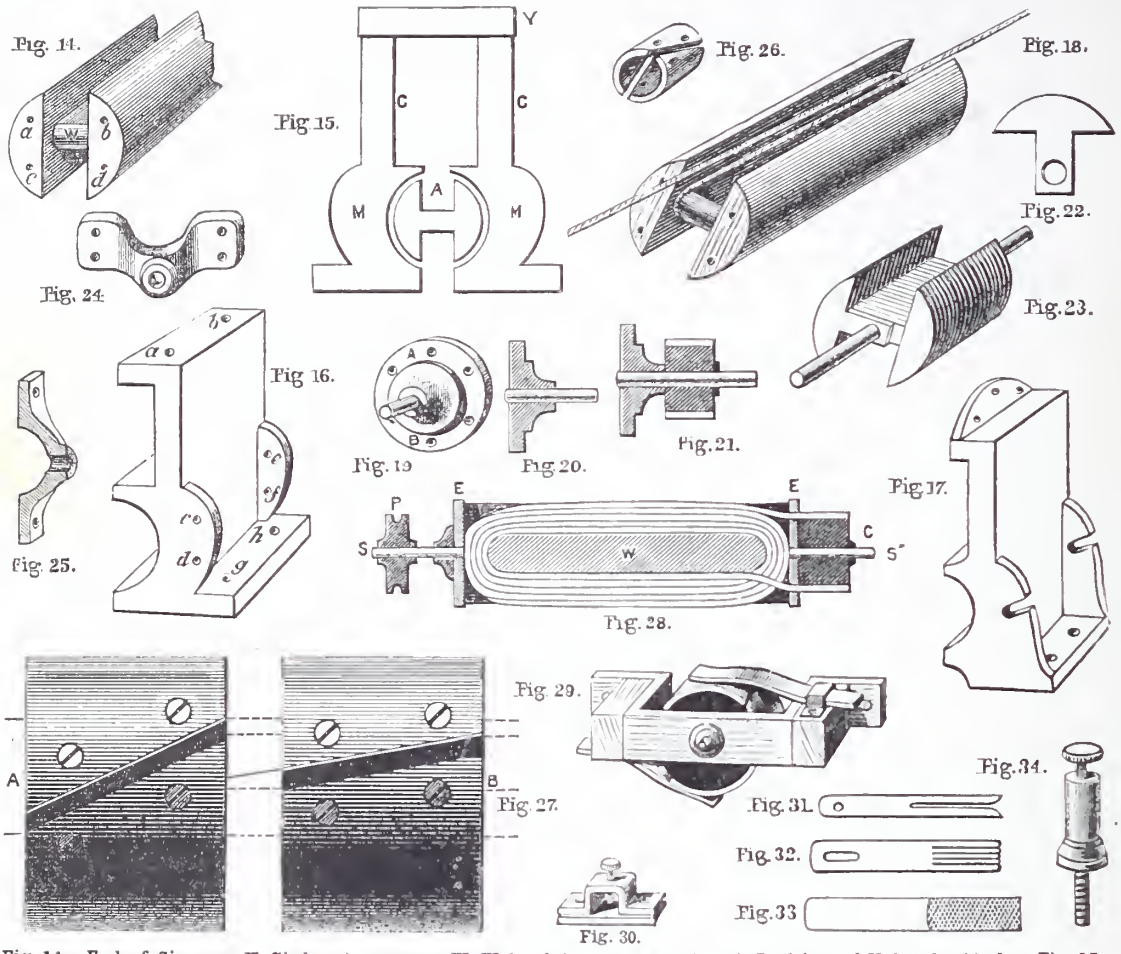


Fig. 14.—End of Siemens H Girder Armature—W, Web of Armature; *a, b, c, d*, Position of Holes for Studs. Fig. 15.—Diagram of Siemens Machine—A, Armature; C, C, Magnet Cores; M, M, Magnet Cheeks; Y, Yoke. Figs. 16, 17.—Forms of Field Magnets. Fig. 18.—Solid H Girder Armature, showing how to commence winding Wire. Fig. 19.—Spindle Holder: end view. Fig. 20.—Section of Spindle Holder. Fig. 21.—Section of Spindle Holder and Commutator. Fig 22.—Laminated Iron Punching for Armature. Fig. 23.—Iron Laminations strung on Steel Spindle to form Armature. Figs. 24, 25.—Bearings for Armature: end view and section. Fig. 26.—Brass Ferrule for Commutator. Fig. 27.—Commutator: full size, showing how to divide Brass Ferrule and fasten Ends—A, Division too oblique; B, Ferrule rightly divided. Fig. 28.—Section of Complete Armature—P, Driving Pulley; S, S', Spindles; C, Commutator; E, E, Holders; W, Web. Fig. 29.—End of Commutator, showing Position of Brushes. Fig. 30.—Clamp to hold Brushes on Brush Block. Figs. 31, 32, 33.—Some Forms of Commutator Brushes. Fig. 34.—Pillar Brush Holder.

TABLE OF MODEL DYNAMOS. SIEMENS' PATTERN.

No.	Size of Cores of F.M.'s	Size and Details of Armature.		Wire on F.M.'s.	Wire on Armature.	Power Developed.			Speed in Revs. per Minute.
	Inches.	Length.	Diam.	All connected in shunt.		Amps.	Volts.	C.P.	
0	$4'' \times 1\frac{3}{4}'' \times \frac{3}{8}''$	$1\frac{3}{4}'' \times \frac{7}{8}''$.	Solid	12 oz. No. 24, s.c.	$1\frac{1}{2}$ oz. No. 24, s.c.	2	15	5	3,000
1	$4 \times 3 \times \frac{1}{2}$	$3\frac{1}{2} \times 1\frac{1}{4}$	Laminated.	4 lbs. No. 22, d.c.c.	5 oz. No. 22, d.c.c.	2	25	10	3,000
2	$5 \times 4 \times \frac{5}{8}$	$4 \times 1\frac{3}{4}$		$4\frac{1}{2}$ lbs. No. 22, d.c.c.	10 oz. No. 20, d.c.c.	4	45	20	2,500
3	$6 \times 4 \times \frac{3}{4}$	$4 \times 2\frac{1}{4}$		8 lbs. No. 22, d.c.c.	1 lb. No. 18, d.c.c.	5 to 6	60	50	2,000
4	$10 \times 8 \times 1$	$6 \times 4\frac{1}{2}$		14 lbs. No. 22, d.c.c.	5 lbs. No. 14, d.c.c.	6 to 8	75	120	1,800

In the above Table, "s.c." means silk covered, and "d.c.c." means double cotton-covered copper wire. The candle-power—"c.p."—given is that of incandescent lamps only, and the machines are designed for this class of lamps.

Winding the Armature.—Before winding the armature, see that the channel is free from lumps, and the ends of the web smooth. Then cut a strip of silk long enough and large enough to envelop the web. Coat this with some good shellac varnish, lay on the silk evenly to form a bed for the wire, and varnish the silk and the channel. When the varnish is dry, proceed to wind on the wire. This will be all the better for the purpose in hand if it has been previously soaked in hot melted paraffin. Commence winding as shown at Fig. 18, lay each coil side by side, as a reel of cotton is wound, and wind layer on layer, forward and backward, close and tight, until the wire set apart for this purpose has been all wound on. Then bring the two free ends to one end of the armature, put on the spindle holder (Fig. 19), bring the ends through the ivory-bushed holes made in this holder for this purpose, put on the commutator, and solder the two ends of the coil to the two sections of the commutator. Then put on the other spindle holder, and the armature is complete. The wire coil must not stand above the cheeks of the armature. If a fugitive layer stands up above the others, and threatens to knock against the sides of the F.M. tunnel whilst being revolved, it must be gently pressed into its place with a piece of smooth wood.

I have again outrun the space at my command, so must defer further particulars on winding the laminated armature and the field magnets to my next article. I therefore give at foot of page 644 a table of measurements suitable to the construction of a few machines of this class. The castings and other necessaries for them are sold by Mr. S. R. Bottone, Carshalton, Surrey; and castings for similar machines can be had from Mr. H. Jones, High Street, Lambeth, S.E.

A COMBINATION CENTRING-DISC AND GAUGE.

BY OPIFEX.

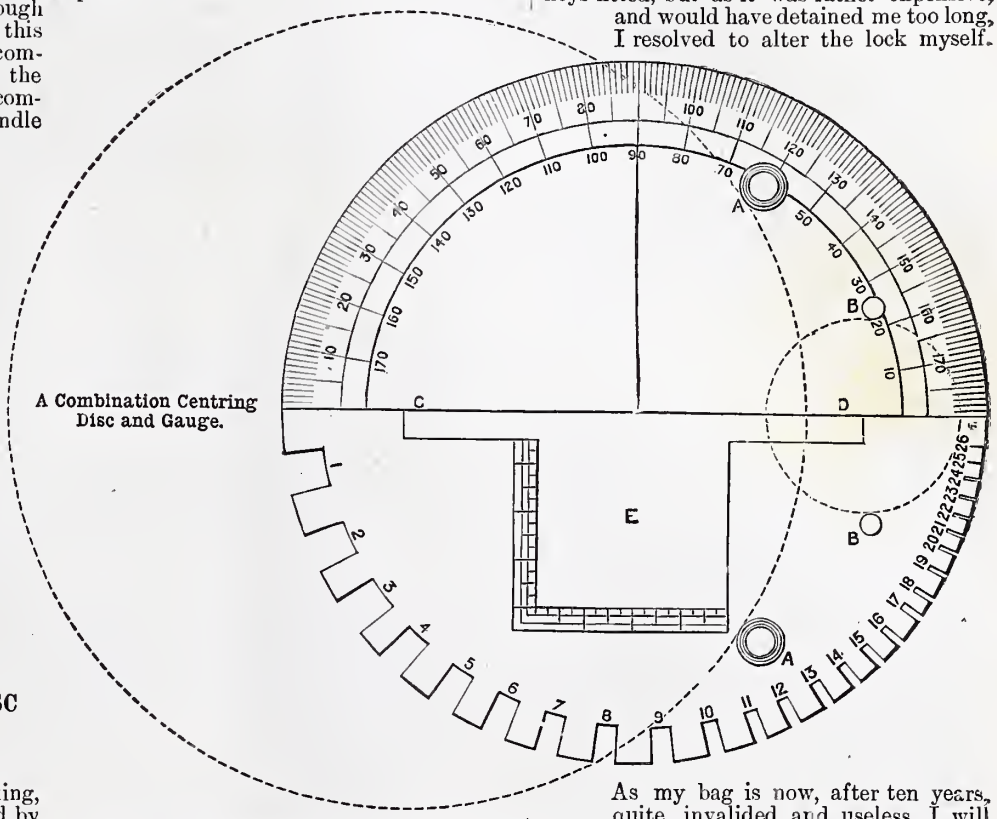
COMBINATION tools are, generally speaking, unsatisfactory, no good end being gained by the endeavour to make one article perform various functions, and the experience of all workmen, I think, goes to prove that no tool of this description does its work as well as an ordinary one. There are, however, exceptions to this, as to every other rule, and it is often a great convenience to possess an appliance that will serve more purposes than one; and this is true with regard to tools for measuring and marking work, especially metal work.

The centring-disc and gauge here illustrated has nothing novel to recommend it, but will be found useful to turners and metal workers generally. The principle of the centre square is the same as found in many workshops, but it is usually in the form of a small T-square, having a small pin projecting from the ends of the cross-piece, while one edge of the shaft forms a line at right angles with one joining the centres of the pins.

In the case of the disc before us, there are two pairs of pins, A, A, and B, B, to suit comparatively large and small cylinders, and the edge C D of the open slit serves for marking the lines by which the centre of a cylinder is obtained.

As represented by the two circles in dotted lines, any cylinder from 4 in. to 1 in. diameter may be centred by means of this tool, and, if the pins A, A, were placed further apart, and the pins B, B, nearer to each other upon the circle which passes through their centres, cylinders considerably larger and smaller could be centred.

The open space E is an inch square, and is graduated to $\frac{1}{16}$ in. upon two sides. This will be found useful for measuring and matching bolts or square iron, etc., of any scantling up to an inch square. A wire, or plate gauge, as shown on the lower semi-circumference of the disc, also forms a most useful adjunct in this combination, whilst the protractor formed by the upper semi-circumference and centre line of the disc speaks for itself.



A Combination Centring Disc and Gauge.

I need hardly say that this tool requires most careful and accurate work, or that it is useless for anyone who does not possess a good lathe to attempt to make it; considerable skill in the use of the file and the graver is also essential, but to any person possessing these, the subject before us furnishes a good opportunity for the display of accuracy and skill.

I made one of these discs of $\frac{1}{16}$ in. manganese steel turned true on both sides. The studs or pins are of brass, the lines are engraved, and the lettering is etched with nitric acid, all of which processes will be found clearly explained in back numbers of WORK.

MEANS, MODES, AND METHODS.

BAG-PORTMANTEAU LOCKS.

MANY of our readers may have observed the great similarity in the style of locks usually fixed on travelling-bags, portmanteaus, dressing-cases, hand-bags, and the like. They seem to divide themselves roughly into two classes—bag locks, and box or portmanteau locks. Of bag locks the quality seems, as a rule, very poor, and the type of key always, or almost always, the same. Once, at Paddington, I encountered a youth who was in tears because his money was locked up in his Gladstone, and he had left his keys behind him; he was trying vainly to force the bag open, when I offered him my key to try with; to his surprise it opened it at once. I was not in the least surprised, as when I bought my own Gladstone I noticed that all the keys in the shop were practically interchangeable, there being, however, two sizes, one for small hand-bags, and the other for bigger hand-bags and Gladstones. As I was then on the point of going abroad, I wished for a better lock: the shopman offered to have the lock altered and new keys fitted, but as it was rather expensive, and would have detained me too long, I resolved to alter the lock myself.

As my bag is now, after ten years, quite invalided and useless, I will explain the method I adopted, to which anyone is welcome.

After due consideration, I removed the lock, or, at any rate, that portion of the lock that was not riveted on to the iron framework of the bag; then I took out the pin which goes into the barrel of the key, and in its place inserted a brass pin nearly half as long again. After this I bored out the key barrel with a Morse twist and drill to a corresponding depth.

In addition to this, I filed down the movable portion of the lock (viz., that on which you press to open the bag) until it was level with the collar which surrounds it.

Then, on putting the lock together again, I had a lock doubly secured against inquisitive persons. It could not, even when unlocked, be opened with any pressure from fingers—pressure from some hard instrument being absolutely necessary. When locked it would have required a key bored out in a similar manner to mine—or a skeleton key—to open it; and in all my numerous travels I have not found that it has been tampered with, or, at any rate, opened.

Of portmanteau or travelling-box locks

there is not much to say in a general way; they are of better quality—lever locks, as a rule—and there seem to be about half a dozen types. A good portmanteau is usually sold with two keys, one made of iron in the usual way, and the other of brass or gun-metal.

I may mention here that the best way to open a portmanteau if your keys are left at home, lost, stolen, or strayed, is to cut through the copper rivets by which the lock is fastened to the leather, or else to file the burred portion down, when the lock will easily come off, and can be as easily fixed on again after being unlocked. In many cases it is simpler to take off the hasp in the same way, *i.e.*, by removing the rivets; or, better still, by knocking out the pin in the hinge of the hasp, if it should be practicable.

About the locks of hat-boxes, *i.e.*, the ordinary circular abominations which hold a hat only, and nothing else, the less said the better. The locks seem to be very common, and of one type only, and, in consequence, any one man's hat-box key will fit any other man's hat-box.

Despatch-boxes, jewel-boxes, and the better quality of dressing-cases and bags, as supplied by good makers, are, as a rule, equipped with locks of much better quality, often, indeed, with so-called Bramah locks, often with the very ingenious Yale locks, which are unpickable by an ordinary person. H. J. L. J. M.

My Speaking-Tube.

When first I started housekeeping, now some years ago, the room that was given up to me as my workshop (or "pig-room," as my women-folk used to call it) was right at the top of the house.

This was an advantage to the household, as the noise of my metal working was minimised, but a disadvantage to me, as there was no bell in case of my wanting coal or anything brought up at odd times; and I was obliged in consequence to go up and down more often than I cared to do. There were already two separate instalments of electric bells in the house, and a third was out of the question; a telephone occurred to me, but, as that required two electric bells in conjunction with it, I bethought myself of a speaking-tube. After jotting down the various things I required, I found it was undoubtedly a cheap, perhaps the cheapest, mode of communication with the downstair regions, and in a short time the installation was fixed complete.

In the course of my inquiries at various shops, I found that the prices of fittings varied to a surprising extent. One firm on whom I called offered to put one up at 1s. per foot, all complete: as I wanted fifty feet or thereabouts, I should have been poorer in the end by £2 10s. This would not do for me at all. Everybody seemed unanimous in recommending tubing an inch in diameter, but, by experimenting at a friendly ironmonger's shop, I found to my joy that ¼ in. or ⅜ in. compo. pipe answered the purpose admirably. I chose the ⅜ in. pipe, as it was rather stouter and stood bending better than the smaller size. The lot of tubing was in one piece; but, unable to put it up single-handed, I cut it into two or three sections, each of which alone was perfectly manageable. The tubing was fixed along the woodwork of the banisters in the mouldings, where it was least obtrusive to the eye, by means of staples. Joints were made by means of red-rubber tubing: it cost more than the white certainly, but is cheaper in the end, as a longer time elapses before it becomes perished by exposure to the air. The whole tube when finished was varnished with a spirit varnish, coloured to suit the graining of the stairs.

The fittings or mouthpieces I picked up second-hand for a very small sum; they were large, being made for 1 in. tubing; but I turned down some cotton reels till they fitted the mouthpieces quite tight, and I turned out the holes in their centres to fit my ⅜ in. tubing. My speaking-tube had to go round several sharp corners and bends, but the bends did not hinder the passage of sound in any material way.

The whole installation did not cost more than 6s. or 7s., and was so satisfactory that I put up another from the morning-room to the kitchen.

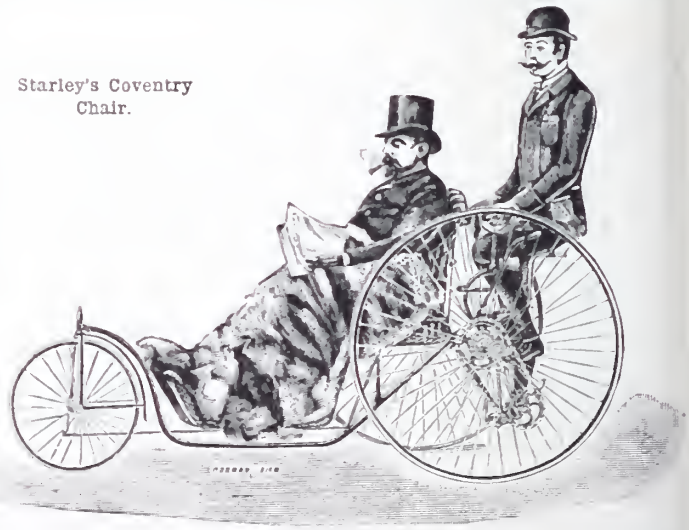
For the first day or two the sound of the whistle was grand fun for my two terriers, who are always glad for something to bark at; all the same, they were mightily afraid of the tube (no doubt thinking it a diabolical invention), and always refused to be conciliated by any expressions of goodwill if conveyed down the (to them) unspeakable tube. H. J. L. J. M.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

106.—Starley's Coventry Chair.

Messrs. J. K. Starley & Co., Limited, Meteor Works, West Orchard, Coventry, the well-known makers of the well-known "Rover Bicycle" and "Coventry Chair," have produced in the latter a machine which cannot fail to find favour as a conveyance for invalids, or for any lady or child whom the rider may desire to take with him on any pleasure trip. The general appearance of the "Coventry Chair" may be gathered from the accompanying illustration, in which it is utilised as a means of locomotion either for a sufferer from recent illness who has reached the period of convalescence, or one whose confirmed weakness of body is such as to prevent him almost entirely, if not wholly so, of using any sustained exertion on his own account. Technically speaking, it may be described as a front-steering tricycle chair, with 40 in. side wheels and 22 in. front wheel, all furnished with 1 in. tyres. It is fitted with patent double-driving gear, and has ball bearings to all running parts, cranks, and pedals. The body of the chair is light, being made of wickerwork, but it is also strong, despite its lightness, and handsome in appearance. It is upholstered in blue cloth. Its powerful brake places it at all times well under the control of the rider, and, in addition to this, the seat and handles are adjustable. It should be said that the wickerwork of the body is varnished. The other parts of the chair are enamelled and tastefully lined in colour, all bright parts being painted. The price of the "Coventry Chair" in the styles just described is £33, but those who may prefer a wooden body can have a machine thus fitted, the body being painted and lined in two colours, for an additional sum of £3 10s., making the entire cost £36 10s., but it must be borne in mind that the machine with a wicker body would certainly be the lighter of the two. It is needless for me to point out that the makers are Messrs. J. K. Starley & Co., Limited, for their specialities in Rover Safeties, Rover Sociables, and Roamer Tricycles, as well as in the Coventry Chairs now under consideration, are so widely known and so highly esteemed in the wheel world as to render any remarks of mine on their merits as makers of machines wholly unnecessary and superfluous. That the Coventry Chair fully meets the requirements of those who move in the inner circles of society is shown by the testimonial given to Messrs. J. K. Starley & Co. by His Grace the Duke of Argyll, who writes, "Your 'Coventry Chair' has been tried by the Duchess. She has found it most comfortable." Medical testimony in its favour is also very strong, for a Malvern practitioner, who has himself taken an invalid for several rides in one, declares it to be so roomy and comfortable that invalids may be said to "repose" in it, while the strong springs and cushion tyres with which it is furnished "make vibration almost unfelt." Which means that a patient can, by means of this chair, obtain exhilarating exercise which is utterly unattended with fatigue, and in which the jolting that is inseparable from the ordinary Bath chair is either reduced to an inappreciable minimum or altogether unfelt. Turning from this to its capabilities for the conveyance of a companion and a considerable quantity of luggage over many miles of country in a journey extending over some days, a gentleman engaged in business in the City of London tells the makers that, although he is by no means a strong man, he was, nevertheless, able to work one of the "Coventry Chairs" from Redhill, in Surrey, to Devonshire and back, laden with, let us presume, a lady weighing over nine stone, and half a hundredweight of luggage, himself riding behind and acting as the motive power, at an average of about forty miles per day, without any fatigue or undue exertion. From these facts powerful arguments can be drawn in favour of its adoption in towns and health resorts as a substitute for the old Bath chair, and as a means of conveyance certainly preferable in the case of ladies to the Sociable, especially when the lady, for various reasons, may not be willing or able to take her due share of the work of propulsion as in the case of the latter. Messrs. Starley & Co. are now sending out their illustrated catalogue for the season 1891. The Editor.



Starley's Coventry Chair.

SHOP:

A Corner for Those who Want to Talk It.

In consequence of the great pressure upon the "Shop" columns of Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Canvas for Canoe.—Lineno writes:—"In reading Work, No. 80, page 485, I see there is a reply to an inquiry for the best canvas for a canoe. It states that No. 1 canvas would be the best, which is very indefinite, as there are several kinds of canvas—viz., cotton for paper-hangers, jute hessian, tow hessian, flax, and dowlas for artists, all commencing at No. 1, and going upwards according to weight and fineness. I send a few samples, with names and widths made, which are largely used by carriage and van builders where they require strength and lightness. The samples are only procurable at heavy linen establishments. The following are the particulars as to sizes made of the canvases, samples of which have been sent:—Loom dowlas, made in widths of 30 in., 36 in., 40 in., 45 in., 70 in., 80 in., and 90 in.; tow hessian or canvas, made in widths of 36 in., 54 in., and 72 in.; flax canvas, made in widths of 27 in., advancing 3 in. to 6 in. up to 70 in.; sail cloth, made in widths of 24 in. and 36 in."

Austin-Leclanché Battery.—J. W. (*Homerton*) writes:—"I have much pleasure in telling you I have made an Austin-Leclanché battery, and I am very pleased with its working. I have put it on my door bell, and although rung several times during the day I find no difference in the sound. Thanks to Mr. Austin for his article."

To cut a Round Glass Bottle in Two.—S. R. (*No address*) writes:—"Get a piece of wool and tie it round the place you want it to break off by, then pour a little paraffin oil nicely all round the wool, so as to saturate the wool with the oil, by means of a spoon or a small bottle; light the wool with a match, and let it burn all round (giving the bottle a little turn): this will make the place where you tied the wool round very hot. When it has burned all round, dip it into a jar of cold water and it will give a crack, then give it a little tap and the bottle falls in two."

"Seal" Engines.—A Subscriber from the First writes:—"In Work, No. 87, page 568, you give an illustration of a half-man-power Seal gas engine. I shall be greatly obliged if you will let me know if they make them in larger sizes, say half or three-quarter horse-power, and the cost complete with water cistern."—[Probably Mr. Seal will answer this correspondent by advertisement in Work or otherwise.]

A Useful Paste.—L. S. L. (*Kirkcaldy*) writes:—"I find ordinary flour paste, made of the very finest wheat flour, in which a small quantity of fine white sugar is dissolved, and afterwards, while cooling, a few drops of carbolic acid is stirred, keeps good for any length of time. The proportion of sugar should be about one-fourth of the flour. I have used this paste standing in an open jar for months."

Lectures in Drawing.—The Rev. J. A. F. (*St. Mary's Working Mens' Club, Chalton Street, St. Pancras, N.W.*) writes:—"It may interest you to know, and may lead to the formation of similar lectures in other districts, that a course of lectures on elementary drawing are being given in connection with the above club on Wednesday evenings, at 8.15, free to all members of the club. The lecturer is Mr. A. R. Jemmet."

"Our Eyes."—J. B. (*Strand, W.C.*) writes:—"The price of this book is 1s., not 6d., as stated in Work, page 567, Vol. II."

II.—Questions Answered by Editor and Staff.

Electrical Machine.—Querist.—This correspondent has made a very effective electrical machine out of a "sugar-stick bottle," a few bits of iron and wood picked up from a scrap heap, and other homely materials. It gives sparks ½ in. in length, and with these he charges a fulminating pane made by himself out of glass, tinfoil, and varnished paper. With this he can do a lot of experiments, and provide much amusement in the dark winter evenings.—G. E. B.

Camera Obscura.—Amateur.—The reference (see No. 75, page 403) is incorrect. A shutter working up and down fixed behind the lens can be liberated from the outside by means of a lever; the shutter should, of course, be one of the self-setting kind.—D.

Spongy Platinum.—Querist.—You cannot make a piece of platinum spongy. Spongy platinum is prepared from a solution of platinic chloride by precipitating the metal with sal-ammoniac solution as a double chloride of platinum, and then heating the pasty precipitate in a crucible until it becomes spongy. It will be cheaper for you to buy than to make it.—G. E. B.

Carpenter's Bench.—G. H. (*Paddington*).—In asking for a description of a carpenter's bench, you ask if an iron one is known to me. Yes; there is an iron-framed bench (see page 235, Vol. I.) sold by Mr. Syer, of Wilson Street, Finsbury, but the writer has no experience of it. As several of your friends are waiting for this information, I shall describe a wood-framed bench. I should suggest that you make the bench not less than 5 ft. at the shortest: the labour would be scarcely any more, and the usefulness greater. For amateurs' work, a bench resembling a cabinet bench would be more useful; but we will try to embody as many useful appliances as possible. If you are careful, and do not object to the expense, have an "instantaneous grip vice"; but if not careful and gentle, have an ordinary wood screw. Cabinet-makers' and amateurs' benches should be a trifle higher than carpenters', owing to the thinner boards dealt with by the cabinet-maker, and usually finer work; in any case, make the bench 2 ft. 9 in. high: you can easily cut an inch off if it proves too high; 2 ft. 8 in. suits me well, and I am of fair height, though for some work I find a higher bench beneficial. Make the legs of good white or yellow deal, 3 in. square, or 3 in. by 4½ in. These should have a cross-rail, 3 in. by 2 in., connecting each in pairs, morticed and tenoned together: tenons, of course, on the rails, being 3 in. by 1 in.,

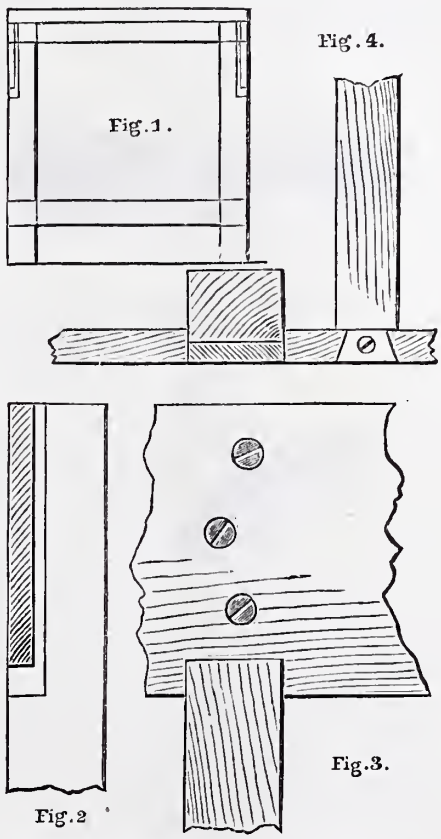


Fig. 1.—Section of a Bench. Fig. 2.—Top End of Leg. Fig. 3.—Sideboard from Front. Fig. 4.—Sideboard from Top, showing Bearer.

well fitted, glued, and wedged. The pairs of legs thus made should be paired again by longitudinal boards, 7 in. or 9 in. by 1 in., as long as the bench is to be; cut a recess on the outer surface of each leg 6 in. to 8 in. long, measuring from the top, and ⅝ in. deep; mark on the sideboards the position of the legs' gauge, ⅝ in. from the front; cut away at the back, notch the bottom of board to fit leg 1 in. deep, and fix with glue and screws; you should have the legs and sideboards flush on the outer side and the top surface. Any desired number of cross-bars are now to be dovetailed into the sideboards, so as to fit well, flush to the top surface; glue and screw them; these rails may be 3 in. by 1½ in.; the section given and the diagrams of connection of leg and sideboard may make it clear to G. H. and his friends. If the bench top is of hard wood, a hold-fast may be added: this is exceedingly handy, and the holes into which it is inserted may be bored through top and bearers. Syer's patent bench knife (see page 235, Vol. I.) is a useful addition to the bench, provided the worker does not object to a row of holes along the bench. If you have an iron bench screw, you may bore through the leg and fix the nut on the inside of it; if a wood screw, then fix the nut as near as possible to the leg and to the under side of the top, and fix the nut to both the sideboard and to the leg and top, or a vigorous amateur screwing up a narrow strip will force the sideboard away from its place. When it is remembered what leverage the bench screw handle gives, this is not surprising. If I had another bench to make for myself, I should certainly have a screw at the rear end, like that sketched in Work, as a "Slojd" bench (see page 797, Vol. I.): this would help to convert the bench into a carver's bench, a project, however, on which I have a paper in hand. If a pair of diagonal struts are placed under the bench from standard to standard, well fixed, and a bolt through the crossing—thus X, it will materially strengthen the structure, and a shelf nailed upon the lower cross rails is very handy. For supporting boards while shooting the edges, a turned and tapped wood screw is very useful, and it can be also used on the top to abut any piece of wood while sawing a shoulder, etc. The slide and its casing should be fixed truly square, the slide having three tenons fitting into mortices in the movable portion of the bench vice, the casing for the slide square to the sideboard in each direction, and parallel to the underside of top. For another ingenious device for the bench, please refer to page 299, Vol. I. This seems, from the description, to be a capital thing. I for one should like to see an example in use or on show in London.—B. A. B.

Paging of Work Parts.—J. M. McB. (*Westport*).—What you suppose is an error in the paging of your parts is really not so. Refer to Work, No. 79. You will find that the four-page supplement of "Shop" is paged correctly between pages 438-443. So they should be bound—if you bind your numbers; and you should.

Works on Perspective.—You should get either of the following books:—Davidson's "Practical Perspective," 2s., Cassell & Company; or Spiers' "Architectural Drawing," 10s. 6d., Cassell & Company.

Draughtsman's Work.—G. P. (*King's Lynn*).—Instructions on this subject will, in all probability, be given in Vol. III.

Adjustable Scribing Block.—W. S. (*Dover*).—The principle of this invention has been covered by one Montgomery, in a U.S. patent granted to him, but as we have not seen the specification, we cannot say what is included in the invention. It is pretty clear that the *object* of both inventions is similar, and it would be needful to compare the description and claims of the U.S. patent with what and how W. S. purposes to carry out his plan, so as to see clearly what is open for him to do, and thus enable him to avoid trenching on other rights—which, if not granted in this country to the American, are now published here, so that they are public property.—C. E.

Engraving Seal Stones.—Improver.—This engraver wants to know the way in which letters, etc., are put in stones of signet rings. A complete answer to this, and detailed descriptions of tools, powders, lathe, etc., used in this art is to be found in Vol. III. of Holtzapffel's "Turning and Mechanical Manipulator," pages 1348-1365, under the head of "Seal Engraving." The book is now out of print and under revision, so Improver will have to apply at some public library for it. It is worth a little trouble to obtain; for this particular article is based on the practice of one of the best of our London seal engravers—Mr. Warner. The following is a summary of the process:—In the first place, the lathe, which is a small one, is made so that the "tools" can be fitted in. These are of soft iron rod or wire, with ends generally in the shape of beads or discs, the diameter of the largest disc being rarely more than $\frac{1}{16}$ in. These are made to revolve rapidly, and are generally charged with powdered diamond dust, lubricated with oil of brick. With these minute wheels or discs, the stone is ground out to the depth and shape required. A good idea of the process is to be obtained at many public places—such as the Crystal Palace and the Aquarium—where men are at work engraving glasses, etc., with names while you wait. The machinery and materials are much the same, but modified to suit the glass, which, is of course, softer than the generality of seal stones. Cutting tools in the forms of gravers, scorpers, punches, etc., are of no use, neither is acid.—H. S. G.

Wire-Work.—Rat-Trap.—I give some addresses of firms who supply wire. I know of no book on flower-stand and rat-trap making; but a serviceable series of articles treating with plain and ornamental wire-work in a practical manner are about to appear in Work. One of the papers will deal with the articles you specify. Messrs. Cicero and Co., Clerkenwell Road, E.C.; Messrs. Thomas, Edgware Road; or Mr. W. Hughes, 57, Drury Lane, W.C., will supply you.—J. S.

Coach Painting—Cane-Work in Panels.—H. W. (*Strabane*). Imitation cane-work in its many varieties, imitation wicker-work with open spaces showing the ground colour of panel, is seldom done with pencil or tube now; it is prepared in large sheets stamped out with most accurate form of mesh and embossment of one line overlaying another, so that it stands up in relief almost as high as the actual cane or wicker-work. It is varnished over on the side to adhere to the panel, and pressed on, and a coat of varnish over all cements it thoroughly to the panel. Before this invention, camel-hair pencils, air-tubes, and wheel-tubes were used, and as it is a good exercise for eye and hand, and some may like to know how it is done, the following details will show that it is simple enough, only needing patience and a steady hand. Having determined your pattern and size, mark off with compasses on the panel the double horizontal and vertical lines from the mouldings of panel; lay

these on first, using a straight-edge lath for the finger-guide or for the tube-wheel (the air-tube clogs, and does not answer so well). Be sure you work from the top downward, then you will not smear your work. Having done the longest horizontal lines first, let them dry. Drying colour may be made of a turps colour mixture—say, a wine-glassful—to which is added a tea-spoonful of quick drying varnish, and a quarter of a tea-spoonful of linseed-oil (never use boiled oil in carriage painting), making it like thin cream. Now work the double vertical lines from right to left of your panel; when these are dry—say, in an hour or two—put in the single diagonal lines in one direction first; leave these a little longer to dry, and then finish off in the cross diagonal direction. When dry, the broad-edge cane is put in the angle of the moulding; this covers up all the endings of lines; if you wish for effect, you may add the "ties" which, in real caning, hold down the broad-edge cane, and you may shade them with a darker tinge on one edge. A coat of clear copal varnish completes the job. The tube-wheel is a most ingenious tool: it is as a syringe in shape, with a small rowel-wheel in the point; the syringe or tube part is filled with colour, and attached to one leg of a pair of compasses, to serve by the other leg as the guide-fingers of the painter's hand. It acts as does a lawn croquet marker, and the revolving wheel, about $\frac{3}{16}$ in. diameter, draws down the supply of paint from the tube and rolls it along the panel. The paint dries so quickly that it must be frequently supplied, and every part of the tool, wheel, etc., is cleaned off with turpentine before it is put away. The only place I know where this wheel-tube is to be bought is at the large coach trade furnishing warehouse, Whittingham & Wilkins, 136, Long Acre, W.C. The price complete is 15s. 6d. This firm deals largely in colours prepared for use, and the sheets of imitation cane and wicker-work.—J. C. K.

Frosting.—XMAS.—Powdered glass is what is applied to cards to give them a frosted appearance; it can be made by heating glass red hot, plunging it at once into cold water, when it breaks into powder; it is then sifted and dried. Do you wish to make the cards for trade purposes, or simply a few for your own use? Whichever way, you ought to experience no difficulty in getting it at a local glass-blower's; or you can write to Messrs. J. Powell and Sons, Whitefriars Glass Works, Temple Street, London. It is very cheap, and weighs light; 1 lb. would be sufficient to frost several hundreds of cards.—W. E. D., JR.

Decorated Tin Sheets.—H. B. (*Brixton*).—You can buy these from the Decorated Tin-Plate Company, Neath.—R. A.

The Art and Craft of Sign-Writing.—C. M. (*Gloucester*).—"The Art and Craft of Sign-Writing," by Mr. William Sutherland, originally published at 15s., and now, owing to its scarcity, raised in price to one guinea, may be obtained from Mr. W. G. Sutherland, "The Journal of Decorative Arts" Office, 15, St. Ann Street, Manchester. There are only a very few copies left of this valuable work, and I therefore advise early applications for same, as, owing to the heavy cost of producing the coloured sheets of alphabets, etc., it cannot be reprinted, and a fresh edition issued. This work will in time become very valuable.—H. L. B.

Painting Advertising Boards for Lettering Purposes.—CALIGRAPH.—If you have taken your contract at a fair price, you must turn out the boards in a fair workmanlike way, so that they will withstand the ravages of sun, wind, and rain for a reasonable time. There are many makeshift ways of stopping up the pores of the wood, but in using them the work would soon become valueless. Nothing can beat a good stiff coat of priming, properly mixed, and containing in equal parts the best red and white lead. Two good round coats of paint upon this should then present a pretty fair ground for lettering upon. For temporary purposes, you may give the boards a coat of size, or better still, ordinary ceiling whitewash—*i.e.*, size and whiting, which, when dry, should be rubbed down with fine glass-paper and the boards well dusted.—H. L. B.

Technical Classes.—D. H. J. (*Balham*).—A reference to your local directory should give you the information you seek. However, apply to the City of London Guilds and Technical Institute, Finsbury, E.C., as to its branch classes.

Rimering Tools.—W. E. (*Birmingham*).—You will turn the tool all over to obtain the blank outline, file the teeth to shape, and temper by first getting red hot, then dipping in oil to let down the heat a little, and then transferring to cold water, where it will remain until quite cold. The teeth will be sharpened with an emery wheel.—J.

Sheet Iron.—S. T. (*Kensington, W.*).—Butterworth Brothers, Marsh Street, Bristol, supply this.—J.

Polish on Steel.—There is nothing better than fine emery.—J.

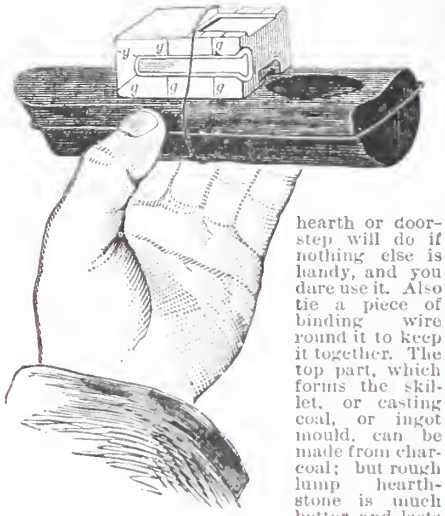
Designs in WORK.—E. B. M. (*Tunbridge Wells*).—At present, sheets of designs at extra charge are not contemplated.

Iron-Work.—APPRENTICE.—You should procure "Iron-Founding," by Wylie, 5s., Spon & Co.—K.

Work on Plumbing.—BALL VALVE.—You should procure "The Plumber," etc., 1s., Houlston and Sons, Paternoster Square, London.

Patent Fire-Light.—PETRO.—You should search the Files of Patents, at the Patent Office, Chancery Lane, London, E.C., to see if a patent such as yours has been registered already.

Melting Gold in Small Quantities.—INDEX.—In a previous answer to this same correspondent it appears that I left out the very part he "wanted minute details about." I will gladly attempt to supplement the answer in WORK, No. 74, page 357, and tell him how to run down a few pennyweights of gold ready for forging into shape. All of this might have been given before if INDEX had only taken the trouble to say what he *did* want when writing to our Editor. Now for business. Here is a sketch of the simplest, easiest, and cheapest arrangement for melting small quantities of gold, and it is one that has stood the test of ages, so it is old-fashioned; but that is no reason why it should not still be used—at least, until one deals with larger quantities, when Fletcher's new arrangements can be employed with advantage. I will briefly refer to these at the end of this answer. The sketch shows that this arrangement is composed of two separate pieces tied together with wire, one of charcoal, the other of hearthstone (or charcoal). The lower long piece is formed from a nice piece of sound spring wood charcoal, ground quite flat on one side with a shallow hollow scooped out as a receptacle for the gold while being melted. The bow of the dividers or a piece of clock spring answers well for making the hollow, and as for grinding the charcoal flat—well, that can be done on any decent size piece of level stone; the kitchen



Melting Gold in Small Quantities.

hearth or door-step will do if nothing else is handy, and you dare use it. Also tie a piece of binding wire round it to keep it together. The top part, which forms the skillet, or casting coal, or ingot mould, can be made from charcoal; but rough lump hearthstone is much better, and lasts longer. The hard pieces are the ones that are to be chosen for this purpose, and as a rule the lumps are too large, and therefore should be cut into two or four portions. Each portion is then to be ground flat on one or more sides, ready for cutting or filing out a smooth groove or hollow of the shape and capacity desired. For example, if our few dwts. are for making something wide, such as the backs of collar studs, then our piece of hearthstone will be hollowed out like the one drawn on the top side of sketch; but if for wire or narrow work, such as a wedding ring, then the hollow should be like the one at the side of the top piece. This latter is really the shape for your job, and you are to suppose that one exactly similar is tied down flat on the charcoal. It hardly seems worth while going into measurements, because two or three meltings will teach all that; to be quite on the right side, make your ingot mould—that is, as you know, the hollows I have been writing about—full large. It is well to have the mouth rather wide so that the molten metal will be sure to run in. And see also that the sides of the mould slope inwards a little, else it will be broken. Make it relieve, in short. Even now it is hardly finished, for it has to fit on a flat charcoal, and being flat itself, it follows that some measures should be taken to allow the air to escape, or else we shall find that the metal has not filled the ingot. It is an easy matter—merely two or three slight grooves, filed or scratched across from inside to outside, being quite sufficient. They are shown on sketch and marked *g*. Instead of this, one finds that a piece of flatted iron of suitable depth, shape, and capacity answers very well when lightly greased and tied between two pieces of charcoal. Before proceeding to melt our gold, the greatest care should be taken to have both parts quite dry, for if there be any moisture about, the gold will spit all over the place. So, to sum up, we have now quite ready for tying together—first, a piece of charcoal, one side flat and hollowed out at one end for the gold; secondly, an ingot mould, of either hearthstone or charcoal or iron. If either of the former, it must be quite dry, and should relieve; if the latter, then slightly greasing suffices. The sketch indicates the rest of the minute details, I think. By it you see how it is held so that it can be easily tilted back to run the gold in. If your coals do not fit, then you will be reminded of it by finding the molten metal run either over the side or into your hand. Now a safe precaution for taking care of the gold is to have a basin of clean water underneath to catch any that may run over; otherwise, an hour's grubbing on the floor picking up minute grains will be spent. A small piece of borax should be used as a flux, and either the mouth blowpipe or one driven by bellows, just whichever you have. I wish you every success in making rings, or, in fact, anything else from odd pieces of gold. I know that the chances of obtaining workable gold are against you, particularly if every atom of lead or silver solder, etc., etc., is not taken out before melting. If it is your idea to have such a wedding ring hall-marked, then add some fine gold over and above what you believe to be the exact quality, otherwise the Hall may smash it up, as they are empowered to do with all work of inferior standard. Just a few words in conclusion with reference to other and improved methods of melting. They are the production of Thomas Fletcher & Co., Thynne Street, Warrington, and the only one I have space to refer to here is what is called Fletcher's new melting arrangement for melting gold or silver rapidly without the aid of a furnace. In this, the two parts of the ingot mould slide on each other to enable ingots of any width to be cast. The blowpipe is part of the rocking stand. A blower, which costs 21s., connects to an upper tube and the gas to a lower tube. The metal is melted in a shallow crucible and the whole apparatus is tilted until the ingot mould is filled. The price of the small size is 13s. 6d., and that melts 3 oz. The crucibles cost 4d. each. There are other patterns and sizes; but this will give an idea of the cost. The firm will send you a catalogue, I do not doubt, if you think of getting one of these stoves. For my own use I have an injector furnace that gives perfect satisfaction, and melts a few dwts. or 20 oz. without any trouble.—H. S. G.

Verge Watch.—BIRMINGHAM.—Go to any watch tool shop—say, Messrs. Swinden & Son, 27, 28, 29, Temple Street—take the verge, the cock, and plate, and ask for a hairspring to suit; also cock-screw. By taking the verge with balance, they will be able to guess very nearly the strength it should be, and by taking the plate they can see the diameter it must be. The screw they will give you will probably be a grey one, perhaps too thick in the head and too long, so that it goes through the plate and projects; if so, cut it off to the correct length, and reduce the head till it is just flush with the cock; see the saw cut is all right, make it red hot and drop it in oil, take out and nicely polish the head, and let the colour down to a blue, and there you are.—A. B. C.

Violin Making.—PAUL JONES.—Papers on this subject are in hand, and only await an opportunity for publication.

French Clock Repairs.—COUNTRY AMATEUR.—Are you sure you gave me the correct number of the wheels and pinions of your clock, the 'scape wheel of which is broken, as by calculating I find it would be a very short pendulum, and if so, it would be one of those cheap common ones that would not pay to convert to watch escapement? However, taking your figures as correct, I find on calculating the following result:—$96 \times 84 \times (45 \times 2) \div 7 \times 7 \div 60 = 216{\cdot}85$ vib. per hour, and $141120{\cdot}0 \div 216{\cdot}85^2 = 2{\cdot}32$ in. as being the length of your pendulum at present; now, is that correct? Now the escapement you have bought; how many vibrations per minute does the balance make? There are three different trains—18,000, 16,200, and 14,400 per hour. If we take the middle number, then I think by taking off the present 'scape wheel of 45, and putting on one of 20, to suit the 'scape pinion, that will give 16,457 vibrations per hour; you might manipulate the hairspring to make it keep time. To fit up the escapement you must cut a piece out of the plate to let the 'scape pinion down through for the wheel to work in; hold it in position, and try the depth of the new wheel, working in 'scape pinion; scratch slightly all round the platform; now drill a hole through platform and plate, and fit a screw, and see that the depth is all right before drilling the other screw holes. If you put four screws, you need not have steady pins unless you have to draw the holes to correct the depths, when, perhaps, it will be best; if you find the length of pendulum in my calculation is not the length of it, see if your figures are the correct numbers for wheels and pinions; if not, give me the correct ones, and I will go over it again. I have a horizontal clock to pieces now, and I find the train of that is as follows:—viz., second wheel drives dial work and revolves once for three hours. 75 reckon 25 in calculating as follows:—$25 \times 60 \times 60 \times 55 \times (15 \times 2) \div$ pinions, $16 \times 8 \times 8 \times 8 = 18000$ train. From this you will see that the wheels are of a lower, and pinions of a higher, number than yours, so that helps me to think you have made a mistake.—A. B. C.

Cardboard Letters.—YOUNG CHIP.—For these apply to Willcox Brothers, Blackfriars Road, London.—S. G.

Unpickable Lock.—H. D. (*Grasmere*).—I do not think any locksmith would be willing to make the lock for the amount you mention; it would have to be hand-made throughout, and would require a great amount of time expended on it. It has never been patented, and may possibly have been taken up by some lock manufacturer. Locks made by Messrs. Hobbs, Chubb, and other makers, are practically unpickable, and could be purchased through any ironmonger; would not these suit your purpose?—T. W.

Improved Key.—W. E. W. (*Brixton*).—Your idea is not a bad one, and would prevent the pipe

ting stopped, but it would considerably weaken key to drill it through to the bow. Submit it to ne well-known maker.—T. W.

Melting Lead.—J. W. (*Thornhill*).—Use resin a flux when melting lead; well skim the dross as it rises, and do not let it get red-hot. Could u not run it out in upright moulds or pigs? the onginess would then only be on a small surface, d could be easily cut off.—R. A.

Missing Pages in August Part of WORK.—H. W. (*Brighton*).—You should write to the ublishers, Cassell & Co., Limited, London, E.C.

Taking out a Patent.—E. J. (*Ely*).—Write to e Patent Office (25, Southampton Buildings, hancery Lane, London, E.C.) for the "Official ircular of Information." It will be sent post free, nd, among other points of importance, you will arn how to ascertain if you are first in the field. he drawings submitted will do for the Patent ffice if drawn firmly in good black Indian ink, and n paper kept from creases. So far as possible, pply the same letters of reference to the same arts in all figures—this greatly facilitates the comrehending of a description. In describing your inention, use the first person "I" freely; and don't onfine yourself to one material when others will erve the same purpose. Keep tracings of your rawings. Decidedly you can sell your invention efore finally patenting it. It is impossible to say hat your patent is worth. Call your invention, "a novable appliance with reel and line to aid in the triking of chalk lines." The same principle was pplied some forty years since to movable pegs for atters, drapers, etc.; but we are not aware that it as ever been utilised in the way in which you propose to apply it.—C. C. C.

Fretwork Machine.—W. S. (*Stockport*).—You should purchase the Index to Vol. I. of WORK. In it you will find references to a host of easily made fret machines. Try and convert one of these for your own requirements.

Tuning Dulcimer.—T. C. B. (*Birmingham*).—By tuning the fourth note on the right-hand side of the left-hand bridge to C you have tuned your dulcimer in the key of G, exactly one note higher than the pitch intended, F. This increases the brilliancy of the tone, and it points to the fact that you have done your work well, or the instrument would not stand the extra strain due to the increased tension. The only objection to it is that the wire, unless very good, is likely to break and cause trouble. To obtain the correct pitch you must tune the first string on the left-hand side of the left-hand bridge to the pitch of your C fork, and this will bring the first note of the scale, which is on the right of the same bridge, to the proper pitch, F. You must understand that (with the single exception of the bass one) all dulcimers, no matter what their pitch, are tuned to the scale of G—that is to say, the first note is always called G, although it may be any other; in the same way that the first note on the flute (all finger holes closed) is always called D, no matter what the size or pitch of the instrument may be. As you have raised your instrument above pitch, I should not advise you to drop it again, but allow it to settle itself, which it will soon do if played on frequently; and as it "comes down," instead of raising it when tuning, simply "level" it until the proper pitch is arrived at. With regard to the "scale being incorrect," it is probably owing to the fact that many of the dulcimers in use in the Midland counties are "diatonic," and most likely the tuner who operated upon yours had never before seen a "chromatic" one, and was therefore considerably puzzled over it.—R. F.

Organ-Building Book.—G. J. E. (*Burley*).—You should get "Practical Organ Building," by Dickson, 2s. 6d., Lockwood & Co.; or "Organ Building," by Wicks, 3s. 6d., Ward & Lock.—K.

Telephone.—X. Y. (*Rochdale*).—You have altered the arrangement very materially from what you spoke of first. I advised the mechanical telephones because I thought it would suit your first arrangement best; but now I feel inclined to advise the other form. There is nothing to hinder a man of your abilities to make and erect telephones for communication between the three offices. There is, however, a great deal more about telephone matters than seems at first sight. As the telephone's patents are likely to expire soon, I would advise you to make a set of receiving instruments, as described in No. 28 of WORK, and a set of transmitters, same as given in "Shop" columns. I have not my back numbers, and cannot give the page, but you will be able to find it; it is in the centre column, and near the top of the page; the description includes little cones of carbon. You will want a switch-board to mount your instruments upon, and a call-bell. An article on this part of the subject is in the hands of the Editor, and may be published before you need it. You will also require a second switch for switching the instruments to the different sections of the line. I will give you these details when you need them. In the meantime, get your instruments made, and watch the paper for more information. Write again when you want anything, for I cannot take up more space at present.—W. D.

Paraffin Wax.—QUERIST.—The paraffin recommended for insulating the various parts of electrical apparatus is a white wax-like substance obtained from coal-tar and from rock oils. It is not the paraffin oil burned in lamps. It is easily melted in a stoneware vessel placed in a saucepan of boiling water, and the sheets of paper are to be dipped in the melted wax.—G. E. B.

Umbrella Pattern.—A. C. H. (*Kennington*).—At first sight it would seem that each of the usual eight segments of the cover of umbrellas would necessitate their being cut *curved* at the seams. This is not so, however, and for this reason the cloth, silk, or other fabric is cut "on the cross," as it is termed, at the seams, and this allows it to stretch to the curve of the ribs when bent; the "selvedge," as will be seen, is drawn up until it forms a curve instead of remaining straight to make up for the stretching. Therefore these segments consist of eight isosceles triangles, their bases forming the sides of an octagon, and their apex being the centre of a circumscribing circle. Hence, two such segments would together form a quarter of a circle; therefore the angle at the apex would be half a right angle—*i.e.*, 45°, and the two angles at the base would each be half of 135°—*i.e.*, a right angle and a half, because the sum of the angles in any triangle are equal to two right angles, or 67½° each. So long as these angles are correctly got, the length of the sides is immaterial; eight segments of a foot, yard, or mile at the seams will equally form an octagon, when placed in position, providing the angles of the apex are 45°, just as six segments would form a hexagon if their angles were 60° each, a pentagon if five segments of 72°, a septagon if the angles of each of seven segments at the apex were 51⅞ths°, or a

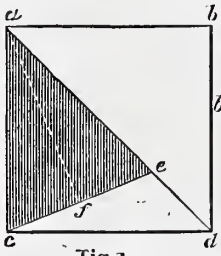


Fig. 1

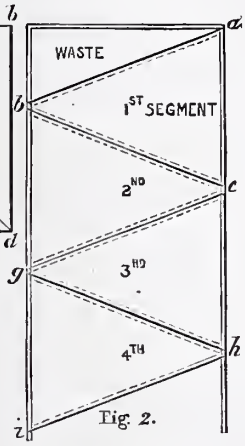


Fig. 2.

Umbrella Segments.

decagon if similar angles were 36°. Construction of pattern therefore is as simple as possible. Let *a b c d* be a square sheet of brown paper (see Fig. 1), and, to ensure the size being correct, measure the rib of the umbrella frame from the hole at its point to the centre of the ferrule, by which it is attached to the stick, usually about 21 to 22 in., though some are 24 in. long. Make the sides of the square exactly of this length, whatever it may be. Now fold your brown paper square on the diagonal *b c*, the point *d* falling exactly upon *a*; then on the folded edge *b c* measure the length of *a b* at *c*; draw the line *a e* joining these points, and with the scissors cut out the segment *a b e*, which for clearness' sake I have shaded over. Having done this, you have a paper pattern to lay on your cloth, which to do so as to avoid waste, you should do as shown in Fig. 2, buying the covering material of the width that your paper pattern measures from the centre of *a e* to *b*, as shown by dotted line *a f* (Fig. 1). It may happen that you cannot get it so narrow in gingham; if so, get it double the width and cut it up the middle into two lengths, if you must use gingham. Silks are woven 21 to 24 in. wide. Lay your pattern on the stuff with *a e* on the selvedge, as shown in Fig. 2, and pin it down and cut out the material, leaving ¼ in. for turnings in at seams (see the dotted lines); then reverse your pattern, likewise laying it square on the other selvedge, about ¼ in. back from your last cut seam-edge, and cut that out also, with very sharp shears or scissors, so as not to fray the edge. Then turn your pattern to the first selvedge again, and proceed as before. Thus you will have cut the first segment *a e b*, the second *b e g*, the third *e g h*: then cut the fourth *g h i*, and so on till you have cut eight. By this plan you not only save waste of material, but you utilise the selvedge, saving the time and trouble of hemming, which is neither so strong nor so neat as the said selvedge. When the segments are all seamed neatly and firmly together, a complete octagon, perfectly flat, is the result. No hole is necessary (the stick should be forced through the centre); securely bind round it with strong waxed thread the ends of the various segments; this again cover with a bell-shaped ferrule. Now stitch with strong thread the selvedge ends of the seam to the holes at the end of each rib—with the frame unopened. Then stitch just below, and again just above the hinge in each rib, or "wire" the seam exactly over the rib to keep it in position. Carefully and gradually open the umbrella, when you will find that all the strains accommodate themselves to circumstances, and a good tight fit of the cover to the frame is the result. These remarks apply to the ordinary shapes of umbrellas; any difference in form or fashion must be specially provided for: such as the parasol shape, where an elegantly pointed shape is given. Though undoubtedly a necessary article in this climate, I never carried an umbrella in my life, not even a white sunshade in the tropics (except when escorting a lady), so that I cannot claim to be a connoisseur, regarding them as I do as a public nuisance—as public enemies to silk hats, to other people's eyes, and as roofs whose drippings filter uncomfortably down one's neck. When soaked with rain and folded in railway carriages and omnibuses, I think they ought to be charged with some tax, such as full fare, or be provided for outside in charge of the guard or conductor.—J. W. H.

Lining.—NOVICE.—Do not use camel-hair pencils, but sable. The former may do for the very light colours such as ultramarine, the greens, drop black, etc.; but they are far too weak to carry vermilion, white lead, and the heavier colours. You may use oil colours, they have the advantage of flowing very freely, and do not clog the pencil like fast drying colour; but it is not always possible to finish a job without giving time for one portion of the work to dry without smudging it by your finger you use as a guide. Colour mixed with gold size and turps dries rapidly, and does not prevent the job being finished straight off, but the pencil requires frequent washing with turps or it soon gets clogged with colour. Care must also be taken or your lines will have a thin and bald appearance, and probably crack if turps is used too freely. Successful lining requires plenty of practice and great care of the pencils when not in use. Wash them very clean, grease them with a small portion of soft tallow, lay them very straight, and keep them free from dust; a bent pencil can only make a distorted line at any time.—WORKER BEE.

Sizes of Holes in Soundboard of Organ.—W. P. (*Bedford*).—I think you will find the following answer very well on a 3 in. wind:—

	CC and 4 following holes.	*Next 4 holes.*	*Following 4 holes up to Tenor C.*
Cornopean	3/8"	5/8"	1/2"
Oboe	5/8"	9/8"	1 1/8"
Open	7/8"	3/4"	3/4"
Principal	5/8"	1 1/8"	3/4"
Voix Celeste	5/8"	3/4"	5/16"
Salcional..	1/2"	3/8"	5/16"
Double	1 1/2"	7/8"	1/2"
Twelfth	1/2"	3/8"	5/16"
Fifteenth	3/8"	5/16"	1/4"
Mixture (3 ranks) ..	5/8"	1/2"	3/8"

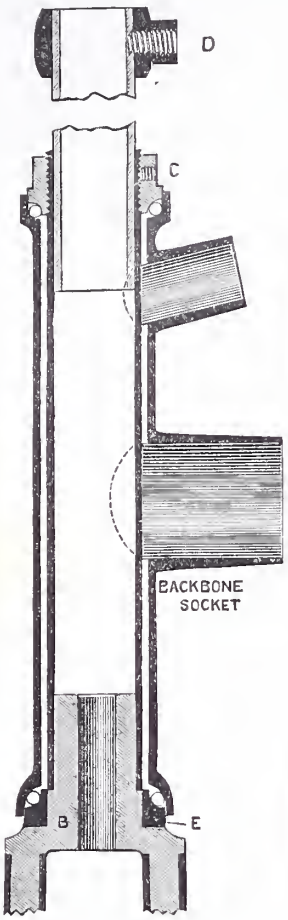
As regards split pallets, as I have not made any myself, I scarcely feel competent to advise as to the quickest method of construction. There are several forms of relief pallets besides the one of which you send a sketch. I should think that the quickest way of making them would be to joint up a board cross-grain in usual way: plane to requisite width and thickness, and then, having marked the pallet widths from the soundboard, or from a rod, saw off the main pallets. Of course, the board is made the same width as the length of the pallets. Proceed in a similar way with the under pallet, and when these are shaped glue on each pallet a piece of the requisite thickness to fill in the space at the end, as at A in sketch.—M. W.

Speed of Dynamo.—M. P. S. (*Kingstown*).—If you have a 1-in. pulley on the spindle of your dynamo, and drive it from a 30-in. pulley, you will have to turn the crank handle at the rate of 100 revolutions per minute to develop a speed of 3,000 revolutions per minute in the armature of the machine. This is the speed necessary for small five or six-light dynamos. The six lamps will take 120 watts of electric energy to light them properly, and this will absorb one-sixth of a horse-power, representing roughly one man-power. You will find, however, that it will seriously tax the strength of a strong man to keep even 5 c.p. lamps alight for any length of time. The 40-in. fly-wheel will certainly help to keep the speed regular, and this is most important in electric lighting; but you won't get any more power out of the fly-wheel than you put into it.—G. E. B.

Electro-Gilding.—LITTLE JOE.—We have not yet published any articles on electro-gilding, or electro-plating with silver or with nickel, but some are in course of preparation. An article on "Electro-Brassing" was published in the weekly number for December 7, 1889, and one on "Taking Electrotype Copies of Busts" in the weekly number for August 9, 1890. Various scraps of information on the electro-deposition of metals, in reply to the questions of correspondents, may be found in "Shop" throughout both volumes of WORK.—G. E. B.—[The price for each single back number is one penny, if ordered through a bookseller, or three halfpence per number if sent by post direct from the publishers.]

Electric Alarm Clock.—J. H. C. (*Halifax*).—I do not know of a book on electric alarm clocks showing "various ways of connecting the wires to the electric bells." An article on "How to Make an Electric Alarum" was given in No. 32, Vol. I. of WORK. There has been much information published in "Shop" on this subject since that date, as you will find by consulting the Index to Vol. I. Why do you seek a book on the subject when you have WORK, wherein our services can be placed at your disposal for the modest cost to you of a few pence?—G. E. B.

Safety Bicycle. — J. H. D. (*Luton*). — Unless J. H. D. is a mechanic, he aims at too much. A ball steering head safety is about the highest class of machine, and requires pretty accurate work to make it, besides some knowledge of the case-hardening process. I enclose sketch of the ball steering head as I make it. It is a section of the barrel with the backbone socket and upper tube socket attached; it is a malleable casting. The ends are turned to fit the balls; B is the front fork crown; it has 6½ in. of 1 in. tube attached. This passes up ½ in. above the barrel, and is screwed for the adjustment collar C. Inside the 1-in. tube is 6 in. of ⅞-in. tube, with clutch D at top for handle bar. The fork crown B is a malleable casting with a ½ in. hole bored up the centre to lighten it or to fit a concealed brake, the plunger rod passing up inside the tube to the handle bar. The ring E, on which the lower balls rest, has got to be case-hardened, as also the adjustment ring, with both ends of the barrel, where the balls run. The ⅞-in. tube passes inside the 1-in. tube about 1½ in., and is there brazed, the 1-in. tube being also brazed to fork crown; balls, $\frac{5}{16}$ in. With regard to springs, I suppose J. H. D. means a spring frame. There are several patents for spring frames in the market, and he will have to keep clear of them; some have the front wheel only fitted with a spring, others have both. J. H. D. had better indicate his ideas of a spring frame; if he has none, I should advise him to build a rigid diamond frame of a good pattern. (2) As to the gauge of tubes for a diamond frame, the main tube from steering head to bottom bracket is 1½ in. in diameter, 16 B.W.G. Top tube from steering head to seat pillar socket, ⅞ in., 18 B.W.G. Two tubes from seat pillar socket to rear axle, ¾ in., 18 B.W.G. Two tubes from rear axle to bottom bracket, ⅝ in., 18 B.W.G. Tubes on the gearing post (see sketch), 18 B.W.G.; piece attached to handle bar, ⅞ in., by 16 B.W.G. The ball steering arrangement shown in sketch is not for diamond frame, but for semi-diamond.—A. S. P.



Bicycle Ball Steering Head.

Wedding-Ring Making.—INDEX.—Why do you not repeat your question when you write? If it has not yet appeared, it doubtless awaits its turn in the overcrowded columns of "Shop."

Greenhouse Construction.—L. W. R. (*Enfield*).—If you purchase the Index to WORK, Vol. I.—it costs one penny—you will find several references to greenhouse matters. A paper on the subject, with illustrations, appeared in WORK, No. 12. It is entitled, "The Tenant's Greenhouse."

"Shop" and WORK Contents.—G. R. R. (*West Calder*).—Whatever delay there now is in the appearance of answers in "Shop" is unavoidable. Steps are being taken to appreciably shorten all future answers, and this will create room for many answers standing over only through want of space. The contents of each week's number rests solely with the Editor of WORK, who may be presumed to be a better judge than any individual subscriber can possibly be of what best suits the tastes of his whole constituency of readers.

Polytechnic Paper Scales.—NEMO.—There is no such scale as you refer to.

Polish.—HANDYMAN.—The Editor has an article in hand on repairing old furniture, which answers your question fully. Look out for it. Burnt sienna ground in oil forms paint, and, so far as I am aware, is not generally used by polishers.—D. D.

Waxing Floors.—WAX.—Finishing floors with wax and varnish will be treated later on. Meanwhile, use brown oak varnish or any similar one.—D. D.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Painting Flowers.—J. E. H. (*Southampton*) asks for a hint or two about painting flowers, etc., on terra-cotta plates, etc.; can he do it with ordinary tube colours (oil) or water colours? If the latter, what can he make the colours shine with?

Small Fire Fan.—T. S. (*Catdmore*) writes:—"Will some kind reader give me the necessary instructions (and working drawings, if I am not asking too much) to enable me to make a small fan to blow the fire with in the mornings, to save time; also say where I could buy the castings?"

Glass Cement.—O. H. O. (*East Dulwich*) writes:—"Will any reader kindly inform me of the best mode in cementing a glass bowl to a metal body of a paraffin lamp, and how to prepare, or where to obtain the cement?"

Prices for Sawing.—E. E. W. (*Bushey*) writes:—"Can any reader inform me how to charge for work done by band and circular saws? I may say the work will consist of all kinds of sawing for builders' yard, wheelwrights, and coach-builders. Also staves for coopers (both doublets and straight cuts)."

Cutlery, Clock Dials, and Pearl.—F. F. F. writes:—"Sheffield cutlers have a method of printing on ivory, I *think*, with caustic or nitrate of silver from engraved plates. How is it done? and in what form is the caustic or nitrate of silver used? Is it possible in any degree to soften or destroy the brittleness of pearl? With what do they paint the figures of clock dials?"

Bristles.—F. E. J. (*London, S.E.*) writes:—"Will someone tell me how to twist the wire and put in the hair, or bristles, or whatever name the material goes by, of bottle brushes or jug brushes and lamp-glass brushes? If twisted by hand, what tools are required? and if by machine, what machine is required. Are the bristles put in by weight? What inches in length to suit each size of brush? If you will kindly help me, you will do me a favour. You see, what I want is to learn how to make those kind of brushes, as it will help me to get a living."

Blackboard. — F. T. (*London, N.*) writes:—"Will any reader inform me how to prepare and what stain to use for a blackboard, as I want to make one?"

Drain Pipes for Decorating.—G. (*Burnley*) writes:—"I should be greatly obliged if any reader would tell me where I could get some smooth drain pipes for decorating upon. I can get the ordinary ones at Burnley, but they are too rough and crooked for my purpose."

Violin Mute.—VIOLIN writes:—"It will greatly oblige if any of the readers of WORK would kindly give me instructions how to make a mute for the violin."

Cork.—G. B. (*Poplar, E.*).—"Would any reader of WORK kindly inform me through 'Shop' where I can get cork wholesale for making life-belts?"

Boot Making. — THE LAST THAT SHALL BE FIRST writes:—"Would M. G. kindly instruct me, through the medium of 'Shop' (say, in two or three stages), how to make a pair of boots (one stage each week); first to the fixing on of the uppers, to the sewing on of the welts, and so on to the finish? I have read his article headed M. M., but do not fully understand it all: the quality of leather for insole, welts, sole, how to fasten the uppers to last and sewing process, what he means by shanked, skived, seats, and lifts, or split lifts; the distance to sew from edge of upper, and where to begin; and I cannot see what he means by putting the heelawl through each stitch on upper side, and taking up stitch when sewing through sole and lifts—in fact, every particular and detail."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Picture Mouldings.—LINENO writes, in reply to H. R. (*Bacup*) (see page 506, Vol. II.):—"These can be procured at several places in Miller's Lane, Manchester."

Cost of Mandrels.—LOCO writes, in reply to J. T. (*Walworth*) (see pages 159 and 455, WORK, Vol. II.):—"If J. T. is still in want of a mandrel, I should be glad to make him one as described in my spare time, for 10s. 6d., or any other small work in fitting or turning."—[Why not follow the example of others, and keep your address before our readers in the "Sale and Exchange" column?]

Circular Saws.—F. J. G. (*London, W.*) writes, in answer to H. G. (*Little Bolton*) (see page 552, Vol. II.):—"The best book published on circular saws is 'Saw Mills: Their Arrangement and Management,' by M. Powis-Bale, published by Crosby Lockwood & Co."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—S. T. H. C. (*Nelson*); A CONSTANT READER; YUTICAN; G. P. (*Elgin*); F. M. R. (*London, E.C.*); BRICKLAYER; J. McI. (*Glasgow*); J. McG. (*Leith*); A. T. B. (*Bromley*); S. T. R. (*Gloucester*); NO FAD; G. H. (*London, E.C.*); J. W. B. (*Huddersfield*); D. McD. (*Cambuscull*); N. H. (*Dartmouth*); PUZZLED; MAGIC LANTERN; W. M. C. (*Glasgow*); OVERMANTEL; SAW; A READER OF YOUR VALUABLE PAPER; J. M. (*Stafford*); T. G. S. (*Surrey*); A. K. H. (*Bridport*); W. J. T. (*Westmoreland*); G. H. B.; H. D. (*Suffolk*); J. T. (*Hull*); S. A. L. (*Derby*); T. W. (*Burnley*); SWANSEA; FITTER; J. S. (*London, N.*); W. J. W. (*Monkwearmouth*); H. W. (*Gateshead*); W. C. P. (*Warwick*); J. C. K. (*London, N.W.*); H. A. (*Ellesmere*); J. L. (*Wimborne*); D. P. P. (*Sheffield*); W. O. (*Wrexham*); W. A. W. (*Stockport*); REFLECTOR; NEW READER; W. S.; F. K. B. (*London, E.*); HEN; CONSTANT READER; A. B. A. (*Nottingham*); MIEUX QUE ÇA; W. D. (*Teisworth*).

"WORK" EXHIBITION.

THE EXHIBITION

WILL BE OPENED TO THE PUBLIC, AT

THE POLYTECHNIC INSTITUTE,

REGENT STREET, LONDON, W., ON

MONDAY, DECEMBER 29th, at 2 p.m.,

BY SIR JOHN LUBBOCK, BART., M.P.

APPOINTMENT OF JURORS.

THE Proprietors of WORK are pleased to be able to announce that by resolution of the delegates to the LONDON TRADES' COUNCIL, the Council will officially appoint the JURORS for the forthcoming Exhibition.

Exhibitors will therefore have the satisfaction of knowing that the awards will be made by experts chosen from the very front rank of workmen, and thus will be the best practical judges of work that it would be possible to select in the various groups.

*** The Secretary begs to inform Exhibitors that any change of address should be notified at once; the omission to do so, especially if letters are returned undelivered by the Post Office, will disqualify the applicant.

JNO. WHITFIELD HARLAND, Sec.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Belt's Patent Enamelled Adhesive Waterproof Advertising Paper Letters and Figures in all colours and sizes. Best and cheapest. Liberal terms to agents. Sample sheets, gratis. Factory, 17, Arthur Street, W.C., London. [21 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT's, 297, Hackney Road, London, E. Send stamp for reduced price list. [4 R

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [15 R

Machinery and Tools.—Largest stock in London. BRITANNIA Co., 100, Houndsditch. Cash or hire purchase.

Gas and Steam Engines.—Engineers', Amateurs', Builders' Tools, Stocks, Dies, Forges, etc.; catalogue of new, 6d., or list second hand, 2d.—BRITANNIA Co., Colchester.

Best Book on Lathe.—Chapters on Metal Spinning and Screw Cutting, 3s.; soiled copies, 2s.—BRITANNIA Co., Colchester. [17 R

Complete Outfit for Making Real Photographs; printed instructions; ready for instant use. Carriage paid, 1s. 9d. Particulars of £500 prize competitions free to all purchasers. No fees.—"Work" Dept., PHOTO NOVELTY Co., Alvaston, Derby. [13 R

Just Published by Britannia Co., Colchester, the Buyers' Guide, containing notices of 749 books on mechanical subjects, with table of contents, price, etc. The most complete catalogue yet published. Post free, 6d. In cloth, 1s. 6d.—BRITANNIA Co., Colchester. [20 R

Picture Moulds.—15 to 25 per cent. saved. Send for wholesale list. One stamp.—DENTS, Importers, Tamworth. [22 R

Sign-Writing Made Easy.—Every man his own writer. Illustrated instructions for easy, cheap, simple, and rapid process by which elaborate lettering can easily be done equal to professional work. Also Diagrams for marking out eight different sized alphabets. The lot 1s., post free.—F. COULTHARD, Terrace Road, Bournemouth. [1 S

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured. Money returned in full if not entirely satisfactory. — ETHELBERT HENRY, Alvaston, Derby. [18 R

.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Etching.—NOSAM.—You say that you can get a ery good ground, "but, when tho acid is put on, does not seem to work;" adding that you havo kept it on for three hours, and it has only made ne slightest impression." Now, this seems rather urious, for it is obvious that the natural propensity f nitric acid is to corrode most metals and alloys vith which it is brought into contact. Are you ure your acid is all right? You might easily ascerain by testing it on another piece of metal. Preuming it is, rare and particular circumstances will ometimes prevent it from acting as ono would nticipate. If you had put your ground on somevhat thick, and the design to be etched consisted nainly of very fine markings with the point, when he acid was put on air might be confined in them, vhich, as long as it was present, would retard the ction of the acid. But perhaps you will say that f air were present it must necessarily rise to the urface, in consequence of it possessing a less specific gravity than that of the acid. Just so; but if you reflect a little, you may be able to recur to a timo when you observed, adhered to tho sides of a vessel containing a liquid, numerous bubbles of gas or air. These bubbles must have been held, in a measure, by the attractive force of the vessel, for if ono struck it and caused a vibration, the bubbles would detach themselves and rise to tho surface. In a similar manner air may have been confined in tho incisions of your ground, held partially by the attraction of tho metal. I do not give this as a reason of your acid not acting; I only adduce it as a possibility. To get over such a difficulty would only necessitate a moistening of the exposed metal prior to putting on the acid. It may be done either by breathing on it, or a fine brush may be employed charged with water. This would bring tho acid in contact with tho metal. Again, sometimes, though unfrequently, when tho acid does act on the metal, the corrosion is only slight, in consequence of the gaseous product resulting from the decomposition of the metal appearing as numerous bubbles, which do not burst very readily, but collect on tho top of the interstices in the ground, thereby arresting corrosion. If this should be noticed, the bubbles might easily be bursted by slightly touching them with the japanned stick or a small glass rod. I noticed a peculiarity some time ago in connection with tho "biting in," the true nature of which I am ignorant. When the acid was poured on, it remained perfectly inactive, as though it were pure water. Thinking perchance I had left a thin film of ground on the exposed metal, I took a steel point, and just scratched at the centre of one of the characters. Instantly, as though an animating property had been imparted to the acid, it immediately became effective, and over the whole line of letters it was soon in a state of ebullition. I cannot give any reason for it. I merely state it as a fact. Possibly "Nosam" has experienced something similar, only without the ulterior result. Different phenomena will be noticed occasionally. There are scarcely two makes of steel which seem to absolutely corrode the same. Sometimes the accumulated residue in the incision will retard the acid from corroding; but a temporary revival may be effected by tapping the article to cause a little agitation. If at any future time the acid does not act on tho metal when first put on, you may be sure that something is wrong which may probably be overcome by a little reflection. Never let it stay for three hours, or three minutes, in a state of inactivity, hoping that it will eventually prove effective. Neither use acid which has not been diluted.—R. G. N.

Unsized Paper.—QUERIST.—All ordinary paper employed as writing paper is coated with size. Unsized paper is the unprepared paper as manufactured at first, such as the white or straw-coloured shop paper.—G. E. B.

Overmantel, Grate, Fender, etc.—H. A. P. (*Glasgow*).—The overmantel should be made along with the mantelpiece it is to be wedded to. The fender, brasses, and grate are sketched simply to show the style of design the best to be used with such a mantelpiece. These are to be had from respectable ironmongers anywhere. If H. A. P. takes a walk up Buchanan Street and Sauchiehall Street in his city, he will see several shops with the kind of grate, etc., to suit both his purse and his taste. In really good work, most, if not all, of the metal front of the grate would be of brass, the fender and fireirons being also of the same material. The overmantel details should be, as nearly as possible, similar to those in the mantel itself. The cornices should have the same members as the mantelshelf, though not of so great a projection. The dentils also should be executed in the same manner, at least in the centre or top cornice and pediment, although the side ones might have the simple common dentil. The pilasters are moulded on the face, as shown in the detail drawing (Fig. 3), and the side framing is then seen as well as the centre framing with a planted moulding inside. The carving in panels and frieze ought to be cut in the same style as the other carving. The principal sizes may be obtained by means of the scale shown with front and end views of overmantel in Figs. 1 and 2; but it is well to state that the size across the posts of the overmantel ought to be the same as that across the jambs of the mantelpiece. The posts are 1½ in. square, side framing 1¼ in. by ¾ in., centre framing 2 in. by ¾ in., but only showing on face 1 in. by ¾ in., and the moulding round glass is 1¾ in. by ⅝ in. The shelf, ¾ in. thick, with ogee

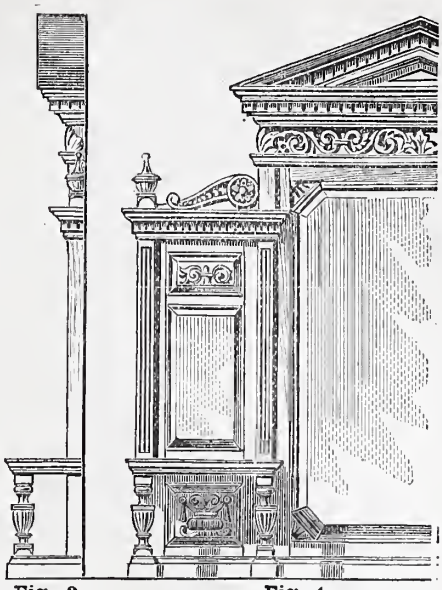


Fig. 2. Fig. 1.

INCHES FEET

12 6 0 1 2 3

Fig. 3.

moulding on front and ends, is supported on pillars 1½ in. square at top and bottom, and 1¾ in. at the widest part of the turning. The base is 1¼ in. high, and it is carried out to receive the pillars on it (see

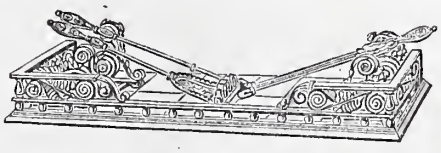


Fig. 4.

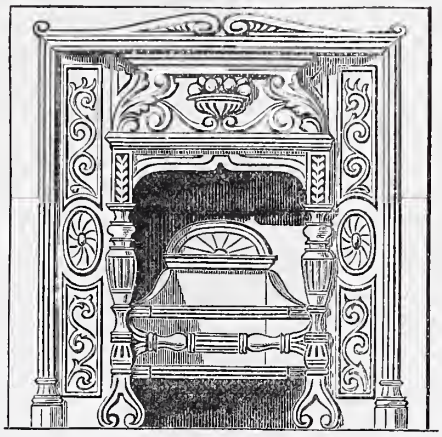


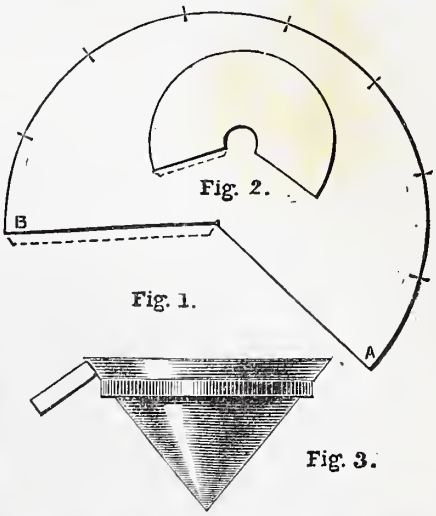
Fig. 5.

Fig. 1.—Front View of Overmantel. Fig. 2.—Side View of Overmantel. Fig. 3.—Section of Post and Framing. Fig. 4.—Sketch of Fender and Fire Brasses. Fig. 5.—Sketch of Grate.

Fig. 2). Do not make the pediment rise any higher than shown in Fig. 1—*i.e.*, one-fifth of the total length gives the height of the apex. The side mirrors should be made with a ¾-in. bevel, and the centre one with a 1-in. bevel.—A. M.

Small Screw Boat.—J. P. (*Stratford*).—The beam measurement for a model screw boat of 5 ft. should be 8⅞ in., but if the model is intended to carry sail as well as steam, you would require a beam of quite 2 in. more; the depth about 12 in. You ask for the width of plates. This is entirely a matter of taste and convenience; the thickness of plates should be about $\frac{1}{16}$ in. The centre of propeller should be about midway between the ends of the sternpost. The making of a lead keel for a model is such a simple matter, that it would not be worth your while to buy one ready-made.—G. J. E.

Small Still.—J. H. E. (*West Kensington*).—The small still mentioned on page 490, Vol. II., would do for distilling water for drinking purposes. I do not know exactly how much could be distilled from it in twelve hours, but I should say about three gallons. I see no reason why it should not be heated over a fire, but you would have to provide for the overflow of cold water, which has to be constantly running (I expect the water company would have something to say about these stills), and it would also very likely be some trouble to bring the supply to it. An oil stove would do very well, as it can be placed anywhere, and regulated nearly as well as gas; a spirit stove would be expensive to burn all day. A Rippingelle oil stove with a 4-in. burner would cost you for oil about 4d. for twelve hours burning, or thereabouts; so if you have to pay on an average 6d. per gallon for your distilled water, it would certainly pay you to use a still. To answer your question as to the best and most economical material for a still, I recommend strong tin with a copper bottom. The size I should make is 7 in. diameter by 10 in. deep. Make a cylindrical vessel this size first; cut stuff 22½ in. by 10 in.; the copper bottom will have to be tinned before being put on. If you want to use it on a fire, no legs will be wanted; if they are, make them of ¾-in. by $\frac{3}{16}$-in. iron; rivet to the sides and solder over the rivets inside; 4 in. from the top make a ⅜-in. hole. Next make the two funnel-shaped pieces; these when cut out will be of the shape shown in Figs. 1 and 2. To mark out the large one, set the compasses 5 in. and describe about three-fourths of a circle, and set off round it 21 in. by setting the compasses at 3 in., and taking eight of these parts round the circumference as shown A to B; draw lines from A and B to the centre, and draw the dotted line parallel to



Small Still. Fig. 1.—Pattern of Large Funnel. Fig. 2.—Pattern of Small Funnel. Fig. 3.—Large Funnel turned, showing Rim and Outlet.

B to allow for lap; turn and solder. Next make a rim to fit the containing vessel and solder it to the funnel; make a ⅜-in. hole at the top, and solder in a short piece of pipe (Fig. 3). This rim will keep the funnel in its place and prevent the escape of steam. The small funnel is made by setting compasses at 2 in. and taking four of these parts round the circumference as in the large one. The circle is a very small one. Compasses at ⅜ in.; turn and solder; solder on over the hole about a foot of ⅜-in. spirit pipe, which is pure tin; do not use lead or composition; pass this through the hole in the side of the container and adjust in position; solder round firmly, and the affair is complete. I trust you will be able to get on with these directions. I do not know about perfumes or sea water.—R. A.

Medical Coil.—BERNHARD.—Medical coils may be worked with current from Leclanché cells, and also from the Gassner batteries. Many medical coils are sent out fitted up with one or other of these batteries. If current is taken from the battery for a period of only ten minutes at a time, morning and evening of each day, a Gassner battery should last for eighteen months. Of course the strength of the current will diminish as the months roll on and the battery is used, but will probably serve your purpose to the end of the time above mentioned. In choosing a Gassner or a Leclanché battery, allow one cell more than in the bichromate battery you have employed hitherto. Thus, if two bichromate cells have been used, you should get three Gassner cells to replace them, because the E.M.F. of this cell is not so high as that of the bichromate cell. Choose large cells in preference to small ones. If the ends of the three secondary coils have been brought out to separate studs, you may use one, two, or three powers, at your discretion, but not otherwise—*i.e.*, if no such provision has been made in building the coil.—G. E. B.

Model Yacht.—E. O'N. (*No address*).—In making "a model yacht for match sailing," work your boat out of the solid. Don't attempt to build a model yacht with frames and timbers and planks, but obtain a good sound block of yellow pine, dry, and free from knots and shakes. This procure from any large timber dealer or saw-mill, at a cost of a few shillings. For a 36-in. boat, a piece will be required, say, 40 in. long by 12 in. wide by 9 in. deep. This length allows 4 in. for the overhang of counter, and will allow of the boat being 36 in. on the water-line. The depth given is for the boat without keel, and as the keel must be of lead, there is no use making one of wood, which would only have to be cut away afterwards; but as you might find a wood keel of assistance while working out the model, you had better commence with the dimensions given, and nail on a false keel, formed out of a strip of wood 36 in. long by, say, 2 in. wide, and 4 in. deep at one end, tapering off to 1 in. at the other. The only tools required are plane, gouge (a long gouge ground on the inside is the best), spokeshave, square, and sand-paper, and an axe, a mallet, and brace, with large centre-bit. First draw straight lines along the top, bottom, and ends of the block, dividing down the middle on its 12 in. surfaces. These lines represent the keel on the under side, the stem and stern posts respectively at the ends, and the centre line along the top side, or deck, and they should be carefully preserved throughout the entire operations (see Fig. 1). Then with a thin strip of wood whalebone, or other flexible material, mark out the deck plan, leaving the stern, say, 8 in. wide, as in Fig. 2, and cut down the wood to these lines, keeping the sides square to the top, or deck, for the present, and you will have a figure somewhat coffin-shaped in appearance. The rest of the work outside will be done with the block upside down, so turn it over on the bench, and with gouge and mallet (or up-ended on the floor with the axe) rough out to the shape desired, and finish off with spokeshave and sand-paper until all is quite fair and smooth, taking every possible pains to get both sides of the boat exactly alike; and for this purpose, if necessary, cut out templates of cardboard, or bend strips of sheet lead, and try them repeatedly. The false keel above mentioned is given as 4 in. deep at one end, and this is for the stern, as this end of the boat must be considerably deeper than the bow, or she will not steer properly. Next proceed to hollow out the inside, and, if a cautious man, you will find the brace and large centre-bit of great assistance, finishing off with gouge and sand-paper. Don't be so rash as to go through anywhere, but leave a skin or shell of about ½ in. thick, making the lower part and round the top edges a little thicker—the former to sustain the weight of the heavy lead keel, and the latter to support the deck and fastenings, so that the section will be somewhat like Fig. 3. For match sailing, bulwarks are encumbrances only, so do not attempt them, but cut away the sides of the model slightly for sheer, as dotted line in Fig. 4. The keel now requires attention, and for this purpose a pattern must be made in wood. Nothing could be better than the false keel before mentioned, which should be removed from the boat, and pressed into a bed of clay tolerably dry, or into a box of sand slightly damped. It is no easy matter to bore holes through a thick piece of lead, so it is as well to provide for the holes necessary for fastenings during the casting process. Therefore, get a number of short straight wires, say eight or nine, and 6 in. long and ⅛ in. or $\frac{3}{16}$ in. thick, and fix them vertically down the centre of the mould, having first coated them over with a soft paste made of clay and water, so that they will draw out of the lead when cast. Do not let your sand or clay be too wet, or the molten lead will sputter, and in pouring in the metal keep your face turned away to prevent accidents. When the lead is cold it will be found an easy matter to hammer out the wires, and the holes for fastening to the boat are ready made. The keel will be rough and require getting up, but a rasp and hammer will soon set this right, and some long French wire nails will suffice to attach the keel to the boat, and make all secure. Next put on the deck, which for racing models should be laid on over the top of the gunwales, and not let in; but first fit in a deck beam, slightly rounded on its upper side, to support the mast. Make the deck of yellow pine, quite thin, say ¼ in., and fasten down all round with stout pins or thin French nails, and varnish and paint according to taste. The much vaunted enamels are perhaps the easiest method of obtaining a good surface; but the best plan is to use ordinary paint two or three coats laid on very thin, and rubbed down when thoroughly dry with pumice stone and water, and then varnished with copal or French polished. As to the rig of the yacht, the cutter will be found to have the greatest speed, and if this rig is selected it is a safe rule to make the mast, bowsprit, and boom the same length as the boat—*i.e.*, 36 in. long; the gaff should be three-fourths the length of the beam, and the topmast and topsail yard about the same length. In giving this rule, it must be remembered that the measurements will be for length of spars outboard, so that in the case of the bowsprit, if it has to be 6 in. inboard along the deck, the whole length of bowsprit will be 42 in. The mast and bowsprit at the thickest parts should be ¾ in., tapering off to ⅜ in. at their outer ends, the boom slightly thinner (the thick end of the boom is placed outwards over the stern), and the gaff thinner still. Yellow pine is the best wood for the spars, though pitch pine is much tougher, and looks better; the extra weight is not objected to. They can be made with the plane, and should be sand-papered thoroughly smooth, and then varnished. The reader will, no doubt, have seen that the model yacht for racing is a very different boat in many ways to the miniature or model yacht in the strict sense of the term, and in the rigging this difference will be made more apparent, as, in the case of the racing model, handiness of gear has to be looked upon from the standpoint of the sailor outside the boat. The mast should not be put through the deck, but should be let into a brass socket or wooden chock (made of hard wood) screwed on the deck. This should be placed about one-third of the length from forward, and can easily be moved, if required, in trying the sailing qualities of the boat later on. Another advantage of this plan is that the boat has no apertures through which the water can gain access to the inside. At the thin end of the mast

Fig. 1.

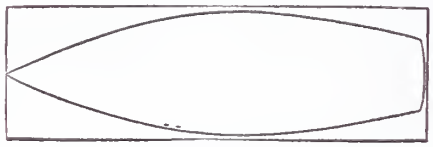


Fig. 2.

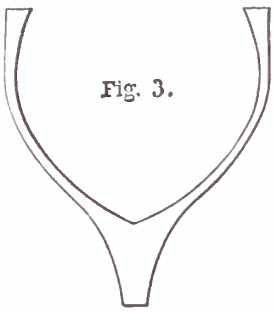
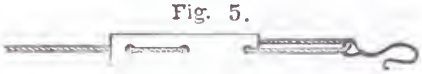


Fig. 3.

fit on a brass ferrule or fishing-rod joint, into which the topmast should slide, and on this ferrule a number of small brass rings (obtained at any fishing-tackle shop) should be lashed with fine, but strong, linen thread or silk, and varnished. These are for blocks for the running gear, and are placed in position like eye-bolts in large yachts. The mast

Fig. 4.

Fig. 5.



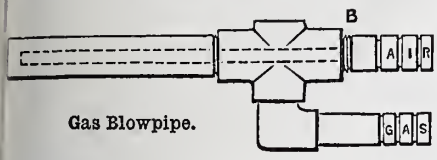
Model Yacht Parts.

should have a stay or shroud on each side attached to the eyes on the ferrule at masthead, and leading down to deck, and there secured, one on each gunwale, to eyebolts or screwed eyes, like those used on the backs of picture-frames. The forestay mast, in like manner, be secured from masthead, and would, in the ordinary course, be made fast to the sternhead, but for a racing model a larger foresail can be carried, if the stay be brought out on the bowsprit, and there secured, about one-third of its length out board. All these stays should be of good stout fishing-line or whipcord. The bowsprit should pass through an eyebolt screwed into the deck near the stem, and the heel of the bowsprit tapered a good deal, and let into another eyebolt screwed into the deck near the mast; but this eyebolt must be so much smaller that the bowsprit will not slip through it; a shroud at each side of the bowsprit, and a bobstay underneath it, must be fitted, like the shrouds and stay, to the mast, fixing small eyebolts into the sides of the boat near the mast shrouds, and in the stern near the water-line for the purpose. It is often desirable to unship the mast and bowsprit when transporting the boat, and there ore the shrouds and stays should be made with hooks, so as to be readily removed, and yet when in use it is necessary for them to be kept tight. The most usual contrivance for this purpose is similar to that commonly seen on tennis nets, and for model yachts should be made of thin bone or brass, and are like Fig. 5. This device will be found very useful, and may be applied with advantage to almost every rope on the ship. The boom should be attached to the lower part of the mast by what is called a goose-neck—*i.e.*, a joint that will work every way; and the most easily constructed is one made of two pieces of brass wire with an eye turned in at each end and one eye hooked into the other. Bend one wire round the mast (or go through it if there is plenty of strength in the mast), and insert the other wire into the thin end of the boom, whipping the end round with stout linen thread, to keep it from splitting. The gaff should slide on the mast by means of jaws, and these are best made with a piece of brass wire bent, with a loop in the middle the size of the mast's diameter (a slack fit), and the ends lashed tightly to the thick end of the gaff with linen thread. Lash three eyes or small rings on the upper side of the gaff for hoisting, one close to the jaws, one in the middle of the gaff, and the other about three-fourths of its length out, and the gaff is complete. The sails are four in number—mainsail, foresail or staysail, jib, and topsail, and by many it is considered necessary to have two or more sizes ready for use in any state of weather. The sails should be made of thin calico, closely woven, and smooth on the surface. The great aim in making sails is to get them to stand flat, and not to let them "belly" like a saucer. With this end in view, let the after side of every sail be a selvedge, and do not hem it on that side. Cut out all the sails first in paper (making them rounded a little on the foot), and then cut the calico from the paper patterns, allowing cloth to turn in for the hems. The sails can be sewn well enough in the sewing-machine, but every precaution must be taken against stretching any side of them which is cut on the cross, or they will be ruined. The jib and foresail may be attached to booms if thought fit, but do not lace any of the sails to booms along the foot. Copper wire travellers should be fixed to the boat for the mainsail and foresail sheets to travel on, and the traveller for the jib is conveniently placed across the bowsprit. The mainsheet is easily worked by the bone or brass clip before described for tightening any of the ropes, or by means of a stout brass pin with an eye in one end, to which the mainsheet is attached and led through a hole in the boom near the stern, whence it leads to the traveller. A number of holes are then bored along the boom, into which the pin can be fixed, and the length of the sheet regulated according to the direction the boat is to be sailed. A word in conclusion as to steering. Of course, as the boat carries no crew, she must steer herself, and this is done by the sails entirely, except when running full before the wind, in which case a heavy leaden rudder must be slung on the stern-post, and allowed to swivel freely on its bearings; and two or three rudders should be provided of different weights for this purpose. Sailing against the wind, however, is most practised, and it should be understood that this is done without any rudder. The mainsail is the principal driving sail, but would, if left to itself, quickly send the boat up into the teeth of the wind. The jib, therefore, is kept in pretty tight, so as to counteract the effect of the mainsail in this respect; and if the sails are not very well balanced, the boat will be continually running up into the wind and paying off again, and a little practice will be necessary to overcome this difficulty, and obtain a nice even balance; but with a little patience this can be done to a nicety. With this in view, the boat is made to draw much less water forward than aft, and the fore-port should be well rounded up, so that the bowsprit does not need to be so very long, and the sails are more compact. A light bamboo rod with brass boat hook or window-hook at the end for turning the boat completes the outfit, with the addition, perhaps, of a few small shot-bags for assistance in steering.—W. H. M.

Rigging Model Yacht.—J. T. S. (*Tamworth*).—To rig your schooner yacht for racing, you will find sufficient directions in answer to E. O'N. above; but give your boat two masts instead of one. If you desire to rig your boat as a complete model of a large yacht, then write again.—W. H. M.

Earning Money with the Lathe.—COMPO.—You wish to augment your income by turning at home, and you wish for advice as to how you may obtain a quick return with little outlay. You do not say you know how to use a lathe—indeed, I gather you do not; you "dabble" in fretwork, but think it impossible to add to your income in that way. Also you wish to know where a lathe may be bought. I think you could best buy a lathe by advertisement, watching for a good opportunity. I once got a good lathe for a workman friend for £2, which I think very cheap. I think you could not reasonably expect to turn anything you could sell till you have had six months' practice; what would you think of a man who set out to be a "comp." in that time? It is useless to try to produce anything like handles, tops, etc., that are made *in quantities*. I turned eighty rings for curtain-poles when going into a new house, and then found I might have bought them for less than I paid for the wood! That is because manufacturers buy wholesale and set boys to work at them on steam lathes, and the *work* costs almost nothing. The only thing I see for you would be to make friends with some neighbouring carpenters or cabinet-makers, who require at times little jobs of turning or fret cutting done sometimes, and do not care to take them far. That sort of thing would pay you, and be a convenience to them. But then, of course, "dabbling" won't do; you must learn a trade before you can exercise it.—F. A. M.

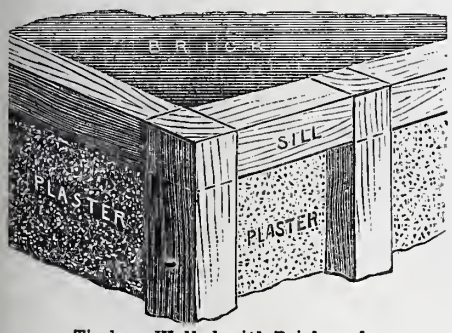
Gas Blowpipe.—CONWAY.—To make a blowpipe the kind you require is not a very difficult atter. I send you a diagram of one that you can ake with very little expense. To make it, you ill require a ¼ iron gas T, a ¼ nipple, a ¼ elbow, nd three pieces of ¼ tube, a brass boss, such as are ed in the ends of picture rods to screw the knob , and a few inches of ⅛ brass tube. To put it gether, take the three pieces of tube, which may of the following lengths: one piece 5 in. long, nd two pieces 3 in., all to have a thread on one d; take the brass boss and solder it in the thread d of one of the short pieces (of course, filing and



Gas Blowpipe.

leaning the iron pipe inside first); screw the piece f ⅛ brass tube into the brass boss, and if you like it an be soldered in, as no heat to speak of comes ack to that part; next screw this short piece of ipe with the brass jet into the T-piece, and screw he longest piece of pipe into the other end; the nd of the brass jet should be ½ in. from the end of he iron pipe; next screw the nipple into the outlet f the T, and the elbow on to that; lastly, screw the emaining short piece of pipe into the elbow, and his completes the affair. You will find this will raze the small things you require, but you will hardly have lungs strong enough to keep up the blast of air that will be required, and will want a foot blower to work it efficiently. In the sketch, B shows the position of the brass boss, and the dotted lines the air jet.—R. A.

Design for Cottages.—J. C. E (*Whitchurch*).—You will find by referring to the plans (see page 289, Vol. II., WORK) that the scullery is the same width as the kitchen, viz., 12 ft., and the length 12 ft., but you can please yourself what size you make it; but I think the scullery would be more useful if it was a little larger, because the greater part of the housework is done in this room. The wood pillars which support the roof or verandah are turned, to make them have a better appearance, and the feet of the same is fixed into an iron shoe which is let into the stone coping, and cemented to the 9 in. brick wall as shown in drawing. The width of the verandah is 7 ft. clear between the brick walls; the width of the hall is also 7 ft. clear; the dimensions of timbers for the half timber work 6 in. by 6 in. for the uprights and diagonals, 12 in. by 6 in. for sills and bressummers. The moulded beam should be



Timbers Walled with Brickwork.

14 in. by 12 in., all timbers to be walled into the brickwork, as shown in sketch. All the exterior walls are 14 in. in thickness, and the internal ones are 9 in.; but if you want to build on the cheap, you may have your external wall 9 in. instead of 14 in. thick, and your internal ones 4½ in. It would be better to pave the hall and scullery, as well as the kitchen, with red and black Staffordshire flooring tiles, but it would not be cheaper than flooring boards, because, as you will see, flooring tiles require a bed of good 6 in. concrete under them, and to be grouted over with cement when finished.—W. B.

Bending Beading.—IMPROVER.—To bend your brass beading-bore a hole in a piece of wood about 1½ in. thick, fix it tightly in the vice, slip the bead in the hole, and gradually bend to the shape required. I use the tool holes in my bench for bending beads of ash-pans, etc., and can manage very well; but the round hole is the better plan; it should only be a little larger than the beading.—R. A.

Coal Bunker.—DITTON.—Will this querist be a little more explicit? Does he want a coal bunker in metal or wood? Is it to be ornamental in any way, or simply utilitarian? What space is available for its reception, and how much is it required to hold? If our readers in asking questions would only give a few details, it would save us many a half hour's puzzling to find out what is really wanted. It is useless to fill up the columns of "Shop" with sketches and information that after all may be of no use to the querist or anyone else.—R. A.

Tool, etc., Chest.—HUGH.—I am pleased you have made my "Combination Bedroom Suite," No. 26, and "Hat Stand and Hall-Seat," No. 41. I have designed the chest shown. Your wife can conveniently use the lower cupboard (or drawers could be substituted). Not knowing how many tools you possess, I hardly know how to distribute accommodation for them; but, presuming it is not a small stock, I have intended that the upper half of chest shall be for your use. You will see that the way in which the top opens will prove serviceable. If you had merely a tray to draw in and out, you would seldom fill the space so full as to occupy that amount of it which the tools on the under side of the flaps would when the latter were lowered. The arrangement of the holders must be left to yourself;

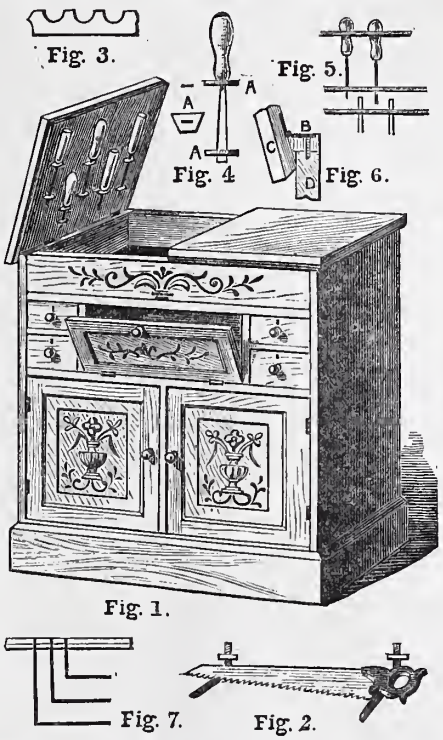


Fig. 1.—Chest Complete. Fig. 2.—Way to support Saws in Top Compartment. Fig. 3.—Elevation of Tool-holding Gallery. Fig. 4.—A, A, A—Tool Holders for Top Flaps. Fig. 5.—Plan of Galleries. Fig. 6.—Explained below. Fig. 7.—Side Elevation of Saw Holders.

Explanation of Fig. 6. If Rails (B) are screwed to sides of chest (D) at top, flush with remaining edges, and wider than the thickness of sides, also with bevelled outside edge, Flaps (C) can be so hinged that when open they may remain so. Suitable dimensions: Width and height each 3 ft. 6 in.; depth from back to front, 18 in.; other parts proportionately.

but I advise you to place them as in Fig. 4, according to the kind of tool to be held. The way in which the lower holder projects, being so near the edge or point, would tend to prevent any accidental contact with tools in the box portion of chest. In the latter it will be best to arrange a series of galleries as in Figs. 3 and 4, the shape and size of each hole corresponding to the handle, etc., of tool, so that they may lay as there shown. I have shown four drawers for nails, etc.; and between them a cupboard for small saws and other tools. The saws could be laid at back on square hooks as in Fig. 2. Fig. 7 shows side view of supporters arranged in order that the saws may be stowed one above another. I should prefer to make chest in mahogany. Suitable dimensions are given in the inscription under cuts.—J. S.

Steam Engine Governors.—F. H. (*Peckham, S.E.*).—Your idea is to make the position of the balls independent of the throttle, and so get isochronism of the governor. But let us see what happens. Your engine is racing: the balls fly outwards; wheel C comes into gear with B, and the throttle closes, slowing down the engine; the balls then descend, wheel A comes into gear, and the throttle opens, quickening the engine speed, and this action is in effect just the same as that of a common governor. Your error lies in supposing it possible to obtain isochronism in any common pendulum governor. In order to perfect isochronism, the number of revolutions of the balls should be the same for all heights of their plane of revolution, which means that their weights should be variable. If the centres of the balls were in a parabolic arc, the governor is isochronous. But perfect isochronism is useless in a governor, making it too sensitive for practical purposes, hence the use of weights and springs in governors that are approximately isochronous in their mode of construction.—J.

Hooks for Shoe-Laces.—CRISPIN BARNETT.—The best paper devoted to the boot and shoe trade is the *Boot and Shoe Trades' Journal*, 9 and 10, St. Bride's Avenue, Fleet Street, E.C., price 2d every Saturday. This paper used to be called *St. Crispin*, I do not know of the *Cordwainer*; Sell's "Directory of the World's Press" does not give it. Then there is the *Record*, 1d. per week, and *Leather*, 4d. per month. The best hooks in the market are Daude's eyelet hook (Fig. 1), from 1s. 4d. to 1s. 8d. per box of

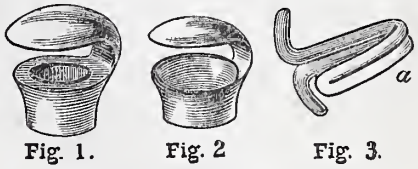
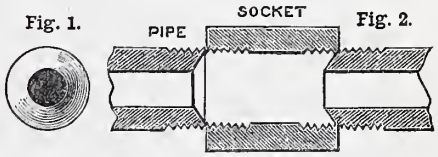


Fig. 1. Fig. 2 Fig. 3.

Hooks for Shoe-Laces.

500, and rings to make them secure at the back, 3d. per box of 1,000. Bray's patent lacing stud (Fig 2) is a good hook, but it requires a machine to put them in with, the cost of which is £1. The studs are 3s. 11d. per 500. There is another—perhaps the one of which you speak (Fig. 3)—but it is not much used now, only for strong work, where leggings are worn, as all the strain is on the curve (*a*, Fig. 3), and when worn a little opens, and catches in the bottom of the trousers. Daude's is what is used in the West End of London for all the best work. They can be procured at Mark Deed's, High Street, Bloomsbury, W., or Penton & Son's, 1 and 3, Mortimer Street, London, W.—W. G.

Perkins' Hot Water System.—A. H. F. (*Cheltenham*).—This system of hot water is for heating only, and it is a high pressure system; I am glad to be able to give you some information about it, but I must also tell you that unless you are a practical mechanic, and with a good knowledge of hot-water fitting, its principles as well as practice, that you had better let Perkins' system alone: it is quite out of the run of ordinary hot-water work, as special tools and appliances are required. The pipes used are Spencer's patent tubes: they are very thick, and of small bore. Fig. 1 shows end section of the smallest size; it is ⅝ bore; the other size—for only two sizes are used—is ⅞ bore, and the thickness of the pipe is about ⅜. No boiler is used in this system, but instead there is a coil of pipes which answers the same purpose. No elbows or bends are used in fitting up the system: all bends are made in the pipes on the job, and the T's are also made on the job by welding and drilling out the hole with a Morse bit. The way the pipes are connected is as follows:—The pipes have a right-hand thread at one end, cut with right-handed stocks and dies, and at the other end a left-handed thread cut with left-handed dies; the special sockets have a left- and right-handed thread to correspond. The ends of the pipes are prepared before screwing together, as follows (see

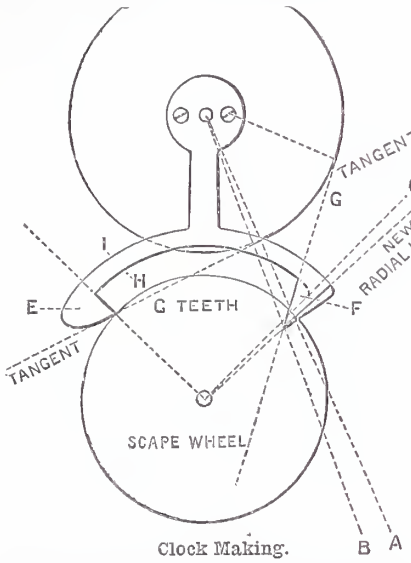


Hot-Water System. Fig. 1.—End Section of Spencer Tube. Fig. 2.—Sectional Drawing, showing Method of connecting Spencer Tubes.

Fig 2):—One end being filed off square and true and then countersunk, and the other bevelled off on the outside to match, both pieces are brought up to the socket and the socket is screwed on; turning the socket one way thus screws it on to both pipes, and they are drawn close together, metal to metal. No red lead or anything of the sort is used, the pipes are screwed very tight with extra strong tongs with long levers, two men generally giving the last pull. The pipes can be carried anywhere: no regard need be paid to getting them level, as in low pressure systems. There is a small cistern at the top of the range of pipes with a valve that keeps closed while they are under pressure. The pipes are filled and subjected to a pressure of several hundred pounds to the square inch by means of a force pump connected to a steam tap near the coil; a Bourdon pressure gauge indicates the pressure, and, when sufficient, the tap is turned off and screwed down very tight, and a gentle fire lit up to test. The greater the pressure the more rapid the circulation. The pipes have been known to get so hot as to scorch a lady's dress, and to scorch the paper on walls. The pressure on a kitchen boiler with a supply 40 ft. high is 20 lbs. to the square inch. The rule for calculating pressure of this kind is very simple: a height of 32 ft. gives a pressure of 15 lbs. per square inch, or, as near as possible, 2 lbs. to the foot in height. Any further information on hot water with pleasure, and sorry your queries have miscarried; you may, however, depend it was from no want of courtesy to you.—R. A.

Permanent Magnets.—A. F. (*Sheffield*).—The conditions suitable to the highest efficiency in a permanent magnet made of steel are almost entirely opposite to those for an electro-magnet. An electro-magnet attains the highest efficiency when the iron of which it is composed is most soft and pure. A permanent magnet made of soft steel will take a high charge of magnetism, but will part with this quickly; whilst one made of hard steel will be hard to magnetise to saturation, but will retain the charge for a much longer period. The power and permanency of steel magnets depend more upon the quality of the steel of which they are made than upon their form. As, however, the available lines of force cluster around the poles, a short stumpy magnet gives more power for a given weight of steel than a long and thin magnet. This rule holds good for all forms, straight, horse-shoe, or compound. The latter make the strongest magnets, because they are made of a number of little magnets bound up in a bundle, and we get the sum total of their combined power.—G. E. B.

Clock Making.—NORTHERNER.—It is a pleasure to answer your query: there is no doubt of what you wish to know. I wish everyone would be so plain; it would save our Editor and his staff a great deal of labour and worry, and be more useful to the querists themselves. From your letter you appear to have Britten's "Handbook for Watch and Clockmakers," and I am very pleased, as it is a most

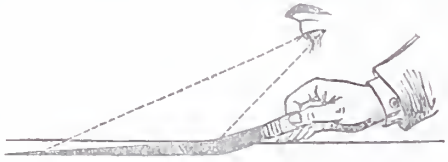


Clock Making.

Rough Sketch of Escapement, the Centres of 'Scape Wheel and Pallets being out of the usual Proportion.

useful book to anyone, amateur or otherwise, I think. Now to draw your pallets: proceed exactly as he says on page 9, *excepting that you mark the exact distance of your centres of 'scape wheel and pallets, and work from that instead of the distance he gives, viz.*, radius of 'scape wheel by 1·4 (of course in new work you would use his measurements). Having done that, you will find that the leading pallet, marked E in sketch, would come out all right; but pallet F would be nothing, or next to it. Now, having drawn the impulse line A, mark off four degrees inside, as dotted line B; next draw radial line D from centre of 'scape wheel through the tangent line G, where it crosses the impulse line B. You will now find you have a good pallet at F equal to the one at E. I trust, from the above and the rough sketch enclosed, you will understand my meaning. Some years ago I encountered the very same thing as you, and was completely fogged how to proceed until a friend, who is a great authority on horology, instructed me as above, and since then, whenever I require to make pallets for *jobbing purposes*, I have followed this rule, always with the best results, always using the distances of the depth on the plates instead of the measurement 1·4 of the radius of 'scape wheel. Allow me to also give a hint: make all these drawings on a piece of zinc, and cut out the pallets as drawn; fit them on the verge, and test them; alter, if necessary, till they escape all right, and make your pallets from it. I find that the easiest way, and best in the end, for if spoilt it is easy to make another, time and material being nearly nil. Now I shall take it as a favour if you will communicate the result—in fact, if all would do that we should know better how to assist others, or whether our advice and instructions were intelligible or not, as sometimes I may forget I am telling one who has not the experience of one who has learnt the trade. You wish also for hints as to shaping and tempering; I always, or nearly so, draw the lines H and I from the centre of scape wheel; the other parts, I think, are merely a matter of taste; but as to the acting faces, round them, as Britten says, and the better they are polished of course the better for the clock. As regards tempering, I always make just the pallets (E and F only) very hard, and leave them so. As regards the castings, etc., for a clock, you cannot do better than send to J. Mayes, 55, Red Lion Street, Clerkenwell, E.C. I can confidently recommend him, as I have had a great number from him; write and say what you require, enclose addressed and stamped envelope, and I feel certain you will get it; the price I cannot say, not at present being able to put my hand on any accounts. I shall be pleased, indeed, to give any further information on this, or any other, job, either in WORK or privately through the post; in case of urgency, the Editor will forward any letter no doubt; we all owe him our best thanks. I have learnt many things from WORK, and trust others have done so.—A. B. C.

Fine-Lining 'Bus Panels. NOVICE.—The failure to draw a straight line with a pencil and colour may result from unsteady nerves, defective vision, tumbling manner of holding the pencil, or faulty positions of the guiding fingers, etc. Or the colour may be badly mixed, the ground-colour surface not rightly prepared to receive the line-colour, or the "lay" of the pencil and starting at each dip of colour may make a gouty line. You must cultivate a faculty—*i.e.*, "deliberation." The first thing you have to do is to study such positions of work in relation to the horizontal level as will train the eye, fingers, pose of body to the many possible positions of a painter at work. The first lesson I once gave a youth was with the microscope—the object lesson: single hairs of different animals, including camel, sable, fitch, lynx, ox, hogs' bristles, etc.; he learned the peculiar formation of different hair, and the overlapping scales which cover them, and that it is these scales which hold the colour, and yield it under pressure by the law of adhesive attraction—not capillary attraction in this instance. This was to teach an impatient youth *deliberation*. Follow for yourself this method. Now for technique and science of manipulation and colouring, which terms are to be rendered by the homely words "touch" and "sense." The panel must have been flatted down with fine pumice-dust to a dull egg-shell dimness of surface: this is essential. Now bear in mind that you should be able to use the left and right hands equally well; if you cannot, put the left hand to do a lot of easy short lines; for to be a painter, the left hand must be taught up to the right-hand mark. Next, as a learner, mark the line at the right distance from the moulding: this is by a pair of compasses, wash-leather on one point, and a finely pointed piece of charcoal, chalk, or suitable soft substance, on the other. This will give you confidence that you are going straight; once you have that confidence, you will never want to use these mechanical aids for your judgment. The 'bus body is usually tilted up to an angle of about 45°; it is not fair to a learner to expect him to lay a line of colour on a vertical panel: that can be done with practice, and has to be done on surfaces horizontal above the painter's position. The moulding of the framing of the body guides the hand by those fingers of the hand not holding the pencil, using the moulding as a gauge-guide; the thumb and finger hold the pencil, the other fingers are kept rigid, but without any strain, and the pencil is drawn along the line with a graduated pace, slightly quicker at first, while the colour flows freely and slower at last, to enable the smaller supply of paint to escape from the hair, in which it is aided by the adhesion of colour drawing it from the pencil, as well as by pencil-pressure on the panel. I asked an expert and prize-winner of painting of the Polytechnic Institution to supplement my remarks by his experience, which he did. Charles Witham, the writer of the following, is a most efficient teacher, if one be wanted by a learner:—"It requires a steady hand, and the hand must be guided by the eye, as shown in sketch. The eye is first directed to the point of the pencil; when that touches, the eye should follow to the butt or the heel of the



Lining Tool.

pencil, and there rest until the line is finished. Confidence is a great thing in all pencil-work, which is obtained only by practice; when you lay the point of the pencil down and spread it out to the required width, which is done by the movement of the fingers as you lay the pencil level to draw, without stopping at a graduated pace, in drawing the pencil along unevenly it will cause the colour to flow more in some parts than others, thus making an uneven width in the line. When your pencil becomes empty, you must re-dip in the colour, then work it on the palette until the hairs of the pencil are even and straight: then you will not get too much colour in the pencil. As the colour becomes thick in the butt or heel of the pencil you must dip it in a little turps, which you have in a 'dipper' by you while you are at work, and work on the palette as before. If you were to use the pencil direct from the pot of colour on to the panel or spoke, you would get too much colour, and it would run all over the surface, and spoil the line. When you have re-filled the pencil to continue your line, do not start from the exact point at which you left off, but start a little way back on the line, or else the connecting line will be smaller and uneven in colour, unless thus retraced, the paint being less in quantity towards the last 'lay off,' and it will not cover the ground colour solidly. On 'busses, as a rule, it is the mouldings that are picked out gold, black, etc., with ½ or ¼ line of another colour on the edges, or sometimes ½ in. away from the moulding on the panel; but the distance may be as much as 4 in. from the moulding, the little finger forming the gauge-guide of the hand. Success is progressive; do not attempt a line 8 ft. long till you can do one a foot long well; now and then practise on old panels, short lengths, and vary the straight line with curves, which are more difficult." Varieties of pencils for lining and striping, or bands, are made of sable, camel's-hair, Siberian ox-hair, etc.; the best are sable, of which there are two kinds, the red and the black, either of these will make good stripes, but the red hair is mostly used for ornamenting panels. Camel's-hair is softer, but does not do for heavy colours, such as vermilion; the sable ox-hair is the best for heavy colours; the camel's-hair is best for blacks, chromes, or whites; this hair being softer, it holds more colour, and levels better. One word, not about painting, but essential to success—cleanliness of shop, tools, and person; a clean painter commands ready work, and keeps his place and health; a dirty painter risks losing both.—J. C. K.

Small Tubes or Sockets, etc.—X. Y.—I cannot advise you how to make a machine to turn and punch the sockets you require. I should think that the best thing you could do would be to get one of Rhodes' small tube bending rollers, of which I send you a sketch (Fig. 1), from which, if you like to try and make one, you can. For my

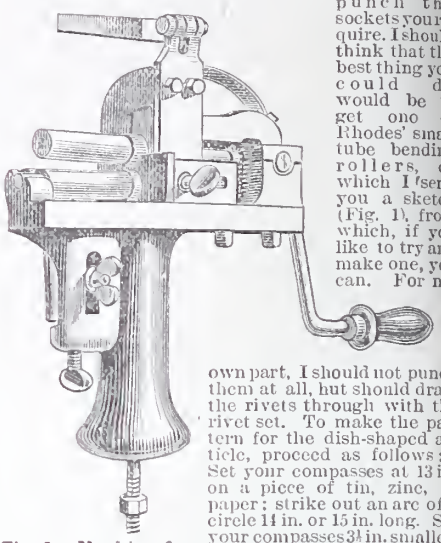


Fig. 1.—Machine for forming or bending Small Tubes or Cylinders, with or without Bead, 6 in. long, 1 in. and upwards in Diameter.

own part, I should not punch them at all, but should draw the rivets through with the rivet set. To make the pattern for the dish-shaped article, proceed as follows:—Set your compasses at 13 in. on a piece of tin, zinc, or paper; strike out an arc of a circle 14 in. or 15 in. long. Set your compasses 3½ in. smaller, and describe another arc (see Fig. 2). On the top line set two points, A and B, 12½ in. apart, and from these points draw lines toward the centre C; the figure contained within A, B, D, E will be the pattern you require; allow ¼ in. each side for the seam. Now as to working it up: the reason it cracks as you turn the edges is, I expect, because you draw it over too suddenly, and do not humour the stuff enough, or else you have bad tin. I should advise you to wire the small part before turning round, then work the gold for wiring the top (Fig. 2) very gradually, using first a flat tool and a broad pane hammer, and stretching the stuff a little on the outside edge, then finish on the half moon stake; if this fails, then wire both top and bottom before turning. To make your hatchet copper bit you must work it at a cherry-red heat, and to make the nick round it, as shown in your sketch, use a bottom tool and fuller, and get someone to strike for you; draw down the hatchet part last.—R. A.

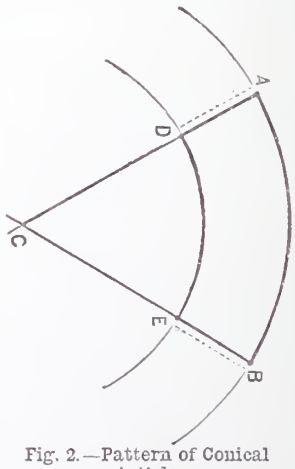


Fig. 2.—Pattern of Conical Article.

American Organ Fittings.—AMATEUR.—For all parts of these instruments, for own building, you will do well to apply to the American Organ Fittings Co., 2, Oseney Crescent, Camden Road, N.W. Papers on the subject are in hand, and will probably appear in Vol. III.

MELHUISH'S No. 735 PATENT

MBINED CARVING AND WORK BENCH CABINET.

itted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

de from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

VARDED for CELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,
84, 85, 87, Fetter Lane, LONDON.

WATKINSON & LONSDALE.

MANUFACTURERS OF
Photographic Apparatus,
NEW BRIGGATE, LEEDS.

PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine,** any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,
TOOL MAKERS, DUBLIN.

Christmas & New Year's Gifts.
Cassell's Classified Catalogue, containing particulars of upwards of ONE THOUSAND VOLUMES, published by Messrs. CASSELL & COMPANY, ranging in price from THREEPENCE TO FIFTY GUINEAS, will be sent on request post free to any address.
CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER.

MASON'S WINE ESSENCES.

These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. **One Tablespoonful of Mason's Extract of Herbs** makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON,
Nottingham.

On WEDNESDAY, JAN. 7th, will be published the First Volume of the New Weekly Issue of

Cassell's National Library,

Price 3d.; or cloth, 6d.

The following is the order of issue for January :—

Jan. 7.—	**The Haunted Man**	DICKENS.
,, 14.—	**Utopia**	Sir T. MORE.
,, 21.—	**Lays of Ancient Rome** ...	MACAULAY.
,, 28.—	**Burns and Scott**	CARLYLE.

Important Announcement.—Several **New Volumes** will be added to this re-issue, which will consist of a **Selection of the most popular Works** in the Library. The Cloth binding of the Volumes will be greatly ***improved*** in style, and this feature alone is likely to render the series even more popular than the original issue.

*** *Intending Subscribers are requested to order the Volumes by Name (not by Number), and to ask for the New Issue.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

WITH

"LITTLE FOLKS"

for JANUARY (now ready, price ***6d.***) is

GIVEN AWAY

a delightful work, entitled **"The 'Little Folks' Diary and Note Book for 1891,"** consisting of Thirty-two Quarto Pages, with Twelve large Illustrations drawn by WALTER CRANE.

The JANUARY PART contains a Picture in Colours, the commencement of Two New Serial Stories, and numerous other attractions for young people.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill,** with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting on screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 3d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing price 4d., post free. A Specimen 6d. Fretwork Design **SENT GRATIS** with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

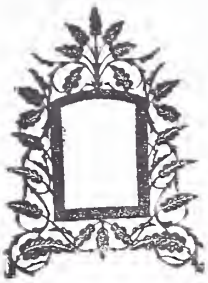
LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores or b Post from the **MANAGER, SALT REGAL WORKS, LIVERPOOL.**

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.



The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

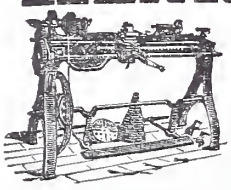
Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. ESTABLISHED 1858.

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6d. OR FOR 7 STAMPS BIRMINGHAM. [33

London Warehouse: **124, NEWGATE ST.**

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 93.] SATURDAY, DECEMBER 27, 1890. [PRICE ONE PENNY.

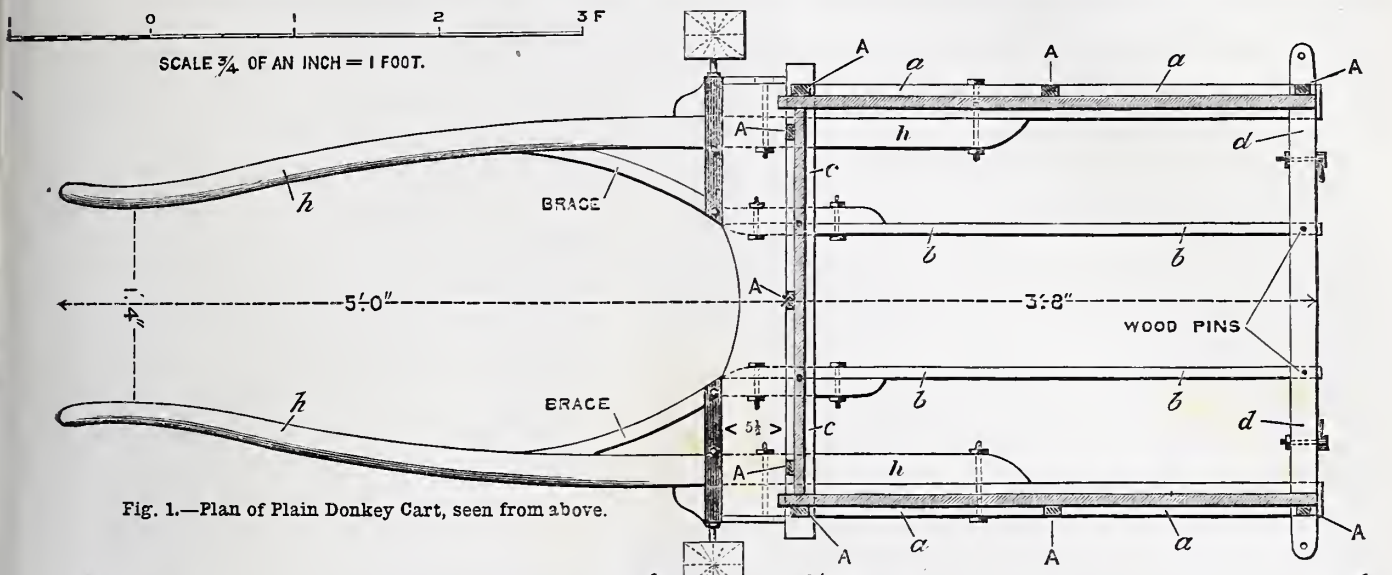


Fig. 1.—Plan of Plain Donkey Cart, seen from above.

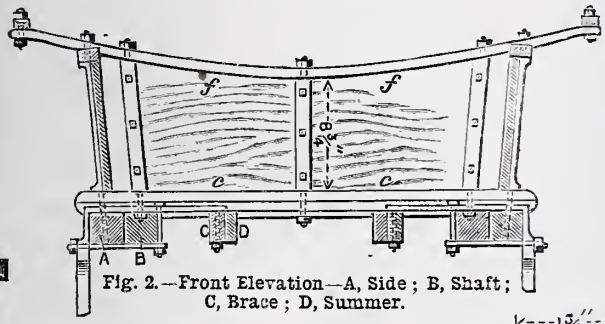


Fig. 2.—Front Elevation—A, Side; B, Shaft; C, Brace; D, Summer.

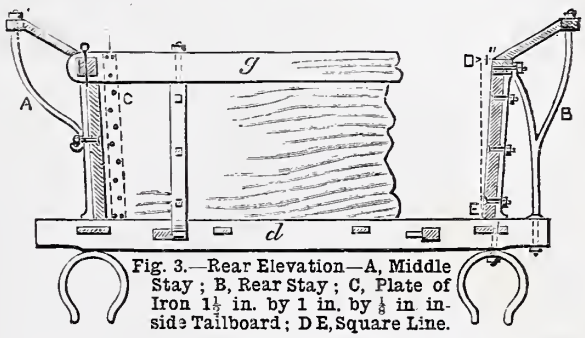


Fig. 3.—Rear Elevation—A, Middle Stay; B, Rear Stay; C, Plate of Iron 1½ in. by 1 in. by ⅛ in inside Tailboard; D E, Square Line.

Fig. 6.—Enlarged Sketch of Standard.

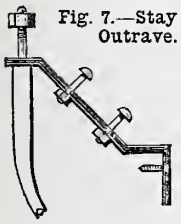


Fig. 7.—Stay for Outrave.

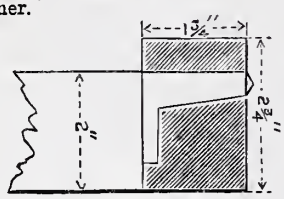


Fig. 5.—Mortice and Tenon of Hind Earbed.

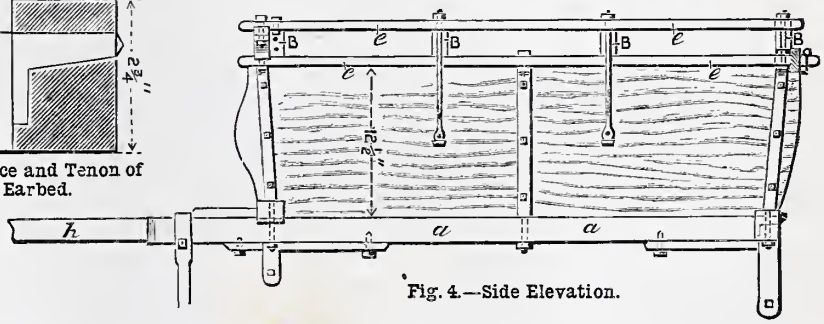


Fig. 4.—Side Elevation.

A PLAIN DONKEY CART.

BY J. P. S.

I MAY best commence by saying that this paper is the outcome of a question asked by a correspondent. As it would take about half the space devoted to "Shop," it seems to me that I may best render assistance to those who are interested in the matter by giving a description of the cart with the necessary diagrams, on a scale of ¾ in. to the foot.

The plainest and cheapest kind of carts for rough and heavy work are what is known as "plank sided," *i.e.*, made of stout planks on edge, instead of a frame of hard wood lined with thin boards. I think I can best serve the readers of WORK by giving particulars of a donkey cart I made early in the year 1887 for a young fellow who had but little money to lay out, and who told me very recently it suited his purpose admirably. He uses it to fetch firewood, and to take linen to and from a laundry, etc. He wished it to be full size, as he hopes to rise to a pony. I advised him to buy a good pair of second-hand wheels and axle complete off a four-wheel cab. He did so for 25s., and bought them well worth the money; if you follow his example, buy them in the rough, not a pair that has been "doctored" and painted over. I give the dimensions below, in case any intending builder of a cart may prefer to buy new wheels and axle. You may get all you require from Mr. Callow, Pembroke Street, N., near the Great Northern Railway potato market; or from Gadsdon's, 11, Brushfield Street, Bishopsgate, E., amongst many others. The

rough sketches of the plan as seen from above, the front elevation, rear elevation, and side elevation in Figs. 1, 2, 3, 4, will give a good idea of the style of cart I recommend. The shafts, sides, raves, summers, front and hind earbeds, should all be of elean dry ash. The panels and footboard are of elm, also dry, and $\frac{3}{4}$ in. thick when finished. The bottom boards of the body may be of yellow deal $\frac{3}{4}$ in. thick. Here are some dimensions—wheels, 3 ft. 8 in. high; hubs, 7 in. diameter, $8\frac{1}{2}$ in. long; felloes, $2\frac{1}{4}$ in. square; tyres, $1\frac{5}{8}$ in. by $\frac{1}{2}$ in.; axle, $1\frac{1}{2}$ in.; solid flaps on which to fix the springs are preferable. Get what is known as a *nut* axle. Springs, 3 ft. 6 in. long; six plates 2 in. steel; four clip staples 4 in. long over all; front scrolls, "cheek" pattern; hind scrolls, "globe" pattern; they are stronger, and will not come in the way of the tailboard when let down; one or two footsteps, according to capacity of pocket, and shaft irons to fit the kind of harness to be used. This will be about all the ironwork that can be bought ready made; the remainder must be made to order either where the springs are purchased or by a local smith. The dimensions of wood are—

		Length.	*Depth.*	*Width.*
Two sides	(*a*)	4 ft. $4\frac{1}{2}$ in.	2 in.	$2\frac{1}{4}$ in.
Two summers	(*b*)	4 ,, 1 ,,	2 ,,	$1\frac{1}{4}$,,
One front earbed	(*c*)	3 ,, 5 ,,	2 ,,	$2\frac{1}{4}$,,
One hind ,,	(*d*)	3 ,, 7 ,,	$2\frac{3}{4}$,,	$1\frac{1}{2}$,,
Four side raves	(*e*)	4 ,, 2 ,,	1 ,,	$1\frac{1}{2}$,,
One bent front rave	(*f*)	4 ,, 2 ,,	1 ,,	$1\frac{1}{2}$,,
One tailboard ,,	(*g*)	3 ,, 4 ,,	$2\frac{1}{4}$,,	$1\frac{1}{2}$,,
Two shafts	(*h*)	7 ,, 0 ,,	2 ,,	$2\frac{1}{4}$,,

The shafts are tapered from the footstep forward from 2 in. to $1\frac{5}{8}$ in. in depth, and in width from $2\frac{1}{4}$ to $1\frac{5}{8}$ in., and all the dimensions are finished sizes and lengths, consequently your stuff should be at least 2 in. longer when in the rough. You will also require two wood braces for the shafts, of which you should make a template and get them sawn out to it.

To construct, commence by planing up true, and framing out the bottom by morticing on the hind earbed; a sketch of the mortice and tenon is given in Fig. 5; these are the only four mortices in the cart, if we except the top rave of the tailboard. Observe the earbed is $\frac{3}{4}$ in. higher than the sides to allow the bottom boards to be flush with it when laid. The front earbed is notched down $\frac{1}{2}$ in. to keep the four pieces in their places. Do not allow the frame to get out of square, nor the stools to "wind" on which it is laid, or the cart will be the subject of many a joke when finished. Next in order will be required nine iron standards to bolt the panels to, and also to carry the raves in lieu of several wood standards. Carts made of $1\frac{1}{2}$ in. planks are held together with long $\frac{1}{2}$ in. bolts instead of these iron standards, but these not only allow of thinner panels, but are easier of construction, and also far more simple to repair. An enlarged sketch of one end of these standards is given in Fig. 6; the screwed ends are $\frac{3}{8}$ in. at bottom and $\frac{5}{16}$ in. at top in all cases; the lengths vary, as reference to the sketches will show: thus the four eorner ones must be long enough to take the four scroll irons for the springs. These standards have large shoulders both top and bottom, and each have three holes drilled in them to take $\frac{1}{4}$ in. countersunk bolts with which to fasten in the panels. Having procured these nine standards, proeeed to fix them as indicated at A in sketch plan (Fig. 1). Observe the panels are "set on" $\frac{3}{4}$ in. from face of framework. The side panels splay 1 in. outwards (see rear elevation, Fig. 3), the front $1\frac{1}{2}$ in. forwards, and the taiboard 1 in. backwards. The side panels are $12\frac{1}{2}$ in. deep. The two side raves and the front rave are next fitted on the top ends of the standards: the panels are fitted in, the raves and panels coming "flush" on the inside. The remainder is fairly plain sailing. The footboard is $5\frac{1}{2}$ in. wide, and hollowed out to give more room to the animal's hocks. The top rave of the tailboard is deep to allow of the mortices in the ends to pin it on to the raves; two plates of iron 1 in. by $\frac{1}{8}$ in. are fastened with screws inside the ends of the tailboard to strengthen it. A couple of hooks and chains to suspend it and to lengthen out the carrying eapacity of the body may be added. The outraves are supported by four middle stays and two rear ditto, the latter also strengthening the hind corners of the body. I have cut away a portion of the tailboard in sketch to show this. The outraves are boarded with yellow deal $\frac{3}{4}$ in. thick; four stays of coach hooping 1 in. by $\frac{1}{8}$ in. are fixed on each side as shown at B to keep the outraves in position, and to these this board is fastened by small bolts. An enlarged sketch of one of these stays is given in Fig. 7.

If there is only one footstep, the near shaft will require three bolts instead of two to keep it rigid. Do not fasten the footstep with a bolt *through* the shaft, but down the side of it. Set the centre of the axle $\frac{1}{2}$ in. behind the centre of the cart body, and fix the left-hand nut on the near side. You may add a plate of iron under the front end of each shaft 2 ft. long. If you care to scollop the woodwork, do so to your heart's content; I have shown none, not wishing to crowd the sketch. Paint the body dark blue, and line it light blue, the wheels, springs, and axle, "mail" red, and line it dark blue; give it a coat of varnish and plenty of water.

If anything is not plain to any reader, let him ask for advice in "Shop." It is just what the Editor likes.

HINTS ON REPAIRING FURNITURE.

BY KENELM POOLEY.

It oeasionally happens that there is an old piece of furniture which, though shabby and somewhat dilapidated, is yet sufficiently sound to be useful. Its appearance is the principal objection, but a little judicious "touching up" may make it, if not as good as new to look at, at least so good that it is not unsightly. Of course if it is a valuable article, and expenditure of money is of secondary importance, the best way is to get the work done by an experienced cabinet maker, but it may fairly be assumed that there are many readers of this Magazine who would prefer to do the work themselves if they only knew how to go about it. For the benefit of such, these few hints are given. No pretence is made that they exhaust the subject, for it is practically inexhaustible. No two articles require exactly the same treatment, and the fitter must just rely on his own judgment to a great extent.

There are, however, some defects which are eommon to most pieces of furniture which have been used—and very likely also misused—and the general eourse of treatment of such may be indicated.

It may be taken for granted that the polishing will require attention. Possibly it only requires cleaning, but on the other hand it may be necessary, owing to defects in the way of bruises or scratches, or in the case of veneered work, where there are blisters, to repolish entirely. Let it here be understood that though the remarks apply more or less to all kinds of cabinet work, they have special reference to carcase work, such as chests of drawers, sideboards, wardrobes, etc., in any of the better kinds of furniture woods.

If the polish principally requires cleaning, there is no better preparation than the one which has been frequently recommended in "Shop." As its components are French polish, vinegar, and linseed oil, there is nothing to injure any polished woodwork to which it is applied, while it not only acts as a cleanser, but as a reviver. A soft rag has merely to be moistened with the mixture and rubbed on, giving a final wipe with a clean dry soft cloth if necessary.

In the next stage of badness it may be desirable to touch up with French polish. This is necessary when the original polish has perished, and the deficiency must be supplied by some more being added. The old polish is not got rid of, but serves as a groundwork of body for what is laid on it. It is, in fact, just to be gone over with a rubber moistened with French polish in the ordinary way. Naturally, some skill in the use of the rubber will be required, as in any other polishing work, the main difference between polishing new things and touching up old being, that with the latter, the preliminary operations of oiling, filling in, and bodying up do not have to be done again.

It often happens that it is desired to entirely repolish work. In this case, the old polish should, as far as practicable, be removed. No difficulty will occur with flat surfaces, but where there is much intricate carving or small mouldings, it is not always an easy matter to clean away the old polish. It may be washed off with soda, potash, and other similar substances dissolved in water, but those inexperienced in such work are advised to use them with care or they may find that they have altered the colour of the wood. It is certainly safer when practicable to rely as much as possible on mechanical means. These, of course, take the shape of scrapers and glass-paper. Occasionally it may be considered advisable to run the plane over the work, but this can obviously only be done on plain, flat surfaces. To those unaccustomed to the scraper, it may be worth while to suggest that a great deal can be accomplished with it alone. The amount of shavings which it will make when properly manipulated may astonish them.

While the scraper is doing its work, scratches, dents, and bruises will become more eonspieuous from the eontrast between them and the comparatively light wood where the polish has been removed. It must be for the worker to decide to what extent he will serape down to remove these defects. One thing he must be careful about, and that is—the surface must be kept as level as possible. It will not do to rub down with paper where there is some particularly deep or objectionable scratch or dent, without removing the surface from the rest of the work to the same extent. The slight hollow caused by papering down locally might not be notieeable to any great extent while the wood is unpolished, but when polished it probably would be.

To repolish, proceed as if the work were new, but if a very little of the surface has been removed, it may not be necessary to use any filling. Of course, if every trace of the old polishing has been removed, the wood is for polishing purposes practically new, and must be treated as such.

Bruises may sometimes be removed by merely moistening them. The action is that the water, or rather dampness, swells the bruised

fibres of the wood, and causes them to rise to their original position. This treatment cannot always be depended on as being efficacious; but there can never be any harm in trying it. Of course, if the polish prevents the moisture getting into the wood, no good can result.

Scratches, cuts, or cracks cannot be remedied by this means. If the two former defects are slight, the scraper may be relied on to remove them, but if very deep and serious they may be filled up with stopping. Cracks, if small, may be dealt with in the same way, but if large it will be better to splinter them up with thin wood. A piece of veneer or wood of suitable thickness should be taken, and after being glued on both sides, forced edge downwards into the crack as far as may be necessary. Do not trim off the upper edges of the splinters till the glue has set. If properly done, the inserted piece will scarcely be distinguishable.

Blisters occur on veneered work. As a rule, they can easily be recognised, but to lay them much care is often necessary. Some may not understand the meaning of blisters as applied to woodwork. It may, therefore, be explained that they are caused by the veneer in places not being glued down to the solid groundwork. This will partly indicate the remedy: it is simply that the veneer must be glued down where it is blistered, or, in technical language, the blisters must be laid. If the glue under the blisters has not perished, it may sometimes be made adhesive by moistening it. How this may best be done depends almost entirely on circumstances. The great matter is to get the moisture to reach the glue without unduly affecting the wood. The blister may be pricked or even cut—of course in such a way that it is not permanently marked. Through the cut a little water must be got under the veneer. Heat and pressure must be used to cause adhesion. They may be applied with a warm hammer-head or anything handy—if necessary, using a small caul and handscrews.

It very frequently, however, happens that there is no glue remaining under the blister. In this case, new glue must be inserted, and the adhesion be kept up as before till the glue has set. Sometimes the veneer is chipped away, and must be replaced by new pieces. To do this properly requires some degree of skill and the exercise of discretion, without which, indeed, it is almost hopeless to expect to do any repairing work well. The colour of the new pieces must be as carefully matched as possible to that of the old, and attention must be paid to the configuration of the veneer in which they are to be inserted. Much may often be managed by cutting away some of the old veneer in order to get a sightly joint. To manage this part of the work properly requires neatness as much as anything.

With these few hints, this article must close in the hope that it may be helpful to many who, though not able to make anything in the way of furniture from the plank, are yet able to do a bit of tinkering. If any reader is disappointed that the repairing to which this paper is devoted deals with the renovation of veneer and improvement or renewal of the polish, and does not go into repairs of actual damage, let me point out that every fracture, or nearly so, requires the peculiar mode of treatment best suited to it. To do this, I should be compelled to deal with hypothetical cases. This would involve too many papers, so I must answer queries regarding breakages specially in "Shop."

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

Piece and Elastic Moulding, with other Wrinkles in Plaster Work.

Piece Moulding from Plaster, Marble, etc.—Elastic Moulds—Clay Squeezes—Mending and Cleaning Casts—Painting, Gilding, Silvering, and Bronzing on Plaster.

In those papers on plaster casting which have hitherto appeared in WORK, we have dealt only with waste moulds—moulds, that is, in which one cast only can be made, and which are destroyed to liberate it; and this is by far the most interesting and important branch of our subject.

Much less space will need to be given to methods of casting by moulds from which an indefinite number of casts may be produced. Such moulds are not like waste moulds taken from soft and yielding substances like clay, but from hard ones, such as marble, metal, and more especially from plaster. If we wish to multiply casts from a model which we have formed in clay, we must first make a single cast by means of a waste mould, and from that a piece mould, or perhaps, in some cases, an elastic mould. It is in piece moulds that the plaster images sold in shops and by wandering Italians are almost exclusively made.

Piece moulding, so far as regards the making of the actual mould, is a tedious operation, and the person who sets about it will need patience and neatness of hand. A piece mould is so called because it necessarily consists of a number of pieces; and every one of these is so arranged that it will "leave" the cast without difficulty. It is, therefore, generally necessary that the pieces should be numerous and sometimes very small; to mould a face, a dozen or more pieces will probably be required.

Before beginning a piece mould from an object in plaster, it will be well to rub hog's lard over the surface, to prevent sticking. This kind of grease is preferred, as being colourless. The first piece of the mould is made in a central position, the moulder making no wall of clay or otherwise round it, but merely building the stiffening plaster with his spatula. He takes care to extend this and every future piece no farther than that it will be able to "leave" without obstruction. When this first piece is set, he removes it, trims its edges with a knife, greases them, and replaces it. Then he builds up two more pieces against it on its opposite sides, and treats them as he did the first piece; and so he goes on till the whole bust, or piece of ornament, or whatever the object in plaster may be, has been covered with pieces. Sometimes these pieces will stick rather tightly to the plaster object, and gentle and careful tapping will be needed to bring them away unbroken.

These form an inner mould, and have next to be covered with an outer one, forming a shell to enclose the whole. In a relief this shell will probably be in a single piece; in moulding from the round it will be in two, or perhaps more, pieces; the shell of a bust will be in two. When the pieces of the inner mould are put together for filling, and enclosed in the shell, which is bound tightly round them, they fit together with such accuracy as to seem almost like one solid mass.

In such a mould as this a very thin crust of plaster suffices to form a cast, for it will have to bear none of the hard knocks by which a waste mould is removed. A piece mould will serve to produce an almost unlimited number of casts. It will, however, gradually suffer from wear. In the earlier casts a faint raised line will show where the different pieces join. These joining lines should, to make a cast look well, be cleaned away. As the mould is used, these lines will grow wider and more unsightly.

When the piece mould is to be taken from marble, no grease should be used on that delicate material; white curd soap is then the proper thing to prevent sticking. This washes off, and leaves the surface none the worse.

Elastic moulds are most commonly employed for the reproduction of ornament. Being far more easily and quickly made than piece moulds, they are more in favour with those who take up moulding—not as a calling, but as an interesting pursuit. A mould of this kind, made in one piece and at a single operation, allows any work in relief, of moderate size, to be readily multiplied.

Fig. 31 (page 579) is intended to explain the principle of the elastic mould; it is supposed to be the section of a circular centre ornament. It will be obvious that with under-cuttings such as those at A and B, no mould in a rigid substance such as plaster could be induced to leave in a single piece. But a mould formed in some yielding and elastic substance might be pulled away without being injured, and when removed its elasticity would cause it to resume its first shape.

Various materials have been tried for making moulds on this principle. Gelatine is the favourite. Cheap gelatine, and sometimes glue, are used, but these are not to be recommended. They are apt to soften when the plaster heats in setting, and to break. The following is an approved recipe:—"Best sheet gelatine (say at about 2s. per lb.), 1 lb.; beeswax, ½ oz.; water, ¾ pint. Boil these in a glue-pot till they become a dense syrup."

The object to be moulded has, we will presume, been cast in plaster (say from a waste mould), and a little oil or lard is rubbed over it to prevent sticking; the syrup has to be poured upon it whilst still moderately hot, but *not* boiling.

When the under-cuttings at the edge of the mould are very deep, it is sometimes desirable to slit the mould to enable it to pass over the obstruction more readily. After an elastic mould has been filled, it is pulled from the new cast just as from the original model. Such a mould will serve for a reasonable number of casts, but will not endure like a plaster piece mould.

Clay squeezes ought also to have passing mention before we leave the subject of moulding; for though taking a squeeze is but an imperfect and makeshift process, it affords a quick and ready way of getting a cast of any small work of sculpture in marble, stone, metal, wood, or plaster, where regular moulding might be out of the question; the plan is essentially the same as that employed by a dentist for obtaining a cast of the internal arrangements of a patient's mouth, only while the dentist uses a composition of wax which does not shrink in the cooling, we use clay. Our method is to prepare well-tempered modelling clay, of the consistency of putty, not too hard, or it will not adapt itself readily to the forms with which it comes in contact, and not too soft, or it will stick to them. Say that we wish to possess ourselves of some of the minor details of an ancient building either in stone or wood carving; we make ready a ball of

clay of the proper size, and press it steadily and directly from the front upon the object. When pulled off it will not indeed give us undercuttings, but it will, if neatly handled, furnish us in other respects with a fairly good mould, from which we can take a cast in plaster. A little knack is needed in taking a squeeze well, and this comes of practice; but anyone can practise with the clay on objects in his own possession.

In a previous article something was said on mending such breakages as occur in casting. Breakages at a later period, when the plaster has become dry, are not quite so easily mended. The fractured edges need to be moderately wetted—not saturated with water—and a little of the plaster scraped away in places so as to allow the newly mixed liquid plaster to run in between the two pieces of the old. If the breakage is a considerable one, say right across the ground of a relief or the limb of a statuette, it is better to let in dowels of copper wire, and to embed them in plaster. By these means the cast may be made as strong as it was before; and, with filling up the crack with new plaster and smoothing it off, all traces of the disaster may be pretty well obliterated, except that in unpainted casts there is a tendency for a faint line of discoloration to appear at a distance from the place—a result of the necessary wetting.

Bare, natural plaster is a bad material to bear exposure. That snowy whiteness which to most people constitutes so much of its beauty soon sullies with dust and dirt, and unfortunately there is no really effectual way of cleaning it. Cleanly housewives, in the innocence of their hearts, sometimes try soap and water, to the utter ruin of the cast. The only known method of cleaning is by sprinkling new dry plaster over the surface, and working it about with a clean soft brush. Most of the discoloration which comes from dust will be taken up by and removed with the dry plaster, but anything of the nature of a stain will remain untouched by it. The only way in which delicate casts are to be kept in their native purity is beneath glass, precautions being taken to exclude air and consequent dust.

To take off the chalky and, in their opinion, raw look of plaster, some persons are fond of saturating casts with such matters as will give them a more soft and translucent look. Many are the matters which have been used for this purpose: among them are white wax, paraffin, skimmed milk, etc. Some skill and care are needed to saturate a cast successfully—with wax, for instance, the cast has to be plunged into the melted wax whilst itself hot. Any ingenious person with leisure might find in this direction a favourable field for making experiments.

The ordinary way of treating the larger casts, such as statues and life-sized busts, is to paint them. For this the cast must first be dry, and the surface will have, before painting, to be satisfied with linseed oil. The paint commonly used is made with best white lead, a little oil, and a much larger proportion of turps than is used in ordinary painting. Some add a little yellow ochre to tone down the white. As a thick coating of paint would tend to choke and hide the modelling, a very thin one only is applied—the painter taking off with a second brush much that he puts on with the first. The painting should be done rather by stippling than by brushing across in the usual way. Casts thus painted can be kept fairly clean; but a new coat of paint is required occasionally.

Gilding, silvering, and bronzing are methods of treating plaster sometimes used, and the latter especially is in favour with sculptors for models of such works as are intended to be eventually cast in real bronze. Gilding and silvering are more used for decorative purposes; but all three appeal to those who find in such like matters interesting pursuits for their leisure. There are persons who make a business of carrying out these processes, and if a solitary cast only has to be treated, it is, perhaps, better to send it to such a person, since in a first attempt no one can expect to be altogether successful. The difficulties are not great.

The cast has first to be satisfied with linseed oil, which should be brushed over it three or four times, with a day's interval between the brushings to allow of drying, and even a longer time should be allowed to pass after the last application. An oil gold size is sold by colourmen, in the form of a paste, like putty, but yellow, from being largely mixed with yellow ochre. This is the best size for gilding on plaster; and if too stiff to work freely, it can be thinned down with linseed oil. It has to be laid smoothly and regularly over the cast. When dry enough to be tacky—say in twenty-four hours, more or less—it is ready to receive the gold leaf, which will best be laid on with a gilder's "tip." The gold has afterwards to be gently pressed down, and superfluous leaf brushed away with a little ball of cotton-wool. Silvering is much the same, only an oil-size without ochre should be used, and the leaf, being thicker and heavier, should be applied whilst the size is somewhat more moist. Both gilding and silvering on plaster are most effective when the surfaces are broad, and much in the same plane, as on flat medallions and other reliefs.

Perhaps that preparation for bronzing which gives the best imitation of the actual metal is of too complicated a nature for any but the professional bronzer, and it would not, therefore, be desirable to occupy space uselessly by giving it here. A more simple way, and perhaps the best for general use, is to apply as a paint the following:—Verditer, Prussian blue, and spruce ochre, varied in quantities according to the hue of bronze required, and ground in oil. Over this, when nearly dry, bronze powder of the hue required is to be dusted on with a bob of cotton-wool. The plaster has, of course, to be satisfied with oil before bronzing.

A DRAWER SUPPORTER.

BY JAMES SCOTT.

I BELIEVE it would be impossible to find a man or woman who has not, at various times in his or her life, been reduced to a state vulgarly known as "out of temper" (which paradoxically means *in* a temper) by being annoyed at the manner in which a drawer would drop when it was opened, and require to be supported by one hand, thus leaving but one hand to turn over the things within, in order to find a particular article. I have a simple contrivance which will, to a certain extent, obviate this nuisance. Its construction will not require advanced skill on the part of my amateur readers. Any existing drawer can have one attached to it, without being injured or defaced in the slightest degree. It is only a pair of flaps.

In the majority of drawers the bottom proper is not flush with the bottom edges of the front and sides of it—there is a space formed by their arrangement. If a thin board is hinged to each side of the drawer, underneath the bottom of it, and within this space, so that it may lay flush with the bottom edges of the sides and front, both boards could be folded flat underneath the drawer, and pushed with the drawer into the carcase; and when the drawer is pulled out to a certain distance, they will fall down at each side, and, by reason of the resistance of the front of the carcase, retain the drawer in a horizontal position.

The size of the flaps must be regulated by the size of the drawer. Of course, they must not be too large to permit them to lay flat. The length of the hinged edge will depend upon the distance it is considered preferable to extract the drawer from the carcase. The drawer should have a reasonable portion of it remaining in the carcase.

It will be advisable to cut the drawer sides at the bottom to the depth of the thickness of a flap, and hinge the latter, as in Fig. 2. It will then fall in a better manner; but each can be usefully hinged, as in Fig. 4. In some cases the flaps would

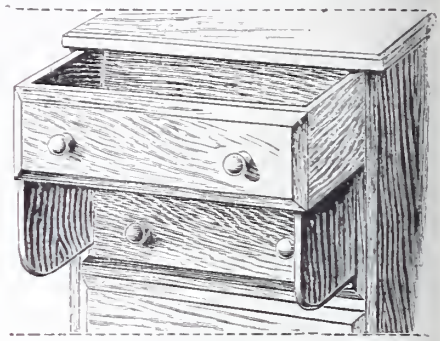


Fig. 1.

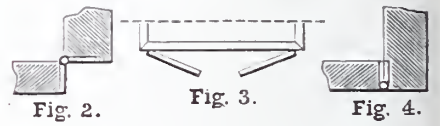


Fig. 2. Fig. 3. Fig. 4.

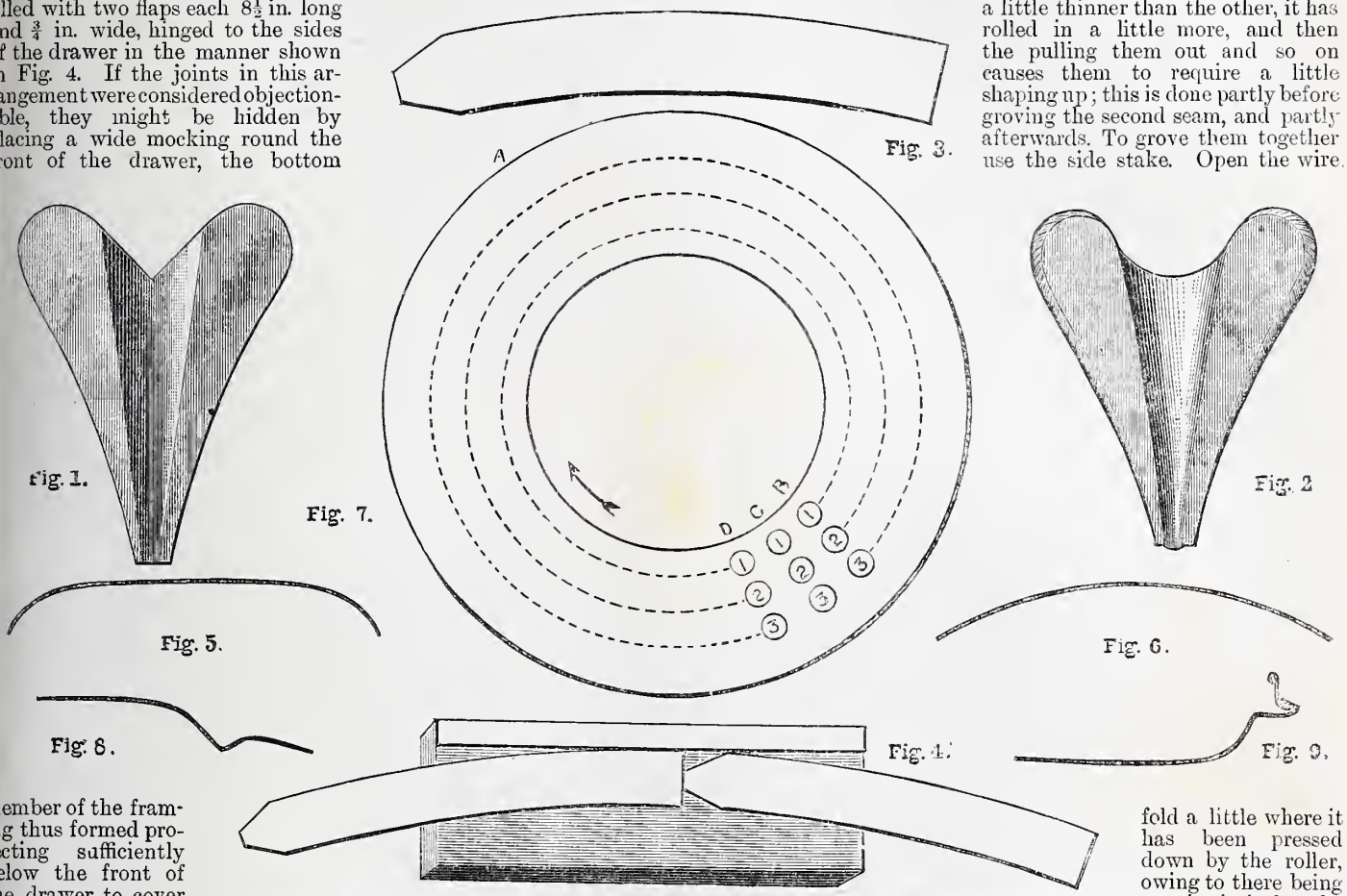
Fig. 1.—Drawer shown open and sustained on Supports. Fig. 2.—Mode of hingeing Supports to Drawer Sides. Fig. 3.—Diagram showing how Supports fold under Bottom of Drawer. Fig. 4.—Another Mode of hingeing Supports to Drawer Sides.

not fall perfectly perpendicular, but this fact will deserve no further consideration.

It will be best, for some purposes, to have the flaps to touch when folded, and a flush bolt connected to them to retain them in a flat condition, if desired, when the drawer is drawn forth. A strip of baize or other material should be glued to the edge of each flap where it comes in contact with the front of the carcase, when down, in order to prevent injury being done to the latter.

It is obvious from what I have already said that the supports will be desirable under these conditions:—Firstly, when it is necessary to pull the drawer out to its fullest extent; secondly, when it is needful to use both hands in turning over the contents of the drawer; and, thirdly, when the contents of the drawer are heavy—as in the case of tools, builders' ironmongery, etc., when the weight in front will tend to depress that part of the drawer, thus tilting up the hinder portion. In such cases, if the drawers are not yet in existence, and have yet to be made, it will be worth while to consider whether or not it will be better when making the drawers to construct them in such a way as will admit of the introduction of the supports as an integral part of the drawers from the very outset. In order to accomplish

his in a satisfactory manner, the sides of he drawers must be made deeper than the ont, and the side must be cut in such a anner that the excess in depth of the des of the drawer over or beyond the depth f the front will project and be flush with he surface of the front. Thus, supposing the ont of the drawer was 18 in. long and 5 in. eep, and the sides of the drawer $5\frac{3}{4}$ in. deep nd $\frac{1}{2}$ in. thick, it is manifest that when the rawer was placed in position on the runers and pushed in, there would be an open pace between the front of the drawer and he rail below it 17 in. long and $\frac{3}{4}$ in. wide, xtending the entire depth of the drawer. This opening would then have to be lled with two flaps each $8\frac{1}{2}$ in. long nd $\frac{3}{4}$ in. wide, hinged to the sides f the drawer in the manner shown n Fig. 4. If the joints in this arangement were considered objectionble, they might be hidden by lacing a wide mocking round the ront of the drawer, the bottom member of the framing thus formed projecting sufficiently below the front of the drawer to cover the joints.



Figs. 1, 2.—Saucepan Boss. Fig. 3.—Part of Rim, showing Notch. Fig. 4.—Tacking Board for Rims, showing Rim in Position for Tacking. Fig. 5.—Section of Hollowed Saucepan Rim. Fig. 6.—Ditto of Tea-Kettle Cover. Fig. 7.—Saucepan Cover, with Guide Marks for Blocking. Figs. 8, 9.—Sections of Turn-ups.

SHEET METAL WORK.

BY R. ALEXANDER.

THE SAUCEPAN AND KINDRED ARTICLES, GROVING, WIRING, EDGING, MAKING SMALL WORK AND COVER.

THE next thing to do will be to grove the body pieces together. This is best done on a bench plate, which is a flat piece of cast iron planed smooth and about $\frac{1}{2}$ in. or $\frac{5}{8}$ in. in thickness and from 12 in. to 15 in. square. Have the wire fold nearest to you, slip one fold over the other, and taking a grover of suitable size and placing it on the seam, form the grove by striking it with a mallet, moving it up and down the seam and increasing the weight of the blows a little until the seam is properly formed (see section of seam Fig. 37, given in page 469). It may then be hammered close with light blows of the square-faced hammer; some prefer to use a very tight grover, and not to hammer down afterwards, or only very little. The next operation is to "wire" the bodies; this can be done on the bench plate or on the crease iron. I mostly use the latter. Take a roll of wire and begin at the right-hand end of the body $\frac{1}{2}$ to $\frac{3}{4}$ in. from the end of the fold, hold the wire in position with the thumb while you knock the fold down so as to fix the wire, then proceed along the body; the curved shape of the wire assists in keeping it close to the tin, and as it is wired, the body will curve to the shape of the wire; but this will not matter as it has to be rolled. After wiring right along, cut off the wire, leaving as much extra at the left-hand end as was left out on the right-hand end. After wiring all the bodies, pass them through the jenny to smooth down the wiring, which up to now presents a puckered appearance. To do this, draw back the guide by means of the screw which is just under the spindle of the handle, till it allows the wired part of the body to enter. If the top screw is screwed down it must be eased up to allow the wire to enter, and then screwed down a little. Commence at the end nearest to you; turn the handle and raise the body a little; the wheels should have grip enough on the stuff to draw it through; if not, tighten both screws half a turn. The wire will then be nearly tucked in and smoothed. Rolling comes next. Set the top front roller so that it will just allow the seam to go between it and the bottom one without flattening it; lower the back roller so as to give sufficient curve to turn the body to a circle; place one between the rollers, with the wire in one of the grooves in the top roller, press down the body to give it a slight bend, then raise it a little and commence to turn the handle, you will soon see if the adjustment is correct; if the circle is too large, depress the back roller a little, and if it is turning in too much raise it a little. The body will require pulling a little to the right as it goes through, as there is always a tendency to draw to the left. Shaping and seaming will be the next job. The reader may naturally say, "I thought the rollers were to roll them into shape." Well, so they do to a certain extent, but in practice we find that there is always a certain amount to do afterwards; perhaps, owing to one-half of the body being a little thinner than the other, it has rolled in a little more, and then the pulling them out and so on causes them to require a little shaping up; this is done partly before groving the second seam, and partly afterwards. To grove them together use the side stake. Open the wire fold a little where it has been pressed down by the roller, owing to there being no wire in it, lap the piece of wire in that projects from the other side and tuck it in smoothly, turn it on the tool to have the wired part to you, and then grove the seam in just the same way as the first one.

The next process is edging the bodies. This may be done either with the stock shears, the jenny, or on the hatchet; the last-named is only used when there is nothing else to do it with. Edging with the jenny is very easy, and is the quickest method. See that the bottom of the body is quite true at the seams, as, in spite of every care, one part sometimes works up a little deeper than the other. This must be trimmed off or the edge will be unequal. The guide of the jenny is screwed back, so that it leaves about $\frac{1}{8}$ in, or less, of the bottom wheel, or rather of the back part of it, and the saucepan body inserted, and the top screw screwed down tight enough to prevent its slipping out as it turns round. Hold the body lightly by the wire and press from you and in towards the guide, but not

too hard or the size of the edge will increase. Do not make too wide an edge—$\frac{1}{8}$ in. is sufficient for this size article: more would necessitate a larger bottom and make a clumsy looking turn up.

Next mark out the bottoms—allow as much turn up as there is edge. The size of the bottom, when found and proved correct, should be marked on the body pattern, making two marks with the compass points as shown in Fig. 33, A, B, which will be found in page 469.

The mode of putting on a saucepan bottom has already been described in "Repairing" (see page 414), and need not be repeated here. So we can now turn to the small work, commencing with the handle, Fig. 28, which is in page 469. The first thing to do after cutting them out is to turn them on the bick iron. Some workmen do this with the point of the bick iron pointing away from them, but I myself have always used it with the point towards me, and I suppose that what one is accustomed to one regards as the best way. Place two together, and with the mallet bend one edge slightly on the tool, then grasping the handles and tools together with the right hand, bend the handles round the tool about two-thirds the required distance. Do this with as many as you have, then slip them apart, and then bend the other edge with the mallet as before, and then finish turning them round; lap about $\frac{1}{4}$ in. The flap must not be turned with the handle but left flat, and after the handle is turned bend it back, and with a small hammer tap it close to the handle; next, punch out some studs with a suitable size hollow punch and hollow them up with the stud boss and punch, or with a stud hammer on the lead piece; these studs must then be edged on a small tool, slipped on the handles, and soldered round. The flaps of the handles can then be knocked back and fitted to the shape of the saucepan. The boss (Fig 29), apron (Fig. 30), and cover handle (Fig. 32), all in page 469, will next be made. The bosses are held on the hatchet stake at the dotted lines and a blow or two struck. The flaps are then bent down, next turned over, placed on the tool in the centre of the boss, and pressed down each side: this roughly shapes them. They are finished on the extinguisher stake with the mallet, and the outside edges are very slightly bevelled as a sort of finish. Fig. 1 shows it as it comes from the hatchet; Fig. 2 when finished. The apron and cover handle are folded with a small fold, then the apron is false wired on the hatchet—that is, it is held on the hatchet by thumb and finger, the folded part just lapping over the edge of the tool; run lightly along with a mallet, and on turning it over it will present the appearance to the uninitiated of being wired. Cover handles are frequently treated in the same way. It does very well for common goods, but for good work they ought to be wired with 15 in. or 16 in. wire. The tip of the apron should be bent back slightly with a tap of the mallet, and the hollowed out part bevelled down a little on the hatchet with the round end of the mallet.

The small work is now ready to be fixed to the saucepan. First tack the handle to the saucepan by a drop of solder placed so as to tack the points of the handle and the flap to the body at the seam that was last groved; next place the boss in its place behind the handle and tack that also top and bottom. The next thing is to solder the apron on; place it in position so that the point is in the centre of the handle and the wide part just below the level of the top of the saucepan, and fasten it with a drop of solder on the point, then solder along the flap. The next job is to rivet the two ears of the boss, and the flap of the handle which is beneath them; rather small rivets should be used—14 oz. will do very well. The riveting in this case is done by placing a rivet on the tool and then placing the saucepan on it and giving a tap to find out where the rivet is, and then drawing it through with a set in a similar way to that mentioned in "Relining Coal-Scuttle," page 414. This guessing of rivets requires a little practice before proficiency is attained; but when you are used to it, it is easy enough. I have seen lads put the rivets in two dozen bottle tops (which means six dozen rivets) in less than twenty minutes, and bottle tops are more awkward to do than saucepans. I must mention here, or I may, perhaps, be called over the coals for omitting it, that there are tools called follies for punching the holes for rivets in such things, and where a great number of articles have to be made they are very useful. I have two or three pairs hanging up on the wall of my shop, but never use them.

After riveting, all that remains is to solder round the boss. Commence at the left-hand side with a good amount of solder, let it well run in at the part where the handle joins the saucepan, and from thence down one side of the boss and up the other, well soaking in that side as well, and then over the bridge of the boss.

We will next turn our attention to the cover, and the first thing to make towards this is the rim. The pieces for this come off the body as I have before mentioned, and I have also said that the rim is marked out by means of a home-made tool called a flue rim. To make this, take a pair of long-legged compasses, or if these are not available a piece of string or wire will do, and on a strip of tin 2 in. wide and 20 in. long, mark a line with a curve equal to × × in Fig. 33, which will be found in page 469. The compasses, if set at about 5 ft. or 5 ft. 6 in., will give the correct radius if string or wire is used; stick a bradawl in the floor at one end of the string, and with another awl at the other end holding it quite upright describe the curve; cut it along very carefully, and fold the straightedge in the machine and knock down with the mallet, and you have a short straightedge and flue rim combined, and if you take the trouble to set it out and stamp the figures on it, a rule also. The object of cutting the rims slightly tapering instead of straight, is so that a better fit may be made, and they are easier to put on and take off. This flue rim pattern will do for straight-sided round articles, and for articles larger at the bottom than at the top, but for articles that taper smaller at bottom, such as slop pails, a pattern with a smaller radius must be used, or the rim would press the sides of the article before it was fully down to the wire. To mark out the rims, take the pieces for that purpose, and placing the flue rim as near the top as possible mark a line; then take the compasses at the ends of the line, divide the remaining space into two, pressing the compasses to make a mark, then draw lines to these marks with the flue rim; if you were making a dozen rims off a sheet of tin you would proceed in the same manner—it is quicker and truer than cutting out one piece of rim and making the others from it. When all are cut out, notch one end as shown in Fig. 3. The two pieces can next be soldered together; this, and the soldering after being turned round, is called "tacking the rims." To do this, a board will be wanted; the side pieces of one of the 14 in. by 10 in. boxes, if fairly flat and smooth, will do very well. Take your square, and with an awl mark a deep, straight line across it, and then take the flue rim and mark a line with that touching the straight line in the centre; to tack the rim, place one over the other, as shown (Fig. 4), and solder together, holding them down at A with an awl or piece of wood till cool.

The next operation is folding the rims. Owing to their curvature they cannot be folded in a machine, but must be done on the hatchet. We usually do two at a time, but beginners would probably fail in attempting this, so try one first. They are folded on the inner curve; let them pass under the left arm and commence at the plain end, so that when folded the solder is outside—a full $\frac{1}{8}$ in. will be about the size; larger rims, larger folds. Do not fold right down at once over, but go over it twice, then knock down flat on the crease iron and turn round two at a time in the rollers; the ends of them will require a little rounding up before tacking to the size of the saucepan. The method of doing this is as follows:—Place a rim in a saucepan and make it a comfortable fit, draw it carefully out and tack (outside first), then replace it to see that it has not shifted, and then tack inside; some cut all superfluous length off, but I think it best to leave it if there is not a great deal too much, as it strengthens the rim. The next process is to edge the rims, which will be done in the jenny, the same as the bodies were done. The covers must then be marked and cut out; more margin must be allowed than for the bottoms because of the hollowing up, about $\frac{1}{4}$ in. larger all round than the outside of the rim will be sufficient in this case, and after they have been hollowed up and found to be the correct size, mark it on the body pattern the same as before mentioned for the bottom (see A C, Fig. 33, in page 469).

We now come to an operation requiring some skill and practice to make a good job of it, and that is the hollowing or blocking, as some call it, of the covers. This calls for some remarks respecting a tool, if I may call it such, that has not yet been mentioned—that is, the block. This is a very important piece of furniture, and I will try to describe it as well as I can. It should be about the height of the bench. If intended to work at it standing, as many do, it may be a couple of inches higher, and if sitting down to it, a little lower. The reader may naturally say, which is the best? To this I answer that it all depends on circumstances. If a lot of work is to be hollowed up—say the sides and tops and covers of one dozen tea-kettles—I should myself prefer to sit down at it; but if only used occasionally I should stand. There is this to be said about it: if the block is high and you sit down to it, there is no power in the blows, as the arm is cramped; and if standing to a short block, it is back-aching work. So now having explained the matter, you can, as the showman says, "Pay your money and take your choice." It should not be less than 15 in. in diameter at the top, and a little larger at the bottom, and should be of a tough and close-grained wood, such as beech, walnut, or apple. They can be got cheaply at any timber merchants. The top must be sawn off smooth and level, but need not be planed. To get it ready for use, take one of the hollowing hammers of a good size, and about 3 in. from the edge hammer a depression, or hole, if you like to call it such, in the block; let the heel of the hammer—that is, the part nearest you as you

d the handle—do most of the work, so t the hole is deepest near the edge, and pes away to nothing toward the centre of e block; it should be about ⅜ in. deep in e deepest part; it will get deeper by frent use. Another place may also be made ittle less in depth than the first, and with ese two we can commence. Covers are, in aking up new work, hollowed up four or c at a time, according to the thickness of e stuff. Covers of 1 C and 1 X may be llowed in lots of six, and for 1 XX or 1 XX stuff, four at a time will be enough. efore commencing to block up, describe a all circle—a little less than one-third of e diameter will be the size. This is for a ide for the workman. In blocking, many eople do not use it, but it is a good plan; evertheless, it is also the limit of the llowing, as saucepan covers are not llowed right to the centre, but a teaettle cover would be; see Figs. 5 and 6, hich give a section through the centre, owing the difference between the hollowg of a saucepan and a tea-kettle cover. ommence to hollow by grasping the lot of x or four, whichever it may be, at A, Fig. 7, umb inside, and hold the covers over the hallowest hole, and so that No. 1 on line 3 omes just over the middle of it; then give rm blows of the hammer as shown, 1, 2, 3, , 2, 3, 1, 2, 3, on lines B, C, D, in the direcion shown by the arrow, and so on all ound; the covers will have come up coniderably, but will present a very puckered ppearance, which the beginner will probably ook at with some misgivings as to his ever eing able to get it smooth, but patience nd perseverance will soon accomplish this. Next go round in rings of blows as shown y the dotted rings in order as they are narked, 1, 2, 3; this will considerably smooth he covers, but they will not be hollow enough yet, so must be taken to the deeper hole and the same process gone through. This will most likely bring them up sufficiently, which may be ascertained by placing a rim upon them; they should show about the same size as the rim; if the rim drops within the inner cover, they are not hollowed enough (unless they have been cut too large); and if the rim hangs over the cover, you will find it a job to get the rims in, but hollow up to a good height if possible, as a flat-looking saucepan-cover is an eyesore to any good workman. Having got them the right degree of hollowness, the next thing is to smooth them off; this is done with a slightly flatter faced hammer, especially for the centre part of the cover; many workmen, in fact most, shift the covers before commencing to smooth—that is, shake them apart and turn each round a little way so that the puckers are not opposite one another. Commence to smooth on a flat place on the block, working from the inner circle outwards and finishing at the edges with the hollowing hammer.

I trust I have made this process fairly plain to my readers; it is a very difficult thing to explain on paper—in fact, I have never seen it attempted before. The next thing is to throw back a flange in the jenny, about ⅜ will be the size for the covers under consideration.

Place the cover between the wheels and screw down, not too tightly, and work round carefully once, holding it the same as for jennying up a bottom; run it round several times, gradually raising it till it assumes the shape shown by the section line (Fig. 8). Let the first one done be the inner cover—that is, the one nearest the hammer in blocking; offer the rim to it, and if it is the right size and shows sufficient to allow for the turn up, the others can also be jennied the same way; the outside one will want a little trimmed off, because, if the inner one was the right size, each one nearer the outside one is a slight degree larger; but in fitting the rims in, there is generally a little variation which makes up for it.

To turn up the second edge which covers the edge of the rim, proceed exactly as in turning up a bottom (see section line Fig. 9, which also shows the rim fitted in); this is a very easy job, and needs no explaining. There may be one or two rims which appear too large to get in; to help them, rap the turned-up edge of the cover back a little as described in the instructions for putting on bottoms, and if this does not prove sufficient, the rims must be pared a little. Pane down on the beck iron and the cover is finished, with the exception of putting on the handle. The handle, Fig. 32, for which see page 469, is folded and a small wire put in, or false wired like the apron; turn into a semicircle the flaps thrown off each side and soldered to the cover by tacking each side *under* the handle. The correct position for the handle is found by describing a circle on each cover of a diameter equal to the width of the cover handle outside the flaps. Put a small rivet through each flap, using one of the round heads or a block hammer fixed in the vice to rivet on, and the example which we have been studying is completed.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

Graining Italian Walnut Wood.

Most of us are familiar with the nature and beautiful markings of the wood of the walnut-tree; and although he would be a *rara avis* indeed who did not know its fruit or kernel, there are undoubtedly many persons who could not distinguish the growing walnut-tree half so readily as the invaluable oak or the less useful chestnut. Judging from the name by which it is popularly called in this country, one would suppose that the *nut* was, if not the only one, albeit the principal feature of the tree's commercial value. That is not the case in this age, we know full well, since the enormous quantity of walnut wood that is used annually in the manufacture of pianos alone must be an item of great value.

To all intents and purposes we may consider the walnut-tree a native of this country; for although we cannot be certain, as is highly probable, that it came here "with the Roman invasion," the knowledge that it has grown in England for over three hundred years is surely sufficient for its classification as such. Although its original "native land" is generally believed to have been Persia and the regions of the Himalayas, the walnut-tree is now largely cultivated throughout south and temperate Europe, from whence, as well as from still more eastern parts of the globe, enormous quantities of walnuts are exported. More southern and sunshiny latitudes than those of Great Britain are necessary, however, for the tree to attain to full growth and a ripe age; hence it seems to come naturally about that the wood of the *Italian* walnut—from the country where the beauties of nature and art alike seem always pre-eminent—should be the most richly marked and highly prized.

Italian Walnut Wood is chiefly noticeable from its masses of beautifully knotted and curled grain, rather darker in general tone than the ordinary "piano" variety, but equally rich and clear when properly prepared and polished. In compiling this lesson upon graining such a very useful and ornamental wood, the heading of my paper was used, not with a view of devoting the space entirely to imitating none but the very richest variety, but chiefly to distinguish in a literal sense as well as in the learner's mind the ordinary curly, knotted, and mottled walnut of commerce from its less pretentious but equally serviceable relation, the black walnut, or, as it is generally termed, *American Walnut.*

Grounds for Walnut Graining, although varying slightly in *depth* according to the intended finish, should always be of one class of colouring: viz., a soft drabby brown. Words are a poor means of interpreting colour, but if the prepared white lead paint is stained with yellow ochre and Venetian red, used in equal proportions, until we get the desired strength, and the resultant mixture afterwards sobered down with burnt umber until it becomes a "leather" colour, then the worker will obtain the tone alluded to. If we wish for a lighter class of walnut graining, one in which the grain and figure will be more distinct, the same tone should be used, only, of course, the white lead being in greater proportion. Very often one finds walnut being grained upon paint in which scarcely a trace of umber can be seen; the consequence is that either the graining colour is used weak and thin, so that the graining, viewed on its completion, looks "foxy"—*i.e.*, gairish—in colour and feeble in form; or else it is the other extreme, in which the figure can be traced from the opposite side of the road. The best demonstration any student can have is to grain a panel upon both the bright and the drabby grounds, varnish them, and not only compare them with a piece of the real polished wood for natural colour, but further, carefully weigh the relative merits of each for *repose* and *richness.*

Graining Walnut Wood is—to any worker who has mastered the use of his water-graining brushes—a most pleasant and entertaining work. The usual method is the distemper, or water-colour process, and the tools required are similar to those previously advised for Pollard Oak. These will be found illustrated in page 40 of the present volume, and need not be here recapitulated. The pigments required, to more or less extent, for walnut imitation are the invaluable vandyke brown, burnt terra di sienna, lamp or ivory black—preferably the latter—and a little of Prussian or indigo blue. These pigments are already familiar to those readers who have followed this series through the preceding papers. They are material colours of strong natural staining powers, and an ounce of each will suffice for a large surface of graining. For home practice and all ordinary purposes, the blue pigments can readily be dispensed with; they are rather costly, and may be difficult to obtain ready ground in water. The only one of the list that can be rubbed up upon the palette is black; all the others are useless, so far as good work is concerned, unless very finely ground and of the best quality. Walnut being an imitation into which black, a bad "binder," enters largely, it is advisable to use beer and water in about equal parts for our fluid. Before commencing the work, the grounding paint should be lightly glass-papered with "No. 1" or "1½," and well dusted down. If the paint is very hard, and has been standing

any length of time, we must also prevent our water-colour from cessing—running off—by rubbing the ground with a little dry whiting on rag, or by giving it a preliminary rub over with a sponge of beer-wash. Having now at hand a little fluid stained with vandyke and sienna—the darker our imitation is the more vandyke in proportion—we take a large worn-in tool or the large mottler, and rub over our surface, not too sparingly, but avoiding sufficient to cause it to run. Before, however, we take further action, there must be a mental decision as to the disposition of the figure. For instance, given a panel say 24 in. by 15 in., we might occupy the greater portion of it with one large cluster of knots and encircling grain, and surrounded by plainly grained parts, as is characteristic of the best Italian. Again, we may get another good effect by working in two or three separated and smaller clusters of knots in one flow of grain—an appearance which is more common. Mottling this stained wash is the first action; and if we work on the former plan we shall mottle our surface small and delicately across the panel, but *fully* under the greater part of knot-mass and more sparingly and broader under the surrounding plain grain. We also, whilst mottling straight across the panel, follow the general curve of the outer grain (Fig. 1).

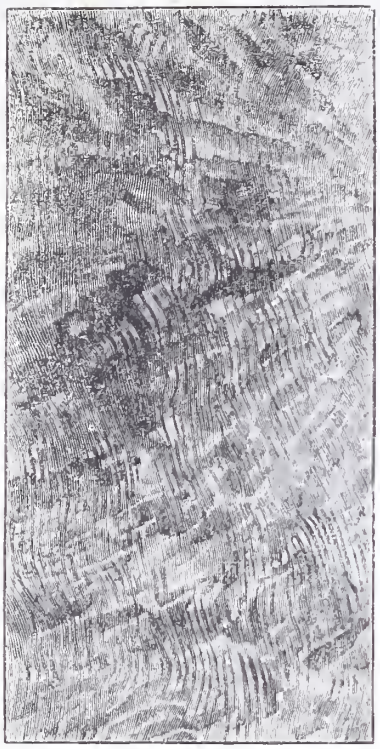


Fig. 1.—Graining Italian Walnut: first stage.

Fig. 2.—Graining Italian Walnut: Mottle and Undergrain.

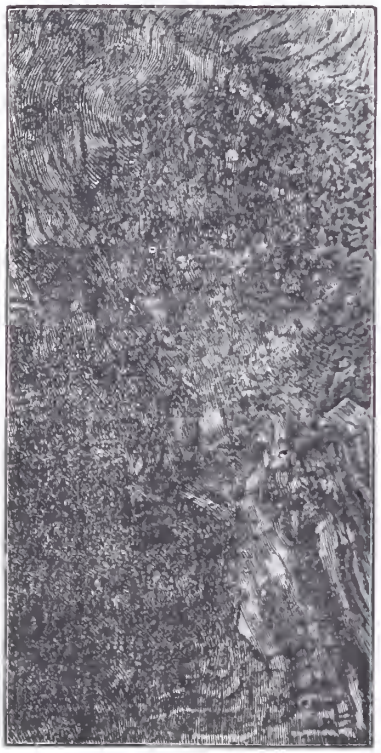


Fig. 3.—Graining Italian Walnut: final stage.

Fig. 4.—Graining Italian Walnut. Fig. 2 with Top Grain but unglazed.

In imitating the second variety, we may mottle on more regular lines straight over the width of the surface, accommodating it slightly to the intended plain and knotted parts, but following no decided curve (Fig. 3). Whilst still wet, we soften with the badger and let it dry. The next step is to imitate the delicate pores or under grain, and this is obtained by using the thin "oak" overgrainer. By separating the hog-hair of the brush after it is charged with colour we get distinct divisions, and in this manner we go over the panel, always working in wavy, "tremulous" lines and curves across the previous mottling. In the same manner as advised for pollard oak we must carefully soften this work outwards or upwards whilst wet, and thus obtain a light inner, and dark outer, edge or grain. This must be kept quiet and subservient to the after-process: and if we desire it, upon the ultimate plainer parts we may subdue the under grain and stipple it instead, as with mahogany.

The next process is to imitate the curly and prominent grain of the wood, and which, upon inspection of a real sample, will show a considerable variety of colour *tone* as well as *depth*. Some leading veins will appear quite black, others a rich warm brown; whilst the bulk of them give various shades of deep brown of the vandyke tone. Now, in order that these veins may sink into and become, apparently, part of the wood, we adopt a double method of softening them. Taking the large mottler, we well rinse the colour out of it, and then draw it quickly and lightly down the panel until the latter is nicely wetted all over. The thin hog-hair "oak" overgrainer is then dipped into a stronger beer-wash, and worked into our black and vandyke pigments—which latter should be rubbed up separately, and ready to hand in a liquid form. The make of the overgrainer, which naturally separates itself into tufts of ever-varying size, enables us, therefore, to work in the prominent grain with despatch and variety of result; and the effect therewith obtained is infinitely superior to anything we might attempt with the pencil, and by making one vein at a time. As this part is the most important in the imitation, the mind must work as rapidly as the hand. The main lines of the panel we have already shaped out by the mottling, etc.; but whilst we duly follow that lead and work the veins across the mottle, we have the natural play of grain, the sharp and subtle curves, the widening out and closing up of the veins, caused by pressure upon the tufts, and the variety of colour—all these points to see to in the manipulation. For the richest Italian walnut (Fig. 4), although by expert twisting of the brush we may make the most natural-looking masses of knots and curly grain, we may with more advantage leave the inner parts for filling in with a pencil and black pigment. The advantage of working the main grain upon the wetted surface is that the veins partly soften themselves, and we also get more time for the process. This softening with the badger must be effected as we go along, and by gently brushing across the grain we get a natural light and dark edge. When the veins lie very close together we are liable to blur one into the other; this is an effect we must avoid, even at the cost of a few hard veins. From this fact it will be gathered that the grain must not be worked too close nor too regularly. If, after making the best use of the overgrainer, we desire to further "work up" the panel, we proceed to wet it all over as before, then put in the inner knots, touches of black or strong veining, with the sable pencil, and finally soften as before. Should we attempt to do this without the wetting, there is a danger of spoiling the panel; inasmuch as we cannot judge how the colours and grain look when varnished, which the water enables us to see.

Glazing Walnut Graining is the last process, wherewith we obtain the final colour, and subdue and heighten different portions of our work. It is in this glazing treatment

hat the advantage of sober grounding olour is most apparent, as we are enabled o use rich and warm pigments without any innatural crudeness. Before this glaze, or ransparent wash, can be applied, we must ecure the previous work with either japanners' gold size or, far more preferably, with he same copal varnish as we finish with. When the binder is dry we spread the wash, naking some parts quite warm with the sienna, and other parts, especially the knotted work, stronger and deeper in colour with vandyke and black. If extreme richness is wanted, the introduction of a little of the transparent "cool" blue, judiciously placed, will, by force of colour-contrast, help to this end. The tone and depth of the glaze being right, and the same spread evenly, we take the damp wash-leather, and roll it over those parts where a soft mottling effect is wanted, and then, with the thumb and leather, wipe out the brighter lights across the knotted work, and carefully soften the whole. As our coat of varnish has "brought out" (Fig. 2) all the work previously put in, we are able to judge if it still requires any finishing touches, and if so, these can be done whilst the glazing is wet. One good finishing coat of copal varnish can now be given, and, if possible, let it have an extra coat a few days afterwards. If aiming at a smooth surface, like polish, it is necessary to rub the first coat slightly down with thick felt and finely pulverised pumice-stone, used with water, and finally, well rinsed down. A serviceable, but, of course, less effective, cheap plan is to rub with fine emery-cloth, and then wash down. In every case have a care that the graining is not rubbed into little white specks, arising from want of fineness in the paint, etc., beneath; far better to sacrifice the smoothness.

The Arrangement of Walnut Graining upon Woodwork is a matter worth a little attention here. In the first place, the worker must remember the cost of time, and therefore aim to get the most effect and natural breadth according to these commercial circumstances. Let the panels of doors, and where most seen, be the best and richest portions; keep the mouldings dark but quiet in grain; if acceptable, black them as *ebony* imitation; and in every case let the surrounding stiles and rails be a foil and relief by their plainness to the richness of the panels. Let rail and stile be equally distinct in *grain* as with oak, but rather less in *depth*, since there is not in nature the same play and action of light as with the former. Always reserve the pencil for only the best panels, such as will probably have a close inspection; but even then do not sacrifice breadth to detail. These directions, if intelligently followed and persevered with, in conjunction with a good piece of mounted veneer, will soon lead to successful imitations of walnut wood.

CLOCK CLEANING AND REPAIRING.

BY A PRACTICAL HAND.

Later Grandfather's Clock.—Next is the more modern grandfather's clock, with minute and seconds hands, a better style of striking part, and going for eight days without winding. The repairs and putting together are the same as directed in the last paper (see page 581), except a centre wheel, which passes through to front to turn minute hand. This wheel must be replaced first, then the large wheels, etc. Now the difficulty is the striking part (again see sketch, Fig. 1); A is the counting lever; B is the small arm which turns it; C is the arm which drops on to D when

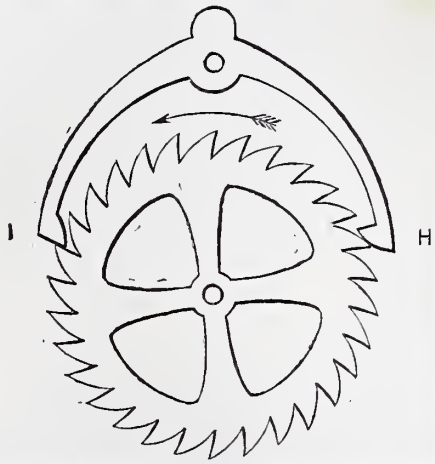


Fig. 2.—Escapement of Modern Grandfather's Clock.

giving warning, and, according to the indent of D upon which it drops, so it strikes the number. This plan will not let the clock strike a wrong number; the

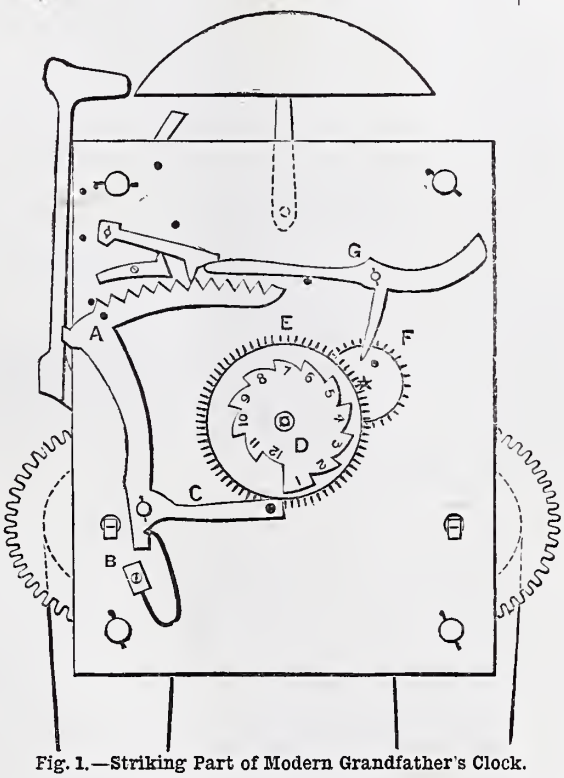


Fig. 1.—Striking Part of Modern Grandfather's Clock.

deepest indent is twelve o'clock, and so on. You should replace this wheel so that it drops about the centre of each section; E, of course, turns round in twelve hours. In replacing the pin, the wheel must, as in the last paper, have part of a revolution for warning. The hammer at rest, and the going wheel F at right-hand side in this make of clock, replace so that the wheel carrying the minute hand would point at sixty if the dial were on; and so place the same-sized wheel geared into it that its pin drops the lever G for striking then, or your clock may strike, like one I saw in a farmer's kitchen, at ten minutes from the hour. They had got used to it, he said; it did not matter. Now replace dial; and if well cleaned and carefully oiled, it will go from twelve to eighteen months, and require nothing. Common Dutch clocks are deemed out of date, where we will leave them. The American replaced them, and they are fast disappearing, though some may desire to put one right.

Turn dial pins, take off hands and weights, draw out two side pins at the circular holes, and unscrew small piece of wood at the top; draw cords over the pulleys at the outside case, and notice how all the parts are arranged—they are not so easy as an English clock. Now draw out the five pins, and all is asunder; examine, as in all clocks, pivots, teeth, holes, etc., and repair same way; clean in paraffin or kerosene oil, and replace the centre wheel and two large ones; so on with each until the whole are in. Now comes the difficult part—the levers. Place in the lifting lever, which is shown in sketch given in Fig. 3. A is the counting lever at rest in count wheel, the lifting and stop lever B (Fig. 4) goes in the two highest holes above escapement; this is acted upon at C by D fixed to E, the hour hand. Slip on front plate, and try if the warning is correct, also striking of the hammer; the rest cannot go wrong in this make of clock if all is correct. Oil and replace into case, then draw the cords through opening up the side of pulley, towards middle, using the hook of pendulum rod; be careful of the tip, you do not bend or break it; screw up the piece of wood, affix the two pins, and replace weights at the side you left them in the case. Now attach rod through the crutch, and replace the ball; stand it quite level, and listen to the beat. If unequal, raise the whole clock on either side and bend the wire part of the crutch towards the side you lifted when it beat right, a little at a time, until correct. Should the clock pendulum have a poor swing, you can alter that by taking off the pallet part, and turn a *very* little the part upon which the pallet works—you will see it is riveted to the frame for that purpose. Now try until you have a good swing; if you turn it too near the escape wheel, it may not escape at all; so, gradually, try it back again until it escapes with a fair swing. All will now be right. If the hammer is too close by accident to the gong, it will sound badly; bend hammer wire from it when at rest; see that gong is well screwed up for a good sound.

American Eight-Day Clocks.—American Gothic cases are similar, except springs instead of weights; in all else they are the same. Some do not strike, so are easily cleaned. The American eight-day circular clocks are now most used; those manufactured by Seth Thomas I always found to be best finished; springs of superior quality, and the wheels stronger and more durable—no matter whether a small mantel clock or a good hall clock. To clean the circular eight-day, proceed as before stated: the only difference is the extra wheels and longer springs to go eight days; all else is the same—the drop of levers into the spaces of count wheel and stop lever. So replace wheels that stop lever has hold of the indent edge when count lever has fallen into the centre of its section. This you do by moving wheel carrying the counting part on

from pinion of next wheel, so that each works correct, the beat and tone of gong as before stated.

English Eight-Day Clock.—The English eight-day kitchen, or office clock, a sound, well-made, circular clock, costing £3 to £4, does not strike, but its ticking even tells you it is well made and of good quality, though unpretending in its appearance. This clock, after you have unscrewed the three dial screws and removed the hands, has, you will find, a fusee wheel upon which the gut cord is fixed to the large spring barrel. This clock, before you take it to pieces, must be run down, or you will have a mishap; do this by unscrewing the two screws holding the pallets and crutch at back; then let it run until all is unwound from the fusee—do not let it run too quick; take off front plate, but before doing so, try what tension is on the cord. Now, if there be too much tension on the cord, and you set it too high, the cord would break at last turn, and startle you much more than is pleasant. Notice a small flat spring at back part of minute hand. Clean and repair all as modern eight-day grandfather's, being nearly similar to its going part; then replace drum and fusee centre wheel first, and the other wheel and escape wheel; pallet you can replace after front plate is on. Now set up tension as before, by turning ratchet on main spring; and when the same pressure is on, replace pallets by putting crutch part through round hole of back plate from inside, and screw the part to hold it in its place. It will, after you wind up, commence to tick quickly; if all is right, replace it in the case, and, perhaps, it would be better for you to try it a few hours before putting dial on; if going all right, then replace dial and hands. It will not require setting into beat, being too well made, and crutch not easily injured. When on the wall move it to its proper beat, and make a pencil mark, so that, in winding at any time, the most ignorant servant or office youth can put it right.

Vienna Regulator.—Next in order is the Vienna regulator for the hall. These clocks, when they have weights, are fairly well made, though many imitation ones are sold at stores, auctions, etc; they go with springs, and are poor affairs, having a worse movement than common American ones. To clean a proper eight-day one, unscrew thumbscrew underneath, and slide the works out, having, of course, previously taken off the weights. You will find the parts are similar to the modern eight-day grandfather's clock, but on a smaller scale, so that the description of cleaning and repairing is the same; if only one weight and no striking part, it is easily cleaned. The pendant action is different; only the crutch is arranged with a single pin, which works into brass hole in pendulum rod, which is made of deal, and the best thing for a pendulum. The atmosphere changes its length so little that that is the secret of its correct-going qualities. To put this clock into good beat, after you have screwed case to wall, with the two thumbscrews near the bottom, you will find a thumbscrew on the crutch; turn this once or twice, and listen if you have made it better or worse; turn the way it improves, until a fairly equal beat is obtained; and this class of clock you may depend on. The imitation one will do for a time, going fairly well, but no extra time keeping, as the spring towards the end of the week is weaker, and the clock alters so that it gives the real ones a bad name, as ordinary folks do not know the difference.

Marble Clocks.—The eight-day and twenty-one-day marble clocks present finer work, more like watch cleaning and repairing. Turn the clock round; at back you will find, on opening the glass, that two screws with long strips of brass hold works into case; unscrew these, and then proceed by taking off the hands, and then the dial. Now examine the striking part well; notice the lifting levers, and see the arrangement for striking the half hours; how simple, but how well, it sounds in an advertisement, "the hours and half-hours!" You will see it simply has an indent twice as wide as the ordinary, so that the lifting piece drops after it has struck one, whatever hour was struck previous. Take off the dial wheels, and then place your finger on the second going wheel, while you unscrew the pallets; then let it down. The letting down of striking is worse for an amateur, as I fear him letting down ratchet or spring, and to open works, however carefully, is too much. Best place a small piece of paper under the counting lever, and leave it to strike down (safe, but slow). When at the bottom, unpin the four or five pins, and take off plate, with the other plate on your bench. Now make yourself acquainted with the parts, as they are fuller to view, and take each one out, keeping the going from the striking wheels to spare you annoyance. Clean them well as if a watch, polish all with brush, and see if holes are in good order, pivots, teeth, etc.; if one of those with visible escapement is on the dial outside, be careful in handling pallets, as you can easily put it out of beat. Place centre wheel in (after oiling, half a drop to each hole, say), and then each barrel, the going wheels, and the striking part; the levers you cannot get wrong, as they only fit in their own holes; besides, by this, if you have read previous papers, you will know what each part does; place them so that the hammer is at rest when stop lever has the wheel against it, and the pin wheel has ¾ of a turn to make.

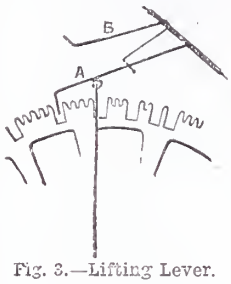


Fig. 3.—Lifting Lever.

When all is in except pallets, replace the top plate, which you have oiled, and before pinning up, turn going barrel a time or two: it ought to run particularly sweet, so that the escape wheel cannot be seen only as a solid piece, looking edgeways, unless pinion has got injured; if so, carefully straighten, as described in previous papers. Now turn up striking part a little, and let the going move slowly to see whether it lifts and warns properly; then if it strikes correct numbers, try it all round: this will save trouble after. Notice if hammer is at rest; if not, study a few minutes how many teeth the wheel and pinion above it ought to be changed. So as to do this, you will soon get into the way: lift pinion out, and turn on a tooth—two or three, perhaps; then refix, and all will be right. Now pin up and replace pallets, unless visible ones; fix on face wheels—one screws on, you will find, and in the trade we have a wooden support to place the movement in; to try it, you can easily fit one up, no matter how rude, almost like an old-fashioned candlestick, with a notch cut to hold outer plate. After trying a day or two, place in marble case, with screws; and now, before screwing up, set case level and turn front of movement, twelve o'clock exactly on top: listen to tick—if equal, all right; if not, just turn a little either way; if twelve o'clock is too much out of place, bend the crutch a little at back, and all is right time for a week or so.

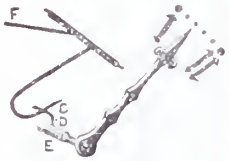


Fig. 4.—Lifting and Stop Lever.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

107.—New Fluid Waterproof Glue.

The Waterproof Glue Company, whose head office, readers of Work are requested to note, is 62, Dale Street, Liverpool, where all communications and orders should be addressed, have recently brought under my notice, for the second time, samples of their new Fluid Waterproof Glue, which is now put up for sale in a novel and most convenient form. The glue has now been before the public for some time, and, to judge from the testimonials that have been received from various sources, has been found to be a thoroughly reliable article. The tins in which it is now sent out—at 6d. or 1s. per tin, according to size, at most ironmongers', or 8d. and 1s. 3d., if sent by post—are cone-shaped, and have a spring bottom like a small oil can. The hole in the top of the cone, which forms a means of exit for the glue, is stopped with a pin, whose head is soldered to the tin with a soft composition, which can be easily removed with a knife, to allow of the withdrawal of the pin, which must be replaced as soon as sufficient glue has been pressed out of the tin. The great recommendation to this mode of putting up glue is the facility with which the operation of gluing can be effected without heating or any trouble whatever, no brush being necessary, and the shape of the vessel admitting of the exact quantity required being put with precision on the place at which it is wanted. After the glue is set, it will bear prolonged exposure to damp, or actual immersion in water, for a lengthened period of time without impairing in the slightest degree the adhesive power and qualities of the glue. All workmen who, in their various avocations, are obliged to make use of glue, either at home or in the workshop, should give this glue a trial. It is perfectly reliable in its effects, cleanly to use, and truly economical, because it can be used without the slightest waste, or any of the danger that has been known to arise from the overboiling of glue in the ordinary glue-pot.

108.—Britannia Company's Buyers' Guide to Technical Books.

The Britannia Company, Colchester, and 100, Houndsditch, London, E.C., have just issued a pamphlet, under the title of "The Britannia Company's Buyers' Guide to Technical Books in the Mechanical Arts," containing the best British and American books, fully described, showing price, size, and contents of each. The books mentioned therein are classified under various heads, namely, Appliances and Processes; Applied Mechanics; Building, etc.; Carpentry, Joinery, etc.; Coach Building; Drawing, and Instruments Used; Electricity; Electro-metallurgy; Fretwork and Carving; Gas Engineering; Machinery; Materials; Metallurgy; Painting and Decorating; Pattern-making,

ulding, and Founding; Plumbing; Refer-ce Books; Sheet-metal Working; Steam, ifers and Engines; Turning, Screw-cutting, c.; Watches, Clocks, and Jewellery. An dex to authors' names, and another to titles of oks, are added at the end of the pamphlet, the ice of which is 6d.

109.—OUSELEY'S FIREPROOF PAINT.

I have been asked to supplement my remarks this fireproof paint by stating that arrange-ents have been made by Mr. Ouseley for its le manufacture and sale by the "Anti-Flamma" ire-proofing Company, 52, Queen Victoria Street, ondon, E.C. This company have been recently warded a silver medal at the Edinburgh Exhi-ition for this paint.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

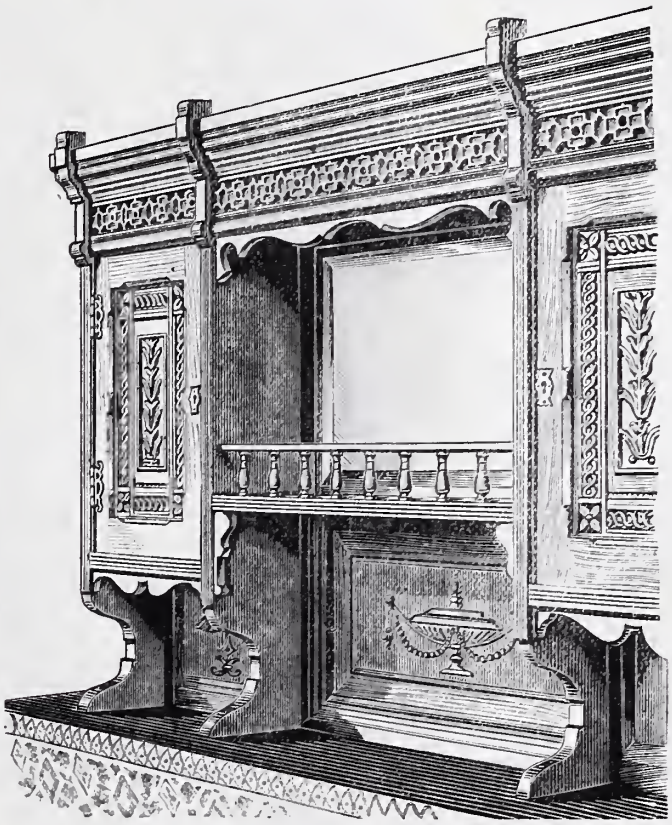
** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

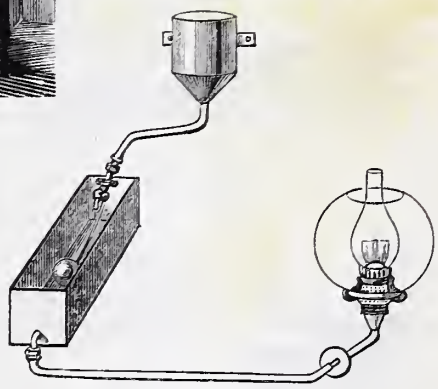
Champion Incubator.—B. A. B. (*Hampstead*) writes, in reference to this Incubator, which was noticed in "Our Guide to Good Things," page 153:—"The prices of the 'Champion Incubator' are: No. 1, the smallest, fitted with paraffin lamp, drawer thermometer, tank thermometer, funnel, one extra lamp chimney, one yard of wick, and egg testers for three sizes of eggs, a copy of Hearson's handbook (full of instructive details), pieces of canvas for the water tray and egg drawer; inside measure of egg drawer, 7 in. by 7 in., will hold thirteen hen or eighteen pheasant eggs; complete with copper tank, £2 15s.; with galvanised iron tank, £2 10s. No. 2, with above requisites, size of egg drawer, 10 in. by 10 in., will hold twenty-five hen or forty-two pheasant eggs; complete with copper tank, £4 7s. 6d.; with galvanised iron tank, £4."

Overmantel.—J. M. S. (*Addiscombe*) writes:—"Enclosed herewith I send you a photo of an overmantel I have made from the drawings and description given in Vol. I. It is taken in a rather peculiar light, and hardly does justice to the work. You will observe that in many details I have departed from your drawings: for instance, the fronts of each of the uprights, the end pieces, and the edge of the end brackets are beaded, the beading being done with a router made by myself from the instructions given in one of the numbers of Vol. I.; the frieze, instead of being of plain wood with small fillets glued on underneath the moulding, is covered with lincrusta walton; the panels of the doors, and also those beneath the cupboards, and the centre shelf are covered with the same material. My way of fitting the lower panels is, I think, an improvement on anything I have seen recommended in WORK. I took a piece of ¾-in. deal, 2 in. wide, and of a length corresponding to the length of the overmantel, measuring from the inside of one end upright to the inside of the other. I then cut a piece ¾ in. deep and 2 in. wide out of the bottom of each of the two middle uprights, and into the space thus left the piece of deal was fitted, being fastened with two screws through the deal up into each of the middle uprights, and a long screw being put through each of the end uprights into the ends of the deal. The edge of the deal facing to the front was beaded to correspond to the other beading on the front of the overmantel. On the solid foundation thus laid a small moulding was put round to hold the panels in. Mirrors could be fitted into the spaces thus formed equally well, and the whole arrangement is safer, stronger, and more sightly than the tin or iron clips I think I saw recommended in the columns of 'Shop.' I may mention that the small moulding is not brought up flush with the front edge of the piece of deal, but a space of about ¼ in. is left, thus giving the whole the appearance of one large ornamental moulding. The advantages of this fitting are that it forms a stiff stay from one end of the bottom of the construction to the other, thus strengthening it at its weakest points; it forms a strong and reliable support for any kind of panels that may be inserted, and it materially adds to the appearance of the whole overmantel, and gives a finish to the bottom that was wanting in your drawings. You will notice that I have put a small balustrading over the middle shelf, which is supported by ornamental bearers at each end, which are very badly rendered in the photo. Instead of putting a plain strip of wood along the bottom of the frieze, I made a small beaded moulding for it, which, I think, gives a more finished appearance. The door frames are morticed together in the orthodox manner, and not *halved*. The woodwork is painted over with Aspinall's sea-green enamel, and the lincrusta is stained a ruddy brown and varnished, the appearance of the whole thing being very good. I had some trouble about the lincrusta panels for the doors, as Messrs. Walton had no panels suitable of the proper size, so I had to buy some pieces of lincrusta, and make up the panels for myself; this is not an easy matter when you have to construct a set design to fill a certain space, but I think I have succeeded pretty well. Each of the panels in the photo is made up of eight or nine pieces fitted together. The space over the middle shelf is filled with a bevelled plate-glass mirror, and the cupboards have backs to them. I am very much obliged to Mr. Adamson for his clear and explicit instructions and drawings, and I should be very glad to have his criticisms on my work. This is the first job of such a magnitude I have done, and I do not think I should have attempted it, if it had not been for his articles on artistic furniture. I have tried to do everything as well as possible, and I have not wasted a single piece of wood over the job by bad work."—[You ask me to criticise your work as described in your letter, and shown in photograph, but I really don't know what to say about it in a critical spirit, if by this is meant suggestions on points which might have been done better. Without actually seeing the overmantel, as I hope I may have an opportunity of doing at the forthcoming WORK Exhibition, I cannot say that there are, from your letter, any objectionable points in it. There cannot be the slightest doubt about your having got up a very much handsomer piece of furniture than the very plain one which was the subject of the description from which I am glad to hear you derived so much assistance. You have, in fact, done what it could be wished more of our readers would do—viz., engrafted your own ideas on the practical instruction given. If everyone would take the pains you have, there is no reason why the design of any piece of furniture which has been described in WORK should not be so altered by the maker as to be virtually a new one. It must be patent to all that this is far more satisfactory and better calculated to develop skill and artistic taste than mere slavish copying. Of course it is easy to read between the lines that you had acquired a fair amount of skill before you tackled the overmantel, even though it is, as you say, the largest job you have attempted. Your construction of the door frames is, of course, much better than if they had been halved, a method only mentioned as less troublesome for novices. Your method of fitting the lower panels is right enough, and, as you suggest, glass might have been used. In conclusion I congratulate you on your success. I understand the photograph is to be engraved in the hope that it may encourage others to send in such friendly tokens of their appreciation of WORK.—D. A.]



Overmantel.

A Self-Acting Paraffin Lamp.—TINMAN writes:—"Enclosed is a sketch of a self-acting paraffin lamp of my own make, which I have had in use about four months, and has never failed to act. It saves the trouble of filling each night, which has to be done in the ordinary lamps, and safe because the bulk of the oil can be put any distance away from the flame; and again, most paraffin lamp accidents are caused by people carrying lamps and letting them fall, or else with them being knocked off tables, etc. Now, this lamp is fixed against a wall on a gas bracket (one with as few joints as possible), and therefore cannot be carried about. The principle of it is just the same as a closet cistern, and can be made to burn a week, a fortnight, or a month or two without filling again with oil. I will now explain how it is made: first, you must have two tanks, one an oblong and the other either round or square; if a round one is used, it is best to put a lantern flue cone on for a bottom so that the oil will flow to one place—of course by this tank you have your week or fortnight's supply, and must make it accordingly. Now the next thing is to get a ball-cock; you will have to cut the rod of it so that it will go in the oblong tank, then solder a piece of strong tin on one end to solder the ball-cock on to, then connect the other tank to it by means of a piece of ½-in. compo pipe, and be sure to keep it higher than the top of the other tank; then take the rubber washer out of the ball-cock and put a leather one in, because the oil swells the rubber so much that it won't act; now fill the round tank, and see what depth of oil it takes in the oblong tank to close the ball-cock. Suppose the said tank is on a shelf 5 ft. above the ground, and it takes 2 in. depth to close the ball-cock, you would want the collar of the burner 5 ft. 2½ in. from the ground; next punch a ⅜-in. hole in the tank near the bottom, and solder a ⅜-in. elbow union over the hole; then connect a piece of ⅜-in. compo. pipe to it and to the bracket, remembering to use a drop screw in connecting with the bracket. The next thing wanted will be a brass cup to fit the collar of the burner and the top of the bracket—for my lamp I have one of Postlethwaite's burners, 50 candle-power, which I consider the best burner in the market. In screwing up all connections use a gascon and red lead, and don't put oil in for a day or two, so as to allow the lead to set. It is well known that liquid always finds its level; it is the same in this lamp: the burner and the surface of oil in the oblong tank are level; as the burner burns the oil out of the said tank the ball drops, opens the cock, and the oil runs in from the round tank, and keeps it on a level with the burner."



Paraffin Lamp.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Phonograph.—SPECTACLE.—(1) Lay the tinfoil out flat upon a sheet of glass, and rub it carefully with a pad of cotton-wool from end to end. This will make it quite smooth. (2) Thin skin parchment can be obtained at any stationer's shop. (3) Two needles are not absolutely necessary, for some forms have only one needle. Their shape varies according to the ideas of the makers; some are made chisel-shaped at the point. In Edison's instrument, where two are employed, the one is bell-shaped and the

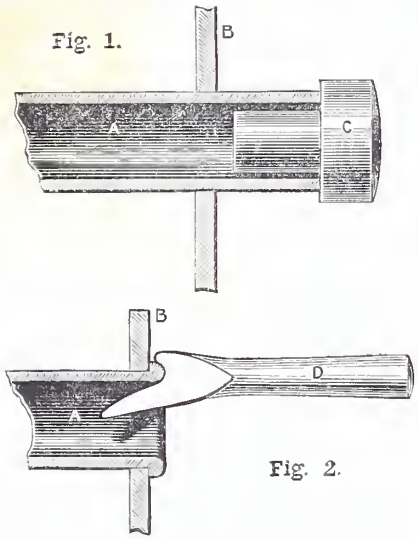
other cup-shaped. They are fixed in a carrier, which is fastened to the soles, or uprights in some cases. This carrier is made adjustable by a screw arrangement. (4) Sufficient pressure to produce the desired result, which can only be determined by experiment. The pressure is regulated by the screws. (5) The motor must turn the cylinder at a uniform rate if the best results are to be obtained. But the needle would describe a spiral on the cylinder whether or not, as the screw on the cylinder is a spiral.—W. D.

Bricks.—P. J. C. (*Balbriggan*).—As the thickness of bricks varies in different localities, it is difficult to give you an accurate reply. However, if the bricks set 3 in., the number required will be 4,800. If they set 2¾ in., 5,200 will be required. Another matter to take into account is whether the wall is faced on both sides, or on one only; if faced on both sides, two-thirds of the bricks must be good hard bricks, and out of ordinary stocks you would hardly get that quantity, so that you should have a larger quantity than is named, unless the bricks are uniformly hard and well shaped; for one face you would be able to get sufficient from the quantity named. If there are any openings, such as doorways, windows, etc., in the wall, deduct 100 for every superficial yard of openings; this is less than the quantity, but you will require a few extra for cutting.—M.

Bicarbonate of Potash Battery.—C. McC. (*Bangor*).—Place a porous cell in an old tin can, and pack the space between the inside of the can and the cell with iron borings. Fill up with a concentrated solution of American potash (crude bicarbonate of potash), and suspend a piece of zinc from a bung on the porous cell in the potash solution, to form the positive element of the battery. Solder a wire to the tin can, which in itself forms the negative element of the cell. The current from three cells of this battery will ring an electric bell, but the solution needs frequent renewal to keep the cells in working order. If you mean a bichromate of potash battery, you will find an account of one in Vol I. of WORK, page 442.—G. E. B.

Picture Framing.—G. B. (*Accrington*).—Strain your glue through muslin, so as to extract any particle of grit, damp your picture, and glue it on to a piece of card larger than your picture; lay under a press of card or any weight near at hand. When dry, which does not take long, take your picture, lay mount on, and with a paper-knife mark round opening of mount; then glue the edge of card thinly up to indent line, and place your mount over, rubbing round with strip of paper; not to soil mount, put press on again for about an hour, when your picture is ready for framing.—G. C. R.

Tubes for Engine.—M. T. W. (*Warbleton*).—The brass tubes (A, Fig 1) are driven hard into their drilled holes in the tube-plates B with a mandrel like tool C, which sends them in without bruising the edges, as a hammer would do. When in position, they are expanded to render them perfectly watertight in their tube plates. A tube expander, of which there are several kinds in the market (Dudgeon's being one of the best known), is used. This is inserted into the open ends of the tubes, and then a handle is rotated and pressure applied at the same time. A tapered centre piece thus presses



Tubes for Engine.

loose rollers outwards against the bore of the tube tightening it in the tube-plate. That end of the tube that protrudes within the fire-box is then rounded or "beaded" over with a hammer first, and beading tool afterwards, the latter having the appearance of Fig. 2, D. The tool is struck with a hammer, and the whole circumference of the end is gone over in detail, thus giving a very neat rounding finish. This serves to rivet the end over, and also affords a better protection against the action of the fire than the keen edges of square ends would give.—J.

Mill Picks.—A BLACKSMITH.—Heat a bath of lead to the boiling point. Plunge the end of the pick to about a length of 1½ in. in it, until heated to the temperature of the lead, and then plunge into cold water; or heat to a cherry red, and plunge into a bath of 2 gallons of rain-water, 1 oz. of corrosive sublimate, 1 oz. of sal-ammoniac, 1 oz. of saltpetre, and 1½ pints of rock salt.—J.

Mould.—G. F. (*Baxmaur*).—By "mould," you evidently mean a pattern from which to mould. A sheet of lead is what you require, or failing that, a sheet of gutta-percha. You can bend these into any required shape, and a moulder can cast from them. If you want a small quantity of steel, a smith could hammer you down a bit. Would a piece of an old saw-blade answer your purpose? You could temper to liking. I daresay Pfiel & Co., Clerkenwell, could supply a large quantity.—J.

Carved Oak Mirror Frame.—SUNEY.—The sketch annexed is, I think, what you want, 5 ft. 6 in. over the cornice, and 5 ft. high to the top of the pediment. I have made it of heavy, massive proportions, which I hope is right; but if not, the breadth of the pilaster and depth of cornice may readily be reduced, thereby allowing a larger mirror to be used, and making the whole lighter in appearance. You speak of getting your mantel mirror made by a cabinet-maker, and then carved by a local carver. To make this design in this way, the cabinet-maker should do all his work without permanently fixing the pilasters and capitals, frieze and pediment, which should then be carved. Afterwards, all the pieces being given to the cabinet-maker, he will fasten them in their proper positions

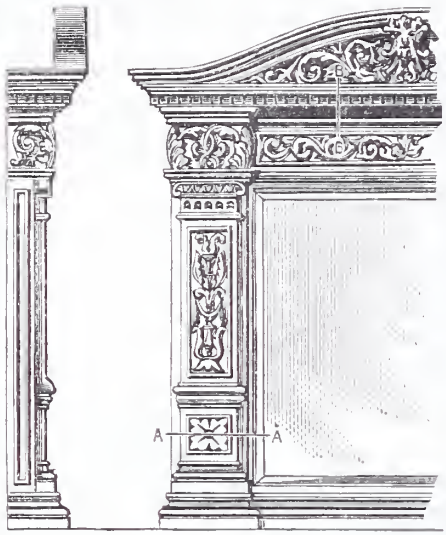


Fig. 2. Fig. 1.

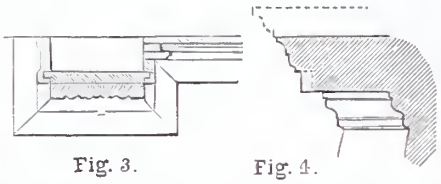


Fig. 3. Fig. 4.

Carved Oak Mirror Frame. Fig. 1.—Front View. Fig. 2.—End View. Fig. 3.—Plan at A A. Fig. 4.—Section at B B.

and finish the article. It will next be in need of the polisher's attention, and he should be instructed to fume it dark and finish it dull. A word may be said in explanation of the plan and section shown. Fig. 3 gives in the hatched part, the section through the pilaster at A A, showing it boxed up first, and with a board planted on its face. The outer lines show the base mouldings. In Fig. 4 is given the cornice mouldings, and the portion returned round the pilaster is also shown. The dotted portion above the hatched part indicates the topmost members of the curved moulding forming the pediment, and which topmost members project right over the straight cornice at each end. The carved mask or face in centre of pediment is intended to lie well forward in front of the mouldings which run behind it, and the carving on each side and under it should be bold and well relieved. The other carvings might all be in low relief.—A. M.

Frames.—C. N. B. (*Guildford*).—I have given your inquiry to one of the best and cheapest houses in London, and they promise to write you and send samples free of charge. If they do not suit you, try Shultz & Co., Long Lane (next Aldersgate Street Station).—G. R.

Bevel Mounts.—CONSTANT READER.—There is no machine used amongst professional mount cutters; there is a special knife make, harpoon shape, which has to be kept as keen as a razor to ensure success. A steady hand and a little practice soon helps to acquire the knack. You can get mount-cutters' blades and handles at any first-class tool makers.—G. C. R.

Nickel-Plating.—JAY DEE.—The replies given to J. C. J. (*Hepworth*) on page 551, Vol. II., and to M. R. (*Huddersfield*) on page 552, Vol. II., will answer most of your questions. A dynamo is preferable to a battery for working large bulks of nickel solutions.—G. E. B.

Electric Light Installation.—HIGH PEAK.—An electric light installation to replace two double-wick paraffin lamps should consist of the following:—

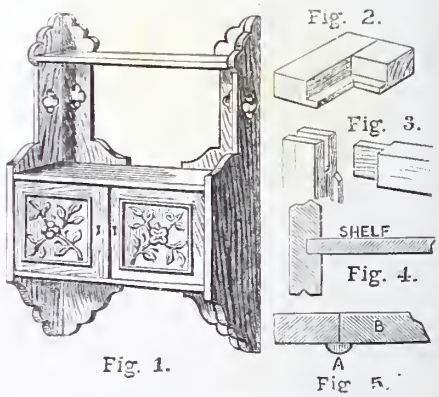
	£	s.	d.
One shunt-wound dynamo of 50 c.p.; cost about	5	0	0
Five 8 c.p. incandescent bottom-loop lamps, at 3s. 9d. each		18	9
Five cheap pattern bottom-loop lamp holders, at 1s. each		5	0
One main-line switch to turn on current from dynamo		3	6
Five "Shop" lamp brackets, at 2s. each ...		10	0
Twenty yards main line 7-strand No. 20 cable, at 3½d. per yard		5	10
Twenty yards No. 20 insulated wire for branches, at 1½d. per yard		2	1
Total for material ...	7	5	2

This will not provide a switch for each lamp, nor a safety fuse cut-out. If you desire a switch for each lamp, so as to be able to turn on one or more at pleasure, it will cost you about 1s. 6d. per lamp extra. A safety fuse cut-out will be most desirable to protect the lamps from injury in case of a sudden rush of current from the dynamo: this will cost about 2s. 6d. more. As you can have power for nothing, I have omitted the cost of motor in my estimate.—G. E. B.

Cheap Bichromate Battery.—F. P. (*Lower Broughton*).—Get two plates of gas carbon, each 5 in. by 2½ in. by ¼ in., and one zinc plate of the same size, but of only ⅛ in. thickness; coat the zinc plate with quicksilver, as directed in the article on the Bunsen battery in No. 1 of WORK. Select a jam or salt jar, or a wide-mouthed pickle-bottle, large and deep enough to hold these plates. Get two thin strips of wood long enough to rest on the edges of the jar, and clamp the zinc plate tightly between them, with about ½ in. of the plate projecting above the wood. Two screws through the ends will cause them to clip the zinc tight. Drill two holes near the corners at one end of each carbon plate, and bang the carbons by two pieces of copper wire across the zinc on each side when this is placed in the jar. Get a clamp to fit on the zinc to hold a conducting wire. One of the wires connecting the carbons may be left long enough to form a connecting wire for these. Place a bit of slit rubber tube under each wire to insulate them from the zinc plate. Charge the battery with 3 oz. of bichromate of potash dissolved in one pint of hot water, and then made acid with 3 oz. of sulphuric acid.—G. E. B.

Registration *versus* Patenting.—INDUSTRIA.—Registration will protect shape or pattern only; if any novel principle or process of construction is involved it must be protected by a patent. By registration, INDUSTRIA can prevent anyone from imitating the mere pattern of his chair-table, but not from making or selling chair-tables on his principle, so long as they differ from his pattern.—C. C. C.

Wooden Medicine Chest.—PHYSIC.—Medicine chests are made in a variety of patterns, none possessing any good looks. The one I here illustrate should suit you. I have not adhered strictly to any prescribed dimensions—use your judgment thereupon. You may have an additional shelf at the bottom by simply reversing all upper parts. You can also cut back-shaped pieces and cupboard backboard all in one piece; or have the latter in



Medicine Chest and Parts.

one piece and the shaped parts separately. Screw them to back edges of sides and shelves. Join shelves to sides, as in Fig. 4. The mortice and tenon in Fig. 3 will be strong enough. Fig. 2 shows one corner of a door (back view) rebated to receive panel, which should be nailed in position. For appearance' sake, glue one-half (lengthways) of a small bead to *one* door only (A and B respectively, Fig. 5). If you have shelves same width as I show, any large bottles can conveniently stand upon cupboard top.—J. S.

Working a Patent.—E. R. (*Salford*).—There are agents who serve as middle-men between patentees and manufacturers who (when inventions have a commercial value) arrange sales and work for royalty. Apply to one of these. But there is no reason why you should employ an agent. You can learn what respectable firms would be likely to take it; and if doubtful as to its value, see what offers they are inclined to make.—C. C. C.

Picture-Moulding Dealers.—G. A. D. (*Bradford*).—The following addresses may serve you:—Multz & Co., Long Lane (next to Aldersgate Street Station), E.C., and at Cologne, Germany; Kohmann, Australian Avenue, Jewin Street, E.C.; City Frame Company, 29, Basinghall Street, E.C., and Hamburg and Berlin, Germany.—G. R.

Willesden Paper.—A. E. (*Dalston, N.E.*).—You can buy any quantity of a retail vendor, but wholesale only in the piece. You cannot do better than use good Scotch glue for sticking together.—G. R.

Re-Silvering Jewellery.—TYRO.—To re-silver jewellery, you would require battery, silver plate (pure), and silver bath; cost about £2: but to whiten up and make old stock look like new, pickling in a sulphuric bath and scratching with soft wire scratch-brush, then washing with plenty of soap and hot water, and dry in warm sawdust (boxwood), is the process. See there is no soft solder on any part, or that the article is not put together with it; take out the steins and pins, then lay them one at a time on a lump of pumice-stone or charcoal, gently apply heat by blowpipe till a dull red, let cool, then drop them in a solution or bath of water nine parts, sulphuric acid (oil of vitriol) one part; the water may be cold or hot (not boiling). I prefer hot, as it acts quicker; let them remain till a dull or dead white, then remove and gently scratch them with a circular scratch-brush on a lathe, if you have one; if not, a hand scratch-brush will do, using plenty of stale beer or alo on it, then wash in hot soda-water and soap, and dry in warm dust. The dust and brushes may be got from the tool dealers, say Grimshaw & Co., 35, Goswell Road, Clerkenwell, E.C.; Haswell & Sons, 49, Spencer Street, Clerkenwell, or others. If the colour is not satisfactory the first time, repeat the process; any bright parts may be touched up with the burnisher, using a little ale to keep moist; extra dull parts required, simply wash and dry. To warm the dust, use an old frying-pan.—A. B. C.

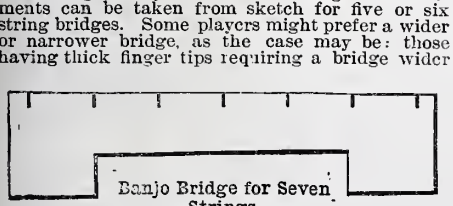
Mount-Cutting Tool.—T. H. (*Walsall*). — You can buy a mount-cutter's blade of any first-class toolmaker; it is a long steel blade, usually 6 in. to 8 in. long, and costs 1s.; the handle is made of hard boxwood, with brass screw so as to move blade at will for sharpening, etc., and costs 3s. 6d. A steady hand and practice is the only necessity to become perfect.—G. C. R.

Picture Frame.—LIVERPOOL.—Tools required—cutting-block, tenon-saw, shooting-board, plane, vice, bradawls, hammer. You may possess some of above; the balance at any respectable toolmaker's. I do not give addresses, as every town has many, and to get them from London makers is costly. How to get your mitre up, see Vol. I., page 637, "Shop."—G. C. R.

Picture Framing.—THEO.—There is no book published that gives practical information upon this subject. There was about two years ago an attempt to start a paper for this trade, but it fell through for want of support.—G. R.

Beginning WORK.—G. R. (*Edinburgh*).—There are fifty-two numbers in a volume of WORK, so if you purchase the current number you can easily determine for yourself when Vol. III. will begin. But why wait to begin? My advice to you is to start at once, for every part and every number is complete in itself to a certain extent as far as treatment of a subject, or parts of a subject, is concerned, and you would then be induced, in all probability, to buy up all the back parts or numbers prior to that with which you commenced. Each weekly number is published on Wednesday, though it is dated for the Saturday following. The part for each month is published on or about the 25th of the preceding month. Thus the part dated February, 1891, is published on January 25th or thereabouts.—ED.

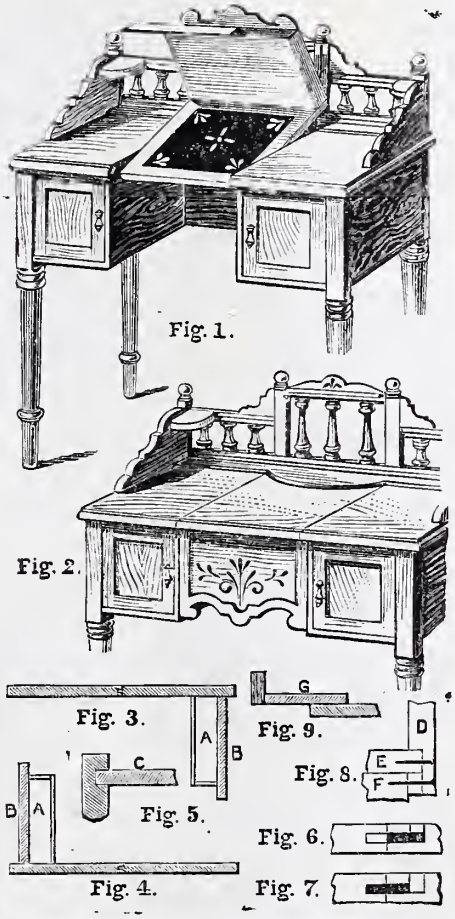
Banjo Bridge.—F. J. P. (*West Bromwich*).—Ebony is not a suitable wood for bridges. Use sycamore, maple, or cedar. I have given a sketch of the size I generally use for seven strings. Measurements can be taken from sketch for five or six string bridges. Some players might prefer a wider or narrower bridge, as the case may be: those having thick finger tips requiring a bridge wider



Banjo Bridge for Seven Strings.

than those who have slim taper fingers. You should make two or three different widths and see which suits you best; and having made one to your liking, whenever you require a new bridge you can mark the exact size from old one. I will attend to your suggestion for an article on "How to Keep the Banjo in Order" at an early date.—J. G. W.

A Writing Table, with Reversible Flap.—A. E. S. (*Maidstone*).—This original writing table design has a resemblance to my toilette and writing table (see pages 400 and 401, No. 78, Vol. II.), and I refer you to that for a plan. The legs, backboard, and four sideboards will be the same as there shown, or dovetail-morticed and tenoned, excepting that the top is intended to be divided into three equal parts, 12 in. each (3 ft.). The principal feature is the reversible middle flap, elevations of which are shown in Figs. 3 and 4, in both of which A is a stationery box; B is the front-shaped piece (Fig. 2) joined to reversible board, and to both of which are joined two ¼-in. boards, 12 in. long and 8 in. wide, and two 8 in. long and 2½ in. wide, with a division down the middle. A lid will be required as C in section Fig. 5. This flap is pivoted in the middle at each side to the inner edges of the other two top boards. To accomplish this, first drill the holes in the respective edges; then drop the pivots into those of the reversible flap, and drill holes from its surface (Figs. 6 and 7) to enable the pivots to be pushed through the holes in the side top boards. To thus fix it and make all right, drive pieces of wood into the surface holes, and fill them completely up (Fig. 7). Join a board, 3 in. or 4 in. wide, to the table top to retain the reversible flap in

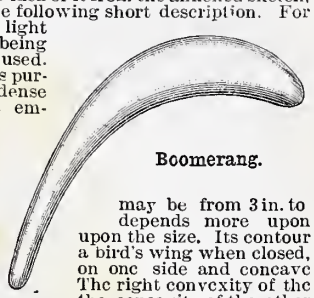


A Writing Table. Fig. 1.—Table with Reversible Flap adjusted. Fig. 2.—With Reversible Flap closed. Figs. 3 and 4.—Flap as in Figs. 2 and 1 respectively. Fig. 5.—C, Lid covering Stationery Box. Figs. 6 and 7.—Diagrams showing how to insert Pivots in Flap, etc. Fig. 8.—Diagram showing how to join Back Parts to Table—D, Side View of Back Parts; E, Table Top; F, Side of Table, with small Length of Wood running between the Rabbet of Back Parts and Table Carcase. Fig. 9.—Board to retain Flap as in Fig. 2.

position. To use, the front end (A and B, Fig. 3) is brought up and over, and a couple of flush bolts in the edges (previously fitted, of course) shot into the inner sideboards to keep it firm. There will be space enough in the cupboards for inkpot, etc. The back pieces can be fitted as shown in Fig. 8. Distance from back to front of table top, 18 in. Length of flap, 16 in. Legs, 27 in. long, 1½ in. thick. Doors, 10 in. square. Thickness of sideboards, etc., ¾ in.—J. S.

Picture Oval Cutting.—T. T. (*Liverpool*).—For a round opening or circle, the compass would soon mark it out, and if it is wood a fret saw would cut it, or if of cord, a mount-cutters' knife. If T. T. requires to strike out a true oval to any given measurement, see "Shop," page 652, Vol. I.—G. C. R.

Boomerang.—QUERIST.—A boomerang is a missile made of hard wood, invented by the aborigines of Australia. It is not easy to give you a correct idea of its form and proportions on paper, but you may gather some idea of it from the annexed sketch, together with the following short description. For amusement, any light wood capable of being carved may be used. For more serious purposes a hard dense wood must be employed. The length may be from a foot to 18 in. or more; the width at the widest part may be from 3 in. to 5 in. Success depends more upon the shape than upon the size. Its contour follows that of a bird's wing when closed, being convex on one side and concave on the other. The right convexity of the one side and the concavity of the other varies with the wood employed, and is found by experiment, the wood being whittled away until the missile achieves its desired mission. It is thrown from the right hand in a horizontal direction, with the concave side upward. The knack of throwing properly is learnt by practice.—G. E. B.



Boomerang.

Melting Indiarubber for Moulding.—J. W. P. (*Chelmsford*).—A compound of indiarubber and sulphur in varying proportions is generally used. Almost anything which will take and retain the requisite shape, and bear being heated to a temperature of 400°F., will suffice for a mould. State more definitely what description of articles you wish to mould.—QUI VIVE.

Cards.—W. B. (*Sowood*).—You will get all kinds of plain and fancy cards from Messrs. Dobbs, Kidd, and Co., Fleet Street, London, E.C.

Violin Varnish, etc.—AMATEUR.—Without knowing what gums and their proportions are in your varnish, I could not say what effect will be produced. If you make the bass bar 10½ in. long, $\frac{5}{16}$ in. thick, and ½ in. deep in the middle, it may remedy the fault you complain of. The thickness of the belly is about right, if anything a shade too thin.—B.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Silvering.—ALBO writes:—"Could any of your readers inform me of the process of silvering aneroid dials, etc., known as 'French silvering'? It is used chiefly on engraved or raised surfaces, and gives a more dead-white appearance than the ordinary chloride of silver process. It is not put on with battery power, I believe. Also, the best kind of varnish to use."

Doll's House.—J. W. (*Sheffield*) writes:—"I should feel greatly obliged for a good design or designs of a doll's house, with brief details as to how to make one."

Etching Acids.—ETCHER writes:—"I much want the name of an acid (or mixture of acids) suitable for etching copper plates that does not fume the same as nitric or nitrous acids do."

Diving Tools.—T. J. J. (*Tottenham*) writes:—"I shall feel greatly obliged to any reader who will give me sketches and sizes of the tools used by divers, I mean those using the diving dress."

Wood-Carving Designs.—J. J. (*Orkney*) writes:—"I would be glad if some correspondent would let me know where I could get designs of wood carving—not paper designs. I would like the design carved out on wood to copy from."

Moulding Making.—CORNICE writes:—"Will any of your numerous readers enlighten me as to the process of making gilt mouldings? I mean in particular with regard to the transfer of the pattern to the composition which is used to cover the ordinary wood foundation. Whether it is effected by means of a circular or flat mould, and how? I am anxious to make some cornice work."

Brick and Marble Tesseræ.—R. E. (*Kensington*) writes:—"Perhaps some of your numerous correspondents may be able to tell me where I can get the small half-inch brick tesseræ—both red and yellow—which are so extensively used in the laying of mosaic work. Also if I can buy marble tesseræ already prepared for laying, and if so, where?"

Shut-Up Grinding Machine.—T. E. W. (*Hull*) writes:—"I have seen a man going about the streets with a small machine under his arm scissor-grinding; it was about 3 ft. high, and the back legs shut up with hinges to the front; it had a small fly-wheel, treadle, and small emery and stone-grinding wheels. Could you oblige by telling me how to make one that size, so it could be put away, and take up little room? I want it to cost as little as possible."

Dovetailing.—T. E. W. (*Hull*) writes:—"Could any reader tell me how to make a simple dovetail, and the way to mark it out before cutting? I do not know much of joinery."

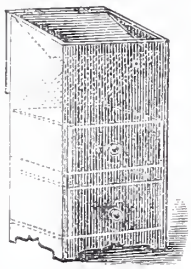
Small Metal Soldiers—the Flat Ones, not the Thick Ones.—L. A. C. (*Wigan*) writes:—"I shall be glad of information upon the following points:—(1) How are the above made—are they stamped with dies or cast in moulds? (2) Is the making of the dies or moulds within the reach of an amateur, or does it require special tools? (3) If not, where can I get them made, and what will be about the cost? (4) What alloy is used? (5) What kind of paint is used to colour them?"

Pyrogravure. — JABEZ writes: — "Will any reader kindly give me a description of the process of burning designs in on leather known as pyrogravure? Also, where is it in operation, as I should like to see it?"

Axle Oil.—J. H. E. (*Shepherd's Bush*) writes:—"I should be obliged if any reader would inform me how to prevent the oil working from the axle into the spokes of mail-cart wheels, and thus causing them to work loose and come out. The holes have been wrongly drilled right through to centre of hub. I have had two pairs of wheels come to pieces this last season."

Pipe Making.—SOUTH WALES writes:—"I respectfully ask if you know of a machine in the market for the manufacture of pipes. It is used in connection with spelter furnaces, and is fixed in the mouth of the retort to receive the metal, and is made out of fire-clay. It is manufactured as follows:—First, the clay is made into a ball shape of about seven pounds in weight, then, after being well sanded, it is put into an iron mould; this mould is fixed into a cast-iron mould, which is stationary, to keep it from moving; then a setter is driven into the ball of clay by a man working it up and down like a steam hammer until it is quite home, then the sheet-iron mould is pulled out and the pipe taken out and fixed on its end and left there until it is sufficiently dry to be removed. A man will make 150 of these in a day, but the work is very arduous, and the process of making is absolutely unworthy of the nineteenth century. If you do not know of a machine, I should be greatly obliged, sir, if you or any of your staff would assist me by suggesting an improvement."

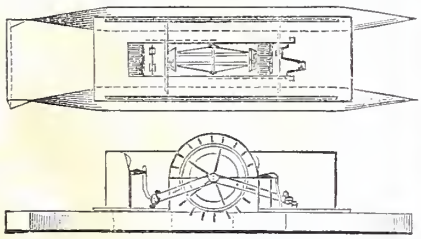
Printing Press, etc. — AMATEUR writes:—"Would any reader kindly furnish me with instructions for making a simple printing press, also the price of type (fancy and ordinary), and where it can be obtained?"



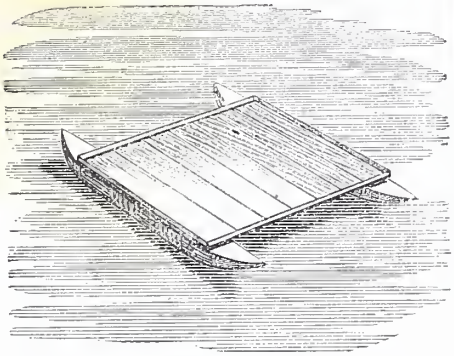
Cinder Sifter.

Cinder Sifter.—T. E. W. (*Hull*) writes:—"I should be very glad if some reader would be so kind as to tell me how I could make a cheap cinder sifter, something like the accompanying pattern, but not a very large size."

Water Cycle. — MOTIVE writes: — "Will anyone kindly give me sketch of a 'paddle wheel' suitable for propelling catamaran 17 ft. long, 18-in. hulls, and about 6 ft. in width, to be worked on the same principle as a tandem tricycle? Also would it be advisable to have both



Water Cycle, showing Principle of Propelling.



Sketch of Catamaran.

chains on one side, or one chain on either side of axle on paddle wheel, the objection to the latter being that one pulls against the other? Which would act the most satisfactorily?"

Vaporiser — Steamy Windows.—J. B. (*Colchester*) writes:—"Can anyone tell me how to prevent this terrible scourge where it is imperative to burn gas in winter?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Cheap Lathes.—P. B. H. (*Hendon*) writes, in reply to ENGINEER (see No. 88, page 586):—"I should advise ENGINEER to put on one side all idea of going to cheap makers of lathes. Cheap lathes are not much good for turning out good work; there are second-hand ones by good makers (Whitworth, Muir, etc.) that would do the work better. Why not get a second-hand one by a good maker, either through a machine broker or else look out for some sale of workshop appliances and attend and bid? You would find plenty of addresses in the Directory of a manufacturing town both of brokers and makers. The choice of town depends on where you live."

Gear Wheels.—P. B. H. (*Hendon*) writes, in reply to STOCKTON-ON-TEES (see No. 88, page 586):—"The most likely people I know to suit you are Messrs. Grimshaw & Baxter, 33 and 35, Goswell Road, London, E.C."

Gypsum.—J. M. (*No address*) writes, in reply to GYPSUM (see No. 88, page 586):—"You must have the flue on your kiln or oven in proportion to your fires; if your draught power is less than your fire power, why, then, material of any sort will blacken by the fumes and gases. Give your flue plenty of power; you can check with damper if too strong. Can GYPSUM, or any other reader of WORK, tell me how gypsum is used in glazes if mixed with other material? What are they, and proportions of each?"

Lathes.—M. (*Bishop Auckland*) writes, in reply to ENGINEER (see page 586, Vol. II.):—"You can purchase a lathe from the Britannia Company, Engineers, Colchester; they make lathes at all prices, and also supply second-hand ones; also from Mr. J. Reside, Engineer, Rastrick, Brighouse, Yorks; send a stamped envelope to either, and they will supply you with what you require."

Cabinet Fittings.—H. F. S. (*Hammersmith*) writes, in reply to W. H. (*Hinckley*) (see page 602, Vol. II., No. 89):—"W. H. cannot do better than apply to Harger Brothers, Settle, Yorkshire, where he will obtain the stated requirements as cheap as any place I know of (see their illustrated catalogue)."

Gear Wheels.—M. (*Bishop Auckland*) writes, in reply to STOCKTON-ON-TEES (see page 586, Vol. II.):—"You can get cut gear wheels from the Britannia Company, Engineers, Colchester, or from Richard Lloyd & Co., 135, Steelhouse Lane, Birmingham."

Camera Fittings.—C. W. (*Stoke Newington*) writes, in reply to J. C. (*Glasgow*) (see page 602, Vol. II.):—"There is no one I can recommend so well as E. G. Platt, 'The Amateurs' Friend,' Birkbeck Works, Birkbeck Road, Ridley Road, Dalston, London, N.E.; he is the manufacturer. Send for his catalogue, post free. His price for half-plate rack and pinion is 5s. He supplies almost everything you would want."

Lathes.—W. J. W. (*Monkwearmouth*) writes, in reply to B. S. (*Edinburgh*) (see No. 89, page 602):—"If B. S. is an amateur, he will find Churchill's 'Eureka' lathe more suitable than the 'Barnes',' which is a heavier tool; but both are good value for the money, and cannot be beaten."

Camera Fittings.—W. J. W. (*Monkwearmouth*) writes, in reply to J. C. (*Glasgow*) (see No. 89, page 602):—"M'Ghie & Bolton, West Nile Street, Glasgow, supply the above at reasonable prices. Their price for half-plate rack and pinion is 6s. 8d."

Cabinet Fittings.—G. P. (*Elgin*) writes, in reply to W. H. (*Hinckley*) (see No. 89, page 602):—"I would advise W. H. to get the catalogue of either Henry Zilles, 24 and 26, Wilson Street, Finsbury, London, E.C.; Harger Brothers, Settle, Yorkshire; or J. H. Skinner & Co., East Dereham, Norfolk. Engravings of some very pretty and useful fittings are given in all their catalogues, and the price of each is also told."

Netting Needle.—T. H. (*Bridport*) writes, in reply to J. H. B. (*Pendleton*) (see page 551, Vol. II.):—"I beg to say that I am a maker of these machines for fishing nets."

Luminous Paint.—G. P. (*Elgin*) writes, in reply to INQUISITOR (see No. 89, page 602):—"I have seen luminous paint mentioned in the list of Theobald and Co., 7A, Bath Place, Kensington, London, W., but cannot remember the price. The list costs 1d."

Model Water Gauges. — ONE INTERESTED writes, in reply to YOUNG ENGINEER (see Vol. II., No. 68, page 261):—"I purchased a set of gauges giving every satisfaction, and perfect in every degree, and, if desirable, I can recommend you to the same place, from which you can purchase every description of brasswork (warranted) and at very reasonable prices. I may state that there are no more joints than in large gauges, and made exactly the same, taking a quarter glass, and the price was 7s. 6d. the set."

Lathe Attachment.—F. M. R. (*London, E.C.*) writes to H. C. D. (see page 583, Vol. II.):—"You will find full details of the above in Specification No. 15,365,189; this can be seen at the Patent Office library, or a copy obtained at the Sales' Room, Cursitor Street."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—ABSTAINER; REFLECTOR; SPRINGY; J. H. B. (*Bristol*); CON-JUNGO; A. J. L. (*Paddington*); J. H. (*Leicester*); H. S. (*Wolverhampton*); S. H. (*Birmingham*); F. C. (*Bolton*); J. H. E. (*London, W.*); J. R. E. (*Manchester*); W. H. P. (*Hornsey*); G. L. S. (*Darlington*); F. B. (*Wakefield*); WATER LILY; E. R. (*Liverpool*); B. H. (*Birkenhead*); J. H. B. (*Bristol*); SLIEV DUARD; MECHANIC; L. M. (*Lee*); J. P. (*Manchester*); CREWKERNE; REV. J. L. (*South Australia*); J. D. (*Glasgow*); AMATEUR; J. H.; ST. PETER'S BOY; M.; WESTWARD HO; S. H. (*Birmingham*); C. W. B. (*London, W.C.*); ELECTRIC; A READER; WOODPECKER; H. T. W. B. (*West Bromwich*); W. J. J. (*Southwick*); R. A. M.; F. C. (*Londonderry*); BRASS; W. K. (*Isle of Man*); W. G. (*Durham*); REGULAR READER; H. W. (*Tottenham*); J. G. B. (*Glasgow*); J. O. C. (*Rugby*).

"WORK" EXHIBITION.

THE EXHIBITION

WILL BE OPENED TO THE PUBLIC, AT

THE POLYTECHNIC INSTITUTE,

REGENT STREET, LONDON, W., ON

MONDAY, DECEMBER 29th, at 2 p.m.,

BY SIR JOHN LUBBOCK, BART., M.P.

APPOINTMENT OF JURORS.

THE Proprietors of WORK are pleased to be able to announce that by resolution of the delegates to the LONDON TRADES' COUNCIL, the Council will officially appoint the JURORS for the forthcoming Exhibition.

Exhibitors will therefore have the satisfaction of knowing that the awards will be made by experts chosen from the very front rank of workmen, and thus will be the best practical judges of work that it would be possible to select in the various groups.

*** The Secretary begs to inform Exhibitors that any change of address should be notified at once; the omission to do so, especially if letters are returned undelivered by the Post Office, will disqualify the applicant.

JNO. WHITFIELD HARLAND, Sec.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [15 R

Just Published by Britannia Co., Colchester, the Buyers' Guide, containing notices of 749 books on mechanical subjects, with table of contents, price, etc. The most complete catalogue yet published. Post free, 6d. In cloth, 1s. 6d.—BRITANNIA CO., Colchester. [20 R

Picture Moulds.—15 to 25 per cent. saved. Send for wholesale list. One stamp.—DENTS, Importers, Tamworth. [22 R

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured. Money returned in full if not entirely satisfactory. — ETHELBERT HENRY, Alvaston, Derby. [16 R

Fretwood. — The cheapest in England. Bilson's Cabinet Works, 21, Horsemarket, Northampton. [25 R

Violin.—Splendid full-size copy Niclaus Amati, beautiful, full, and mellow tone. With baize-lined case and silver-mounted bow. Take 15s. immediate cash. Very exceptional bargain, but must sell. Advertiser will give in free 20s. worth of unsoiled music.—GARNHAM, College Buildings, Ipswich. [1 S

Sign-Writing Made Easy.—Every man his own writer. Illustrated instructions for easy, cheap, simple, and rapid process by which elaborate lettering can easily be done equal to professional work. Also Diagrams for marking out eight different sized alphabets. The lot 1s., post free.—F. COULTHARD, Terrace Road, Bournemouth.

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [3 S

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [2 S

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [26 R

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,
84, 85, 87, Fetter Lane, LONDON.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

FOO-CHOW ENAMEL.

Patented and Registered. **PRIZE MEDAL.** **REAL CHINESE.**

DRIES IN FIVE MINUTES.

For House Decoration, for renewing faded furniture, for *bric-à-brac* generally, there is nothing like it.

FOO-CHOW is the only Enamel suitable for Floors. Try the Oak and Mahogany. Can be used on any surface, oily or greasy.

The Gold, Silver, and Bronze are simply invaluable, the effect being equal to leaf gilding. For Baths it is made in White, Aqua Marine, and Cerulean Blue.

THE QUEEN states:—"The uses of Foo-Chow Enamel are practically limitless."

THE LADY states:—"In every way the most satisfactory."

THE BAZAAR states:—"Having tried other kinds of enamel, we feel quite justified in saying that it is quite the simplest and most pleasant in use."

GOLD, SILVER, BRONZE, AND ALL COLOURS.

☞ **Write for Pattern Card,** which will be sent POST FREE from the Manufacturers.

FOO-CHOW ENAMEL is sold everywhere in Sixpenny and One Shilling Tins; or from the Manufacturers, three stamps extra.

ADDRESS—
Donald Macpherson & Co.,
KNOT MILL, MANCHESTER.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill,** with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting on screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 3d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design **SENT GRATIS** with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

MELLIN'S FOOD

FOR INFANTS & INVALIDS.

MISS STOECKER. Age 3 Years.

"27 A, Sloane Street, London,
"18th February, 1889.

"Mrs. A. STOECKER encloses a photo of her little girl who was fed entirely on MELLIN'S FOOD for more than a year, and she has never had an illness."

MELLIN'S FOOD BISCUITS.

PALATABLE, DIGESTIVE, NOURISHING, SUSTAINING.

Price 2s. and 3s. 6d. per Tin.

SHAKESPEARIAN WISDOM ON THE FEEDING AND REARING OF INFANTS.

A pamphlet of quotations from Shakespeare and portraits of beautiful children, together with testimonials, which are of the highest interest to all mothers. To be had, with samples, free by post, on application to

G. MELLIN,

Marlboro' Works, PECKHAM, S.E.

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the **MANAGER, SALT REGAL WORKS, LIVERPOOL.**

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

SCIENTIFIC AND ELECTRICAL MATERIALS,

With every Appliance for the Construction of Electric, Optical, and Scientific Apparatus.

Cameras, Lenses, Stands, Sensitised Paper, Dry Plates, and all Photographic Requisites.

SEND FOR ILLUSTRATED CATALOGUE, 4 STAMPS.

PRICE, TALBOT & CO., LIMITED,
LATE DALE & Co.,
26, LUDGATE HILL, LONDON, E.C.

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of *Muscular* and *Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,* etc. Also most efficacious in *Bronchitis* and *Throat* and *Chest Affections.*

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes: "Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

From all Chemists, 1s. 1½d. *and* 2s. 9d. *per Bottle, or 3d. extra for postage, from*

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A Work on the "Home Use of Pumiline" sent free on application.

Monthly, 4d.

CASSELL'S TIME TABLES.

New Issue of
CASSELL'S
NATIONAL LIBRARY.
Vol. I. ready Jan. 7.
Price *3d.*; cloth, *6d.*

CASSELL'S CLASSIFIED CATALOGUE *sent post free on application.*

ESTABLISHED 1851.

BIRKBECK BANK,
Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER.

MASON'S WINE ESSENCES.

These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. **One Tablespoonful of Mason's Extract of Herbs** makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON,
Nottingham.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 94.] SATURDAY, JANUARY 3, 1891. [PRICE ONE PENNY.

WHIBLEY'S REVOLVING-TABLE BANDSAW MACHINE.

)R CUTTING HANDRAIL WREATHS, CIRCLE-UPON-CIRCLE RAILS, DOVETAILS, AND OBLIQUE CUTS OF EVERY DESCRIPTION.

BY THE INVENTOR.

IE MACHINE ITSELF: ITS PECULIARITIES AND CHARACTERISTICS.

BOUT three years ago, whilst discussing ith a fellow-workman various matters ertaining to the principles and practice of andrailing, I was asked if I thought it ithin the range of possibilities to cut a uared handrail wreath direct from the lank by means of a bandsaw machine. his question set me thinking, and sugested possibilities not previously thought f. A careful examination of the conditions be complied with led me to see that hough handrail wreaths, or rather forms possessing the elementary properties of handrail wreaths, might within very narrow limits of possibilities be produced upon the table of an ordinary bandsaw machine, by the aid of auxiliary appliances designed for that purpose and for use upon the table, yet the conditions were obviously such as to render these machines practically useless for any such purpose; and hence it was that such work was invariably done by hand labour at the bench. What was required was a machine with a table that could be canted to the pitch angle of plank from which the rail was to be cut (usually a very steep incline), and while so canted, or in any other position, turned freely around the saw; means being also provided for suitably controlling the movements upon the table of the material to be cut. That such was practically possible was soon placed beyond doubt. A jigger or fretsaw machine was made to these conditions, using for that purpose the blade of my bowsaw connected

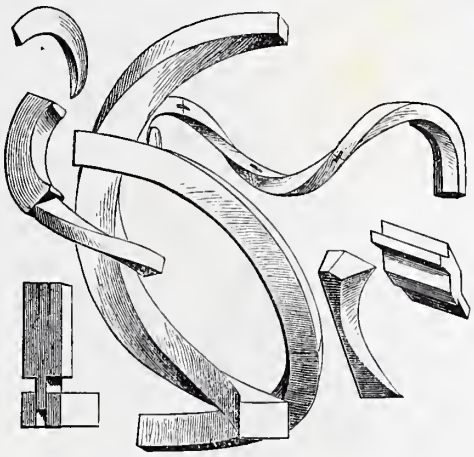


Fig. 3.—Group of Pieces cut by Machine.

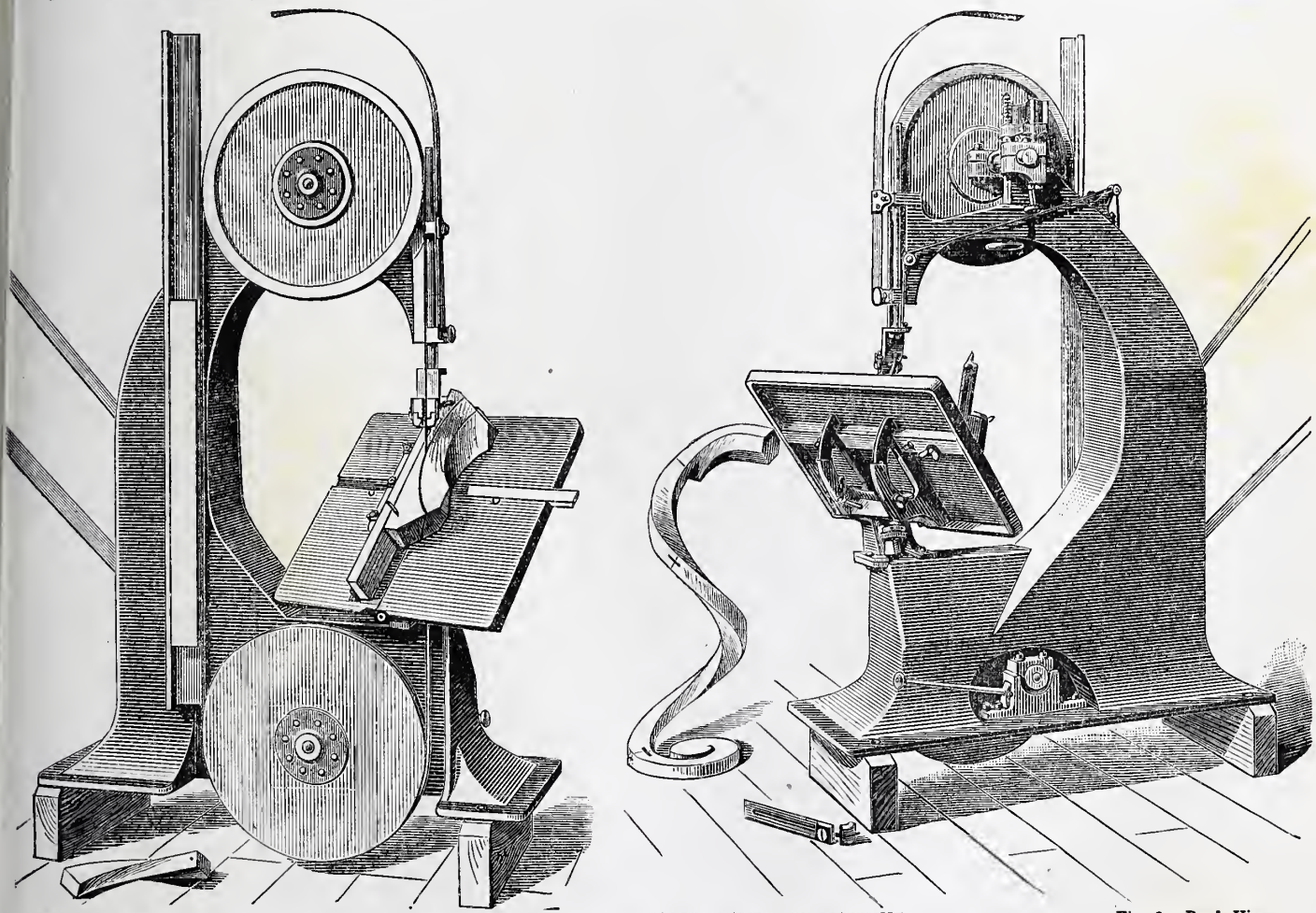


Fig. 1.—Front View. WHIBLEY'S REVOLVING-TABLE BANDSAW MACHINE. Fig. 2.—Back View.

to a reciprocating frame. This was a very primitive and unpretentious looking affair, made in a few hours out of odds and ends to hand, without the outlay of a single penny, but yet it worked fairly well, and enabled me to cut out wreath pieces in the manner desired, as also other work of double curvature, etc. etc.

This machine in time gave way to a small model bandsaw machine of more substantial make, with saw pulleys 8 in. in diameter, made so that it could be driven direct from the lathe; and many and various are the forms I have produced with this mechanical toy; including among others all those mentioned in the title of this article, or illustrated in Fig. 3. A bandsaw machine with saw pulleys 30 in. in diameter, to be power driven, was next made to the order of my then employers, and has been in constant use during the past two years, giving the most perfect satisfaction, and by its performance has most conclusively established its great superiority over all others; not only for the class of work for which it is specially designed—viz., handrail wreaths and other work of double curvature—but in an even greater measure for general workshop purposes.

A half-full size wooden working model of this machine, but with such later improvements as have been suggested by experience gained in working the original, and from a continued desire to render the whole as perfect as possible, will be shown at the forthcoming "Work" Exhibition, with several specimens of work done by it.

Figs. 1 and 2 are front and back views respectively of this model, which it will be seen materially differs in many respects from those of ordinary construction.

The differences briefly stated are :—

1.—In the construction and mounting of the table.
2.—In the character of the guide fence for use upon the table.
3.—In the form and character of the standard.
4.—In the placing of the driving belt and pulleys.
5.—In the mounting of the bottom saw pulley.
6.—In the mounting of the top saw pulley.
7.—In the construction of the saw pulleys.
8.—In the character of the saw guides, both above and below the table.
9.—In the counterpoising of the top saw guides.

1. The table is constructed to cant through an angle of 60°—a far greater angle than usual with such machines—and is perfectly balanced, however placed. It can also, whether horizontal or inclined, be freely turned around the saw, and secured in any desired position by means of a clamping screw; or may instantly be adjusted and secured in any one of four primary positions 90° apart by the insertion of a locking pin in a hole provided for that purpose. The two axes about which the table turns are mutually at right angles and intersect; one coincides with the cutting edge of the saw, the other with a horizontal line upon the surface of the table.

2. Upon the upper side of this table and parallel to its horizontal axis a dovetailed groove is formed extending from side to side; in this a slide-bar or plate is fitted, of easy motion, its upper surface being even with the top of the table. By means of a clamping screw with fly nut on under side of table, this slide may be made fast in any part of the groove. It may also be caused to move freely throughout the whole length of the groove, passing in at one end and out at the other; or by the use of an adjustable stop provided, the motion of the slide in either direction may be determinate in distance, if so required. The slide is also reversible—end for end. To one end of this slide a guide fence can be attached, perpendicular to the table, but capable of angular adjustment relative to the slide. This fence consists of two parts; the fence proper, and a base plate to which it is attached at one edge, and by which it is secured to the slide in table. This fence may, when required, be caused to move freely in the direction of its length along the edge of the base plate without altering its angular adjustment relative to the slide in table; or may by means of clamping plates be made fast to the base plate. At either end of this fence and at right angles to it, another or auxiliary fence can be secured; the connection being by a simple dovetail attachment that jams and tightens upon the application of a slight pressure, and may be instantly released again by the application of a reverse pressure or a light tap at the back. This auxiliary fence has a dovetailed groove along its inner or working face, for guiding and holding an adjustable stop.

It will now be seen that the various movements of the fence, of the transverse slide in table to which the fence may be attached, and of the table around the saw, may all be effected separately or simultaneously; and that each or all may be made fast and immovable relative to the others, if so desired.

3, 4. The special character and requirements of this table; the obvious advantages that would result from having a clear working space around the machine; the unwarrantable risk of danger associated with an unnecessary exposure of fast-moving belts and pulleys; the mechanical impropriety of causing unnecessarily an external force, as that of the driving power, to act ex-centrally upon the machine; and various other minor considerations, chiefly of a mechanical nature, led to the designing of the standard or body of the machine, different in many important particulars from those in general use.

In this machine the standard is formed hollow and open at the bottom and back, and encloses the driving pulleys and belt; the arrangement being such that the machine may be driven direct from overhead, horizontal, or underground shafting; the angular range through which the belt may be placed exceeding 200 degrees, an angular range far in excess of that which is practically possible with any other machine of the kind. By thus enclosing the driving belt and pulleys, immunity is also secured against what is not only a serious obstruction to free working around the table, but likewise an ever-present element of danger that invariably exists in all other bandsaw machines as now made, owing to the hitherto universal practice of placing the driving pulleys and belt external to the standard. Greater compactness and neatness of appearance are also obtained, and steadier running with total absence of perceptible vibration, consequent upon the pull of the driving belt coinciding with a plane that passes through the centre of gravity of the whole machine.

5, 6, 7. It is now generally agreed among experts that the saw pulleys, especially the upper pulley, should be of the lightest possible construction, that the resistance alike of inertia and of friction may each be a minimum; otherwise the strain upon the saw when the machine is started, especially if suddenly started, may cause it to break. For this reason cast-iron pulleys are unsuitable; they are too heavy, and if run at high speed are apt to fly in pieces. Wrought-iron pulleys are both lighter and stronger, and are now generally used by good makers; though for the upper pulley some prefer wire wheels of similar construction to bicycle wheels. What in my opinion is preferable to open metal wheels for saw pulleys, and what I have decided to use for this machine, are solid wooden wheels formed of a number of thin boards glued together, the grain of adjacent pieces crossing, and the whole subjected to sufficient pressure to expel all surplus glue and bring wood to wood. A circular row of copper rivets passing from side to side near the outer edge prevents any separation there of the component layers, and the centre is firmly bolted between a loose annular plate and the radial flange of a cast-iron hub. These pulleys are cheap, light, and durable, and may safely be driven at the highest possible speed, while the retarding influence of the air is far less for them at high speeds than for open wheels, especially those with many spokes, as in the bicycle wheel variety. This means less pull upon the saw, and consequently less danger of breakage. Nor are open pulleys so safe as solid ones, as foreign substances are apt to get between the spokes with results that may prove disastrous. A thick indiarubber tyre completes these pulleys: this forms an elastic bed for the saw to run on, and still further reduces the strain upon it at starting.

In the early forms of bandsaw machines the saw pulleys were formed with a radial flange to the outer edge upon the back side to prevent the saw running off, the edge being slightly coned upwards towards the flange to ensure the running of the saw against it. This is for some reasons an unsatisfactory arrangement, and is never used now for first-class machines. A better and more approved way is to have the spindle of the upper saw pulley adjustable from the horizontal in such a manner that the plane of pulley can be thrown out of line with that of the lower pulley. By this means the saw can be caused to run upon any desired part of its periphery, and a flange is not needed. Each saw requires its own special adjustment, as different saws run differently; a slight variation in their width or set causing a considerable variation in the positions they will run to on the pulleys. It will be readily seen that a wide saw lightly set is practically a flat band, whereas a narrow saw heavily set is essentially a triangular or wedge-shape band of pronounced form, and that an adjustment of pulleys upon which either of these would properly run would be such as the other would immediately run off of.

In some machines the upper pulley runs upon a fixed spindle, connected by a knuckle joint to the elevator, by which it is raised or lowered to suit saws of different lengths, its plane being thrown in or out of line with that of the lower pulley by means of an adjusting set screw that is always more or less inconveniently placed, and can only be operated when the machine is at rest. In other machines the pulley is made fast to a running spindle that works in bearings, usually adjustable for wear, that are connected to the elevator. In these the point or centre about which the pulley is adjusted to regulate the running of the saw is usually so far distant from the pulley that any alteration for the purpose of

adjustment alters the tension of the saw, in extreme cases to such a degree that the saw becomes unduly strained and may break. In addition to the advantage of adjustable bearings to take up wear, this arrangement has a very considerable advantage over the previous form, in that the running of the saw upon the pulley may be adjusted to the greatest nicety whilst the machine is working.

In the machine here shown the upper saw pulley is fixed to a running spindle that works in bearings adjustable for wear, but the centre about which the pulley is canted to suit the different saws is placed close against the pulley, thus avoiding any alteration of tension in the saw when adjusting same for running. The position and form of the adjusting screw have been specially designed to place it within easy reach of the operator when standing in a position where he can observe every movement of the saw upon the pulley. The lower end of the screw-stem is made to terminate in a small hand-wheel head, to enable it to be turned without the aid of spanners or the like. By this means the saw can be adjusted with far greater facility than is possible in other machines.

Another and a very important feature of this machine is that the lower saw pulley, like the upper one, is adjustable for cant relative to the other. This, though very desirable, has never previously been done. The means by which it is effected are both simple and novel, and this pulley can be adjusted with equal facility to the other.

8. The saw guides of this machine, both above and below the table, differ in many respects from those in general use. The most general and certainly the simplest form of saw guide consists of a block of hard wood severed across the grain, the saw working between and being laterally supported by the cut surfaces. Sometimes the block is but partially cut through, so that the back of saw runs against the wood; sometimes completely through, and the back of saw caused to run against a hard metal surface, usually of steel tempered dead hard. The saw cuts in these blocks quickly enlarge with wear, due to the friction and vibration of the saw, and are then comparatively useless to prevent any bending or twisting of the blade. This defect some makers seek to remedy by substituting metal guides in lieu of the wooden blocks at the sides of saw. Whilst the saw is clean and of even thickness this answers very well, but if the saw has been improperly brazed and the metal left extra thick or kinked at the join, or if it has accreted resin or other like substance from the wood during working, it is very liable to jam in these guides and break. Nor is the use of exceedingly hard steel bearings for the back edge of saw to run against free from serious objections. However hard these bearings may be the saw will surely cut into them, and, as constructed, are usually expensive to repair or renew. But a far more serious objection is that being so hard they compress and stretch the softer metal of the saw, producing at its rear edge a stress of increasing intensity that ultimately renders an otherwise good saw practically worthless, because once a saw breaks as the result of tensile weakness consequent on the action of this stress, it hardly pays to be repaired again, as break follows break in rapid succession.

The records of the Patent Office give evidence of much thought and ingenuity having been exercised to produce band-saw guides that a running saw would not destroy; the effect of the guide upon the saw being invariably overlooked, with the result that in nearly every instance the evils I have pointed out exist in these in an augmented form.

The saw guides of this machine are free from the objections urged to the foregoing. In this the saw is kept in line and prevented from bending or twisting by means of two friction rollers, one on either side. The bearings of these rollers are each connected to a thin steel plate that forms a stiff spring tending to press them closely together, and by means of a set screw to each can be adjustably separated for the saw to pass freely between; thus jamming is impossible consequent upon any increase in the thickness of saw by accretion upon its surface, or other causes, as any such increase of thickness would simply bring the saw in closer contact with the rollers, or cause them to yield outward subject to the pressure. The rear edge of the saw, both immediately above the work and below the table, is caused to bear centrally lengthways against a piece of thick wire several inches in length of some comparatively soft and self-lubricating metal, such as phosphor bronze, or any other more suitable metal that can be had. The object of having a long bearing surface for the back of saw to run against is to obtain an extended distribution of pressure, and consequently a small unit pressure of saw per unit length of bearing. By this means the back edge of the saw is protected from injury, and the wire bearing when cut into—which under these conditions takes place very slowly—can be partly turned round to present a fresh surface for the saw to bear against, or replaced by another piece in a very few minutes.

9. It has of late years become the practice of some makers to balance the weight of the top saw guides and attachments by means of a counterpoise, suspended by a cord or chain over a pulley near the upper end of the slide bar to which the guide block is attached. Thus balanced, the guide can be raised or lowered with ease and safety to suit the thickness of stuff, even during the process of cutting, as one hand is sufficient for that purpose. This is a great improvement over the unbalanced guide, and is one that every machine ought to possess. A disadvantage to the usual form of this arrangement is, that as the guide is raised the counterbalance descends, and is apt to be very much in the way. It certainly would be so in such a machine as I have described. There is also the risk of the supporting cord or chain breaking, or in some other way becoming disconnected, in which case the effect of the weight falling upon the table or the work would almost certainly prove disastrous. These objections I have provided against by suspending the balance weight within the hollow back of the standard, the cord or chain being guided over pulleys, as shown in the back view of the machine (Fig. 2).

This detailed and comparative description will be, I think, sufficient to clearly show the distinctive differences between this machine and others.

From what has been said, it will be understood that the principal object aimed at in working out the details of this table and its attachments was the production of a machine wherewith the twisted snake-like forms of handrail wreaths for stairways, and the rails of double curvature in circle-upon-circle work, could be cut by saw to the "squared" or straight line section to which this work is always brought before being moulded, it being evident that a considerable economy of production must thereby result, as the "squaring" of these rails by hand involves a large amount of heavy but highly skilled labour at the bench, and consequent expense. For this purpose it has proved an unqualified success; whilst for dovetailing, and the forming of angular and oblique cuts of every description, it has been found uncommonly useful. The ready facility, too, with which this table and its fences can be adjusted and operated in adaptation to innumerable conditions of constant occurrence in workshop practice, renders it even more valuable for general purposes than for the work for which it is specially designed.

SURFACE PLATES: A HINT.

BY ARTHUR BOWES.

An accurate surface plate is one of the necessary tools for the production of metal work where the various parts of a machine are intended to work in contact with each other with a minimum of friction and perfect regularity of motion. To produce this essential tool, the usual method is to adopt the procedure introduced by Sir Joseph Whitworth, and explained by him in a paper before the British Association just fifty years ago. Briefly described, the method is this—dealing first of all, for the sake of simplicity, with the production of a straightedge. Three straightedges are prepared at the same time, and after preparing each one singly, and bringing it to a moderate state of accuracy, two of them, which we will call A and B (see Fig 1), are compared with each other by placing them edge to edge. Any irregularities which may be found are removed, and the process repeated until A and B fit each other perfectly. The third straightedge, C, is now taken in hand and compared with both A and B, and when it is found that it will fit perfectly either A or B, then there is no doubt whatever that the three are all accurately straight—not perhaps mathematically straight, but approximating to the truth in proportion to the labour that has been spent upon them. Why this is so will be seen from Fig. 1, where it is obvious that if A is rounded instead of being straight, B may be hollow sufficiently to make them fit each other perfectly, but it is impossible that C shall fit both the rounded and the hollow straightedge.

In the case of surface plates the same system is adopted, three castings being worked upon in conjunction with each other, and compared in couples. As described in a well-known and valuable work, after working up one surface plate to the utmost perfection "its face is now thinly coated with ochre and oil, B and C being successively made counterparts of it by repeatedly placing them face downwards on A, and then lowering with the scraper all the reddened parts on which they bear. This must be continued till the contact between A and B, and A and C, is as perfect as possible." At first sight it would seem that these instructions, if carefully carried out, were sufficient to ensure accuracy in the plane surfaces, and it will no doubt be a surprise to many to learn that three surface plates may be made to compare with each other in this way, any one with each of the others, and fitting each other with such accuracy as to enable us to grasp the handles of the upper plate and lift up the lower one

by atmospheric adhesion, and yet they may be very far from being plane surfaces. Most readers of this Journal will know what is meant by a surface being "in winding"; for those who do not, Fig. 2 will explain what it is more clearly than a long description in words. It will be seen that the two

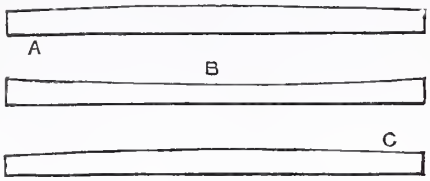


Fig. 1.—Method of preparing a Straightedge.

corners X and Y of the surface stand higher than the other corners—in fact, that the surface "winds" or twists. Now, the three surface plates under consideration may all be in winding, and yet fulfil all the above conditions.

Perhaps the easiest way to see the reason of this is to take three pieces of wood or cardboard, such as are lettered A, B, and C, in Fig. 3, insert drawing pins, or stick on wafers, or if you prefer it merely make pencil marks in the diagonal corners, in the position indicated by the mark X, and imagine that each of these marks represents a raised portion of the surface plate—that is to say, that the plate is "in winding." Now place your pieces of wood or cardboard

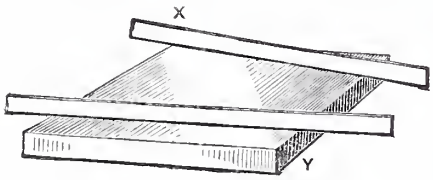


Fig. 2.—A Surface in Winding.

face to face in every possible combination, and you will find that shuffle and turn them end for end as you will, the raised corners will always come over the depressed corners, and if each plate is in winding to the same extent the error cannot be detected by laying one surface on the other.

What is the remedy? Well, having once seen where the possibility of error comes in it is easy to avoid it. The surface plates should not merely be laid upon each other in testing one with the other, they should be turned round through quite a quarter of a circle, when the high parts of one will be brought in contact with the high parts of the other with which it is being compared. In this manner only is it possible to ensure

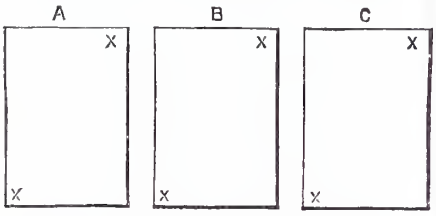


Fig. 3.—Diagram of Surfaces in Winding.

that the surfaces shall be perfect planes. A further extension of the idea might suggest that the best form of surface plate to ensure accuracy is *circular* and not rectangular—that is to say, in the form of a round disc or plate, and not in the form of a square or oblong piece of metal—whose four corners are right angles, as represented in the winding surface plate with straightedges applied to it, illustrated above in Fig. 2.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

Small Dynamos for Electric Lighting.

Winding Laminated Armatures.—Whilst winding the wire on the armature or the field magnets of a dynamo, great care must be exercised to get each coil of wire close to its neighbour, and each layer of wire regular and close to the layer beneath, for on this will depend the full efficiency of the machine. Slack and irregular winding will cause loss of power, and this is specially observable in the winding of the armature, where cross winding will not only prevent a sufficient number of coils being got in a given space, but also cause cross currents in the wires. But whilst giving all attention to the tightness and snugness of the winding, it is possible to be too zealous in this direction, and fall into the more serious error of pulling the wire so tight over the iron ends of the armature as to cause the iron to cut into the covering of the wire. One such abrasion of the covering, however small, will render the machine useless, as the current will travel by this small contact through the iron of the machine instead of through its wire coils. To detect such accidents as these (and they are of frequent occurrence) it is necessary to have a small galvanometer, or current detector, and with it test the insulation of the covering as we proceed. Almost any price may be paid for a galvanometer, from 2s. 6d. up to £10, according to the value of material and workmanship put in the instrument; but a plain and simply constructed one, good enough for this purpose, can be got for 10s., or perhaps less, from any vendor of dynamo castings. To test the wire for complete insulation whilst winding, connect the free end of it to one stud of the galvanometer; connect the other stud to one terminal of a good battery (one cell of a Bunsen or a bichromate will do very well), and attach a length of wire for testing to the other terminal of the battery. With the end of this wire touch the bare iron of any part of the armature (or of the field magnets whilst winding them). If the needle of the instrument moves, and is deflected to one side or other of the zero mark, we may take it for granted that the wire covering is abraded, and must then unwind each coil until the faulty place is discovered. Such faults are best repaired with a thread of unspun silk or of soft darning-cotton, soaked in melted paraffin and wound around the abraded spot. If the needle does not move at all when the iron is touched with the battery wire, we may be certain that the coil is insulated from the iron of the field magnet core, or from the iron of the armature. Greater care should be exercised in winding a laminated armature than in winding one having a solid core, since the edges of the plates are liable to cut through the protecting coat of silk and the covering of the wire, if this is pulled too tight over the edges. Some little difficulty also will be experienced in getting the coils of wire to lie close to the spindle whilst winding them on one side. This little difficulty may be met by tying each coil back with a short piece of tape, until the curvature of the spindle has been passed. In winding a laminated H girder armature for a Manchester field, the coils may be prevented from slipping at the ends by turning forward two of the laminated plates at each end, so as to form two flanges, against which the coils can rest as against the sides of the end slot in a solid armature. As there are no spindle holders to pass the ends of the coil through, we have to fasten them down to the sections of the commutator direct, to which they should be secured by soldering them to the inside edges. It will also be advisable to tie the ends down to the spindle with a few turns of tape, to prevent the outer coil from being shaken loose in working.

Winding the Field Magnet Cores.—Before winding the field magnet cores, it will be necessary to prepare them for the wire by wrapping around them a layer of silk ribbon well soaked in melted paraffin, and applied to the iron hot. This must then be made quite smooth. The wire must also be prepared for winding by first dividing the allotted quantity into two equal parts, making these into hanks or coils large enough to go loosely over a two-gallon stoneware jar, and well soaking them in melted paraffin. The wire may be divided by measurement, if it is found inconvenient to divide it by weight, if we remember that No. 22 B.W.G. d.c.c. copper wire measures 120 yards in the lb. The wire may be wound on by hand if the amateur is unprovided with a winder or a lathe, but it can be more regularly, smoothly, and tightly wound in a lathe, or by means of a winding apparatus. This can be easily and cheaply made up for the purpose out of a few scraps of wood, a few bolts, and a winch handle. Centre the field magnet casting in the lathe, and when it runs true, proceed to wind on the wire. If the hank of wire is placed over a glazed stoneware bottle filled with water, the coils will slip off easily as we wind the wire on the casting. Commence at the channel or bottom end of the core; wind some seven or eight inches of the wire on a pencil to form a close spiral, to be stretched out after winding to form connections with. Lay this close to the bottom end, take one turn around the casting, and secure the spiral to this with a piece of strong twine. Wind on the coils evenly side by side, and when within two inches of the end, lay in two four-inch lengths of tape under the last few coils on the outside of the core, leaving the ends hanging. Before winding back with the next layer, bring the ends down over the first layer, and thus secure the last few coils of the first layer from slipping away under the pressure of the next. If the ends of each layer are thus bound, there will be no danger of the overlying layer sinking in between the coils of that just beneath it. When the wire has been all wound on, tie the free end to one of the coils, or to the core, with a piece of stout twine. Serve the other field magnet core in a similar manner, testing each layer for insulation as the work proceeds; then coat the wires with a layer of sealing-wax varnish, and set them aside to dry. As the cores of some other field magnets are unprovided with flanges, this method of taping just described will be found very convenient in preventing slipping of the end coils, but flanges are preferable where these can be introduced, as they not only effectually prevent slipping of the end coils, but also protect the coils from injury when the pole pieces have to be screwed on after the cores are wound.

Fitting and Erecting the Machine.—The various parts having been prepared, we must now set about putting them together, fitting each in its proper place, and making the whole up into a dynamo-electric machine. The field magnets must, when at work, form the two limbs of a horse-shoe magnet, the extremity of one limb forming the north pole of the magnet, whilst its opposite forms

he south pole. It is well known that a traight bar magnet has two opposite poles -one at each end. One of these will ttract the south pole of a compass needle, nd is therefore called the north pole of the nagnet, its opposite being the south pole. f now we bend the bar in the shape of a orse-shoe, the two poles are brought near each other, but they still preserve their characteristic opposite polarities. If we wind an insulated wire around a piece of steel, or of iron, from left to right, and send a current of electricity in the same direction through the wire, we shall find that the left-hand end of the iron or steel bar has assumed a north magnetic polarity, and at the same time its opposite end has a south magnetic polarity. Bend the bar into the shape of a horse-shoe with the wire on it, and it will then resemble the two field magnets of this machine, with a hollow curve between the legs for the armature to revolve in. Now, we want to make the two field magnets like a horse-shoe magnet, with a north pole on one side of the armature and a south pole on the other side. As both of the cores have been wound from the bottom or channel end, it follows that if we send a current through each separately in the same direction in which they are wound, the two bottom cheeks would be both north poles, and if we connected the finish end of one coil of wire with the commencing end of the other, we should realise the same result; but if we connect the two finish ends of the coils together, as shown at Fig. 36, and send a current from the left-hand end to the right, it will enter at N, traverse the coils in the direction shown by the arrow, leave at S, cross over to the right-hand core, and traverse its coils in the opposite direction, thus causing a south pole at the bottom and a north pole at the top. How shall we determine the direction of the current? This is determined by sending a current from one or two quart Bunsen or bichromate cells through the coils, taking care to connect the carbon of the battery with N on the left, and the zinc of the battery with S on the right. As the current from a battery always starts from the zinc and moves towards the carbon, we can by this means always ensure sending a current in the right direction. When thus magnetised, the field

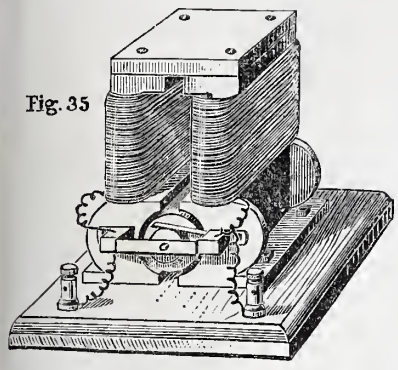


Fig. 35

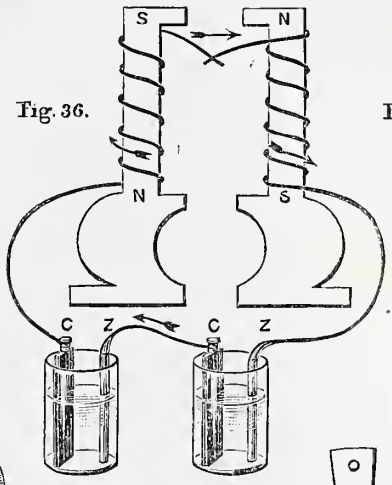


Fig. 36.

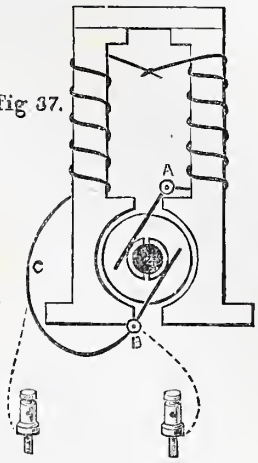


Fig 37.

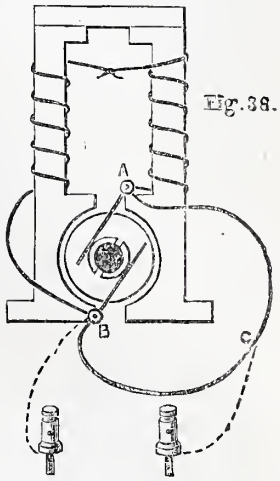


Fig. 38.

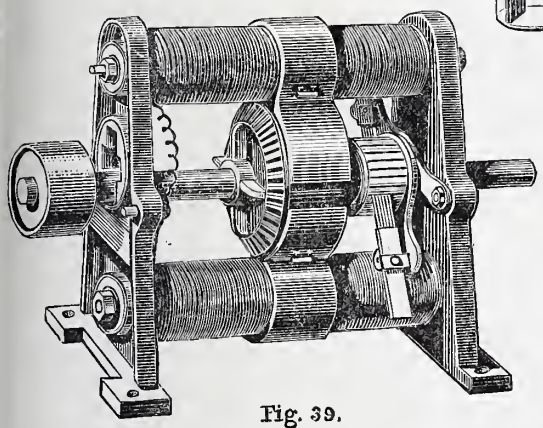


Fig. 39.

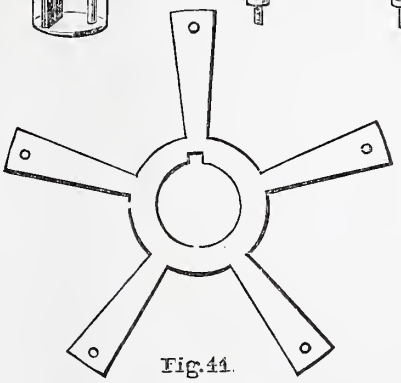


Fig. 41.

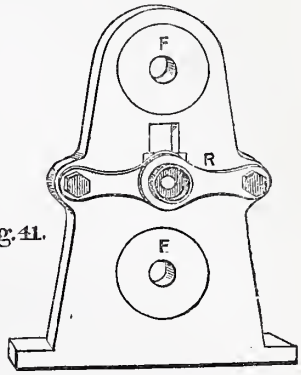


Fig. 41.

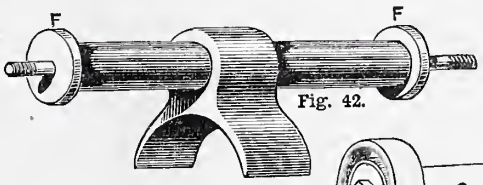


Fig. 42.

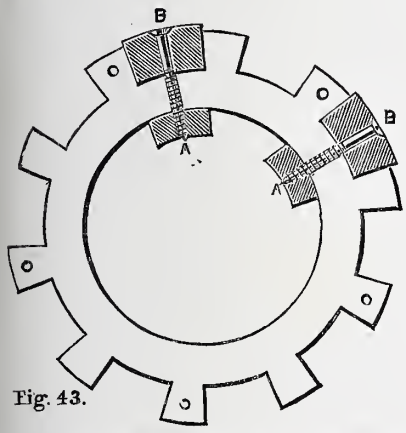


Fig. 43.

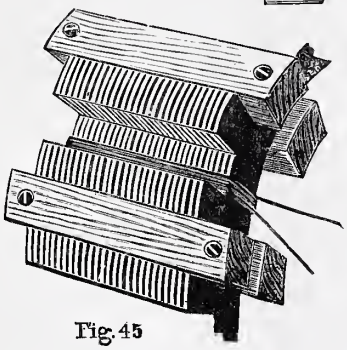


Fig. 45

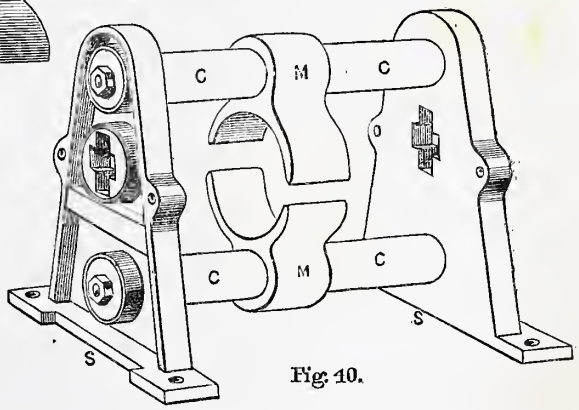


Fig. 40.

Fig. 35.—Model Siemens Dynamo complete. Fig. 36.—Diagram of Dynamo Field Magnets, showing how they are magnetised. Fig. 37.—Diagram of "Series" Connections for Dynamo. Fig. 38.—Diagram of "Shunt" Connections for Dynamo. Fig. 39.—Model Gramme Dynamo complete. Fig. 40.—Iron Carcase of Gramme Dynamo—S, S, Standards; M, M, Cheeks of Magnets; C, C, C, C, Cores of Magnets. Fig. 41.—Inside of Standard fitted with Bridge for Brush Holders. Fig. 42.—Magnet Cores with Flanges. Fig. 43.—Laminated Iron Punching for Armature. Fig. 44.—End Support for Laminated Punchings. Fig. 45.—End of Armature ready for winding.

magnets may be connected together and the machine set up.

The field magnets are fastened securely together by the yoke at the top, but to ensure proper rigidity and stability to the machine, they must also be firmly secured to a thick well-seasoned slab of oak, teak, walnut, or mahogany by short coach screws passing through the lower outstanding flanges. This may be trimmed at the edges, and nicely planed and polished, to ensure a finished appearance.

Making the Connections.—Owing to the simplicity of design, the Siemens machine lends itself readily as a subject wherewith to illustrate clearly how the wires of a dynamo should be connected. Figs. 37 and 38 show two distinct methods of connecting the wires. The method shown at Fig. 37 is known as connecting the machine in series—that is to say, the field magnets, the armature, and the work to be done in the outer circuit, may be regarded as three cells of a battery, and the whole connected up one after the other in one circuit, so that all the current must pass through each of them. Like a battery also, no current can pass through the field magnet coils until the outer circuit is completed. If one end of the field magnet wires is connected to the brush A, and the other end to the brush B, as shown in the diagram Fig. 37, the machine will be short-circuited. But if we break one of the wires at C, and take it to a binding screw, then take the piece hanging to B, and connect that to another binding screw, the two screws will form the two poles of the machine, to which the wires from the outer or working circuit must be attached. This method of connecting the wires is only suitable when the machine has to do steady definite work in which the resistance does not vary.

Fig. 38 shows a method of connecting the machine in shunt, as it is termed—that is to say, a part of the current generated in the machine is always passing through the coils of the field magnets, and thus they are always kept magnetised. This may be done in one of two ways. The wires are first connected as in the first case—that is, in series—and then the brushes A, B, are bridged with a fine wire offering a higher resistance than any work likely to be introduced in the outer circuit. The two brushes A and B are then connected by thick wires to the two terminal binding screws of the machine. This method has the disadvantage of opposing a useless resistance to the current in the circuit—one that absorbs heat and gives back no equivalent—and also, by means of this resistance, prevents the full power of the machine from being developed. The most approved method, therefore, is to wind the field magnets with a wire having a definite resistance, and this so balanced with the resistance of the wire on the armature as to ensure a definite output of electricity from the machine. The two ends of the field magnet coils are then connected to the two brushes, and these are both connected to the binding screws which form the terminal poles of the machine. The circuit is now divided, part of the current going through the work in the outer circuit, and part going through the field magnet coils. When the resistance in the outer circuit falls, less current goes around the field magnet coils; the E.M.F. of the current also falls, and thus the machine regulates its output of current automatically, since the strength of the current is proportioned to the strength of the fields. On the other hand, should the resistance rise in the outer circuit, the effect will be to throw more current through the field magnet coils through the shunt, and thus strengthen the fields to overcome the increased resistance. This is the method of connecting adopted in dynamos intended for incandescent electric lamps, and is applicable to all machines described in these series of papers. Those of my readers who may wish for more detailed information respecting the small dynamo just described may find what they require in a little book on "The Dynamo: How Made and Used"—a book for amateurs, by S. R. Bottone, published by W. Swan Sonnenschein & Co., price 2s. 6d. This little book of seventy-three pages deals in the first twenty-eight pages with the theoretical principles involved in the making of a dynamo; in the next ten pages it shows how to make the patterns for the castings of a small Siemens dynamo; and in the remaining pages gives practical illustrated details of its construction. It will be found to be a useful book for amateurs.

The Gramme Dynamo.—In 1871 a French electrician, named M. Gramme, invented a dynamo in which he used a ring of soft iron wires wound in sections with insulated copper wire as the armature. Although he was not the first to use a ring armature made of iron, he was able to patent his modification, and this gave birth to the form of armature which has since been modified and altered in many different ways, but is still known as the Gramme ring. The patent expired in 1884, and since that time the machine has been copied and the copies turned out in great numbers by makers who waited until this good time to avail themselves of the benefit of Gramme's valuable invention. Among the many modifications of Gramme's iron ring may be mentioned armatures made up of insulated hoop iron, flat rings of iron plate bolted together, and semicircles of sheet iron bound together with wire. All these, including the Gramme ring itself, must, however, be regarded as imitations of a discovery made in 1860 by Dr. Antonio Pacinotti, Professor of Technical Physics at the University of Pisa, in Italy. This renowned professor discovered that he could make a most efficient dynamo by employing as an armature, a cogged iron wheel with sixteen cogs, and winding between the cogs sixteen spirals of insulated copper wire. Here, then, was the first ring armature, imitated since in many ways by numerous modifications.

Among the several makers of dynamo machines who availed themselves of the expiry of the Gramme patents in 1884, was Mr. Alfred Crofts, of Dover, who commenced practice for himself as an amateur electrician, and developed into a professional one under the stress of circumstances induced by the wants of other amateurs. Mr. Crofts devotes his attention to the development and manufacture of the Gramme machine, because, as he says in his little book on "How to Make a Dynamo":—"The Gramme presents fewer constructional difficulties than some of its competitors, and produces a direct current at a moderate speed." Some idea of the general appearance of a Gramme dynamo will be gathered from the illustration (Fig. 39), which represents a small model Gramme machine complete.

The Carcase of the Machine.—The carcase of a Gramme machine differs in form and structure from that of other machines. A general idea of its form is given in Fig. 40, where S, S, represents the iron standards or supports; C, C, C, C, the iron cores of the field magnets; and M, M, the cheeks of the field magnets, forming a tunnel in which the armature revolves. The whole may be made of wrought-iron forgings, but the labour of making and fitting these would be a heavy task, and would never repay the amateur for his outlay in face of the fact that soft iron castings can now be so cheaply obtained from the makers. The castings will be received rough as they come from the foundry, and must be put into shape and fitted for use by the dynamo maker himself. The first thing to be considered and taken in hand will be the standards, one of which is shown at Fig. 41, fitted with a bridge for the brush holders. It will be seen, on referring to Fig. 40, that each standard has two projecting legs, one on each side. The uses of these are: in one standard to hold the bolts which support the bridge of the brush holders, and in the other standard to hold the screws which form the terminal poles of the machine. The bridge should be one of the iron castings sent with the carcase. This must be mounted on the face plate of a lathe, the inside of the hub of the bridge turned to allow the spindle of the armature to pass freely through it, and a ring formed on the outside of the hub to hold the ring of the brush holder. The holes F, F, above and below the bridge are for the bolts of the field magnet cores to pass through, and as it is most important that the flanged ends of these cores should be in clean and perfect contact with the iron of the standards, it will be advisable to mount the standards in a lathe and surface the rough iron within the radius of the rings shown, or enough to match the bright ends of the turned core flanges. Holes must also be bored in the feet of the standards, to receive bolts for bolting the machine to a bench or to the floor. The other standard must now be treated in a similar manner, but in this the holes in the lugs will be used, when plugged with ebonite to hold the terminal binding screws of the machine. The cross-shaped slits in each standard are intended to hold the brass bearings, which are fitted into the slits below the cross, and held in position by small wedges.

The Field Magnet Cores.—These are best when cast with the cheeks, or pole pieces, and the flanges in one piece, and also with the shank of a wrought-iron projecting pin or bolt embedded in the casting at each end (Fig. 42). Perfect contact is then ensured between all the parts, and this is important in order to maintain magnetic continuity between the pole pieces and their yokes—the standards. The outsides of the flanges where they are to meet the bright circles on the standards should be turned down true and bright, to ensure a clean and true fit. When both cores with their pole pieces have been fitted to the standards, the ends of the projecting pins screwed and fitted with nuts, and the cheeks are seen to hang in line with each other, it will be well to bolt all up tight, mark the positions of each piece by small nicks with a file, on flanges and standards, and drill two ⅜-in. holes (one on each side of the core) through each flange and into the standards to the depth of ¼ in. If iron pins are now fitted in these holes and fixed in the flanges, they will guide the workman in fitting the parts after the cores are wound with wire, and also ensure the cores being placed in their right position.

The Armature.—The armatures of these small model Gramme machines are not now made of iron wire, as in the machines made by their inventor. They are now built up of laminated punchings or rings of sheet-iron, cut as shown at Fig. 43, with a number of cogs on the periphery of each ring. It will thus be seen that the armature of the

Gramme machine is nothing more or less than a Pacinotti cogged ring armature. The number of cogs and intermediary spaces are arranged to suit the designer of each machine, and may be any even number, such as ten, twelve, fourteen, sixteen, and so on. In the small machine shown, the number is ten. As these small laminations run from fourteen to twenty-five to the inch in thickness, a large number of them are required to build up an armature. The method of building up is as follows: small holes are drilled in each alternate cog of each lamination, as shown at Fig. 43. These holes may be ¼ in. or ⅜ in. in diameter, but they must exactly coincide with each other through the whole number of plates, as they have to form continuous holes through the plates to admit brass rods on which the laminated plates are to be threaded. The rods must be of brass, to avoid magnetic complications in the armature when at work. Both ends of each brass rod must be cut with a screwed thread, and fitted with small hexagonal nuts. The plates must next be coated with good tough varnish, such as Japan or Brunswick black, and set aside until the varnish is dry and firm. They are then strung on the brass rods, and all bolted securely together to form one continuous ring or cylinder. This ring must now be mounted on a hub, which in turn has to be fixed to the spindle, whilst space must be left between them for winding the coils of wire. This hub must be of brass or of gun-metal, and is generally cast in two parts in the form of two wheels with projecting spokes, and sold with the other castings for the machine. One with five spokes, to suit a ten-cogged armature, is shown at Fig. 44. Each arm must have a hole drilled in it as shown, to fit the ends of the brass rods running through the armature plates. The holes in the centre must also be bored true to fit a spindle, and a key-way cut in each. When bolting these spiders to the armature, care should be taken to gradually tighten all the nuts, and so bring the plates and the spider snugly and tightly together without straining the threads. This done, the surplus thread should be cut off with a hack-saw, and each nut secured with a touch of soft solder.

Preparing the Armature.—As the winding of a Pacinotti ring armature differs from that of the Siemens H armature, some special arrangements must be made for winding on the coils. Each space between the cogs will be filled with a coil of wire, which will be wound by passing one end of the wire through the space between the arms of the supporting spider and around the combined thickness of the laminations, as shown at Fig. 45. As the space inside is slightly less than that between the cogs, there is a danger of the inner part of one coil encroaching on the wire space of its neighbour. To prevent this, Mr. Crofts employs wooden guides fixed between the cogs on the outside, and secured to other wooden guides inside the armature by long thin screws passing through the ends, as shown at Fig. 45, and shown in section at A A, B B, Fig. 43. These effectually prevent slipping of the wire coils whilst the wire is being wound on, and can be moved from one space to another as the work proceeds.

I must leave details of winding and other matters relating to this machine to be dealt with in my next article, in which I also hope to treat of the Manchester and the Simplex dynamos as used for model electric lighting. Those of my readers who may wish for a more detailed account of how to make a Gramme machine will do well to invest 2s. in the purchase of a little book of 102 pages, on "How to Make a Dynamo," written by Mr. A. Crofts, 7, Clarendon Place, Dover. In the compass of these few pages Mr. Crofts gives concise directions for making a Gramme dynamo, from the rough castings up to the perfect finish of the machine. As it is clearly written and profusely illustrated, it forms the best book on the subject for the amateur electrician.

HINTS TO WATCH WEARERS, AMATEURS, AND OTHERS.

BY HERR SPRING.

A MOST important matter in connection with the time-keeping qualities of a watch is what is known technically as "positions." Comparatively few are acquainted with the influence which the position in which a watch is placed exercises on its time-keeping qualities. The two chief positions that a watch naturally occupies in its ordinary life are those of hanging and lying. A watch lies on the dressing-table at night, and stands upright in the waistcoat pocket during the day. It may be that it is also hung up at night, in which case it is practically always in one position. But I will now deal with the effects of the two positions: namely, hanging and lying. Generally speaking, all watches gain when lying, and lose when hanging: a fact which is due to the friction being less in one position than in the other. It is not on the whole of the mechanism that there is an appreciable change of friction, but only on the pivots of the staff or spindle of the balance or fly-wheel. The fly-wheel of a watch is so sensitive that the smallest imaginable cause affects it, and, therefore, affects the time-keeping of the instrument. Take your watch out of your pocket, open it, and hold it so that the movement is in the same position that it occupies when in your pocket. Then observe the fly-wheel. You will notice that the pivots of the balance-staff are resting in both the jewel holes, and that the fly-wheel is suspended pretty much in the same way as the wheel of a wheel-barrow is suspended when being worked. In other words, the sides of the pivots are resting against the sides of the holes, hence there is the friction of both pivots to account for. But now rest your watch on the table in a lying position, and you will see that the balance must now be resting on the extreme point of the bottom pivot, and is practically spinning on the point like a peg-top. True, the top pivot is still in the top hole, but there is very little friction to be feared, for the spinning motion tends to keep the top pivot in the centre of the hole, and perhaps it scarcely touches the sides. You will, therefore, see the great difference in friction that may exist between a watch hanging up and lying down. Probably you will be able to detect this for yourself. Place your watch in an upright position, and observe the action of the fly-wheel. Before you move the watch, note particularly the extent of the motion of the fly-wheel. Then lay the watch flat on the table, and again observe the action of the fly-wheel. Almost without exception, the change of positions makes a difference in the motion of the fly-wheel. In the hanging position, the motion of the fly-wheel becomes small—or "drops off," as the technical phrase has it. In the lying position the motion of the fly-wheel increases. In very common watches this difference of motion in the two positions is sometimes enormous, but in very fine watches it is often scarcely appreciable. But where this does exist in a large degree, no good time-keeping can be relied on. This defect, even in the most perfect watch, can never be completely eradicated; but in very high-class watches, after everything has been done to equalise the friction of the fly-wheel pivots, the error in time-keeping can be corrected, in a large degree, by means of isochronisation. At the present, however, I am dealing with the average class of watches generally in use, and in this class there is usually a large degree of error in the two positions. I will now address myself to an imaginary country watchmaker, who knows how to take a watch to pieces and put it together again, and, perhaps, to execute a few repairs, but whose theoretical knowledge is limited, owing to the lack of opportunity. It is convenient for me to adopt this plan because my remarks will at the same time be, to a large extent, intelligible among amateurs and watch wearers. Let us suppose that some client, more particular than the general run of wearers, brings his watch to the country watchmaker, and complains that it *will not* go evenly, although he has "had it at many watchmakers." Now, a highly trained mechanic, like a highly trained physician, would probably diagnose such a watch almost at a glance. He would in a moment detect where the watch was made, make a shrewd guess at its age, perceive to what extent it had suffered at the hands of rough workmen, and probably pick out a leading fault, which would at once start a train of reasoning in his mind, leading up to some trouble in a hidden and unexpected part of the watch. But I am writing now for the benefit of those who are not capable of making a diagnosis of this sort, and such men have frequently to deal with watches which, while performing fairly well in an ordinary way, and never stopping, still give no great satisfaction. In such cases I would advise the country watchmaker, if he is ambitious to improve himself and to overcome difficulties, to try the watch in positions. But, first of all, he must see that the fly-wheel has a good motion—for it is of no use to attempt to obtain good results unless there is a good swing with the fly-wheel. A man suffering with the headache cannot be expected to do good mental work, nor can a watch with a poor motion be counted on to keep good time. Both are indicative of some interior trouble, which should be removed. Supposing, however, there is a fairly good action with the fly-wheel, and still the time-keeping is erratic. What is to be done? Let the country watchmaker wind the watch to the top (that is important), set the seconds hand exactly with the hand of a reliable regulator clock, and then lay the watch on its back, and allow it to remain thus for, say, eight hours, when it is again to be compared (the seconds hand of both watch and regulator to be at the 60, both when *set* and *compared*). He must make a note when he sets the watch and when he compares it, and mark down the result. Let us suppose that the watch has gained twenty seconds during the time, in which case his note would read as follows—although he can use any form of note which is intelligible to himself:—

Lying: Watch set at 9·30.
To be compared at 5·30.
Result in eight hours—Fast, 20 seconds.

The next day he must wind the watch to

the top, and having set it with the regulator clock, *hang it up* for eight hours, and then compare it. Let us assume that, in hanging, the watch has lost ten seconds, making a net variation of thirty seconds in eight hours in two positions. Of course, with such an error as this no watch could be expected to give satisfaction. Hence we must go to work to cure it. The first thing to be done is to try the shake of the lever on the banking pins. If they are too wide they must be closed a little. If the escapement appears to be a square and well-finished one, the bankings may be closer than if the escapement is a rough and clumsy one. But only practical experience can tell the precise shake required on the bankings. One good test is this: close the bankings until the lever has no shake, but is just free, then if the watch goes with the pins so close, you will be safe in giving but little shake. But do not forget that the shake of the bankings alters a little with the position of the watch—if it be lying on its back, on its face, or hanging. Therefore a shade of allowance must be made for this. Next try the curb pins, between which the hair-spring works. Move the index slowly round while the balance is at perfect rest. As you move the index, observe, with a very strong glass, if the spring always remains in the centre. If not, you must bend the spring until you can move the index from one side of the cock to another without the pins

Fig. 1.—Straight cut Jewel Hole. Fig. 2.—Rounded Jewel Hole.

unduly pressing on the spring while they are being moved. The reason for this is important. If you get your watch right in positions, and your index does not work in perfect circle, when you come to move the index, the curb pins, by pressing too much on one side of the spring or the other, would tend to destroy the adjustment. After this, take your balance out, and very carefully poise it. The poising is of vital importance. But you cannot poise accurately with the calipers. You must obtain a small poising table with two knife edges upon which to rest the tip of the pivots. Do not move the balance, when on the poising table, with any instrument; simply blow gently on it till it moves, and wait till the heaviest portion of the rim falls to the bottom (I am using the word "balance" now in place of "fly-wheel"). After you have poised the balance, carefully examine the pivots and also the two jewel holes. Very often the secret is to be found here. In ordinary watches the holes are, as a rule, too long and straight, with the result that the pivots have too much of the surface of the hole to work upon when in a hanging position. Hence, there is so much friction, that, in hanging, the watch goes slow. It is a good thing for the hole to be long—the longer the better, because there is then room for the oil. But when the hole is long and straight the friction is dreadful. Now, in the case of the watch which we are experimenting on, if the jewel holes are at all straight they must be altered. In any case, send them to the nearest jeweller, if necessary, by post, and ask him to polish the holes up a little inside, and, if need be, round them up. If you have a very strong glass—and you should have one in stock—you will in all probability find the holes like Fig. 1, whereas they should be like Fig. 2.

In Fig. 2 you have all the advantages of length and strength in the jewel hole combined with the minimum of friction, and it often happens that this alteration in shape, which the jeweller will do for you, reduces the error in positions most materially. Finally, have the balance pivots "touched up" nicely with a fine burnisher; examine the lever-notch, and, if rough, have that carefully burnished with a fine burnisher shaped for the purpose. Having done all this, put the watch together again, and try it hanging and lying for eight hours each way. We will suppose that the error in positions has been reduced from thirty seconds to fifteen seconds, and that so far a great victory has been achieved. In my next contribution I will deal with the remaining error.

A CABINET PHOTOGRAPH FRAME.

BY OMADAUN.

THE crescent moon has been used for decorative purposes in so many different ways that I almost hesitate to claim for my adaption of it the charm of novelty; yet so far as I am aware it is a conception of my own, and whether the actual design be novel or not, I think the frame as a whole will be new to most of my readers.

It is not possible to convey an adequate idea of its effect by means of an engraving, as it owes so much of its charm to the colour and materials used, in which, as it will be seen, there is considerable scope for variety, and I have not, therefore, attempted to give a sketch of the complete article, but a general idea of it can be obtained from the diagrams given to explain the construction, when I say that the crescent is painted or enamelled, and the mount covered with plush, the colours of course harmonising. I have used a pale "electric" blue plush, and lemon yellow for the crescent, which looks very well; but individual taste will differ, and various other combinations of colour will readily suggest themselves. The frame might look very well too I think if the crescent were gilded or bronzed with one of the various coloured bronze powders that can be obtained, but in any case the construction, which I will now explain, will be the same. It will be best perhaps to begin with the mount. For this we shall require a circle of wood which should be about $\frac{3}{16}$ of an inch thick (Fig. 1), and a similar one of stout cardboard (Fig. 2). The former has a piece cut out of it sufficiently large to take a cabinet photograph, an oval of the usual size being cut in the card mount, so that when the two are placed together with the openings coinciding, we have a rebated frame as shown by the dotted lines in Fig. 2, in which a glass and photograph can be fixed in the usual way.

One side of the wooden mount should now be covered with some tinted or plain white paper, which must be cut sufficiently large to admit of its being turned over the edge all round, the paper being also cut out and turned over the edge of the opening. The card mount has next to be covered with plush, the material being carefully and evenly turned over the edges in the same manner; the two mounts can then be glued together back to back, and left to set whilst we turn our attention to making the crescent.

The shape of this is shown by the dotted lines in Fig. 1. It will be seen that it is cut

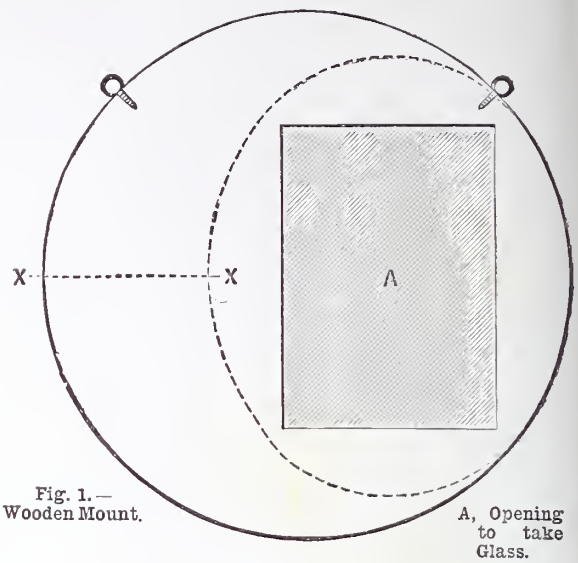


Fig. 1.—Wooden Mount. A, Opening to take Glass.

in such a way as to leave the exposed part of the mount in the shape of an oval, in the centre of which is the photograph. It is very essential that there should be an *equal* margin round the inner oval, so that care must be taken to get the crescent cut out correctly, and it will be found by far the best plan to make a full-sized drawing to work from. It should not be more than $\frac{1}{8}$ of an inch thick, and should be cut out with a fret saw from a piece of pine which must be free from knots, the wood having been pre-

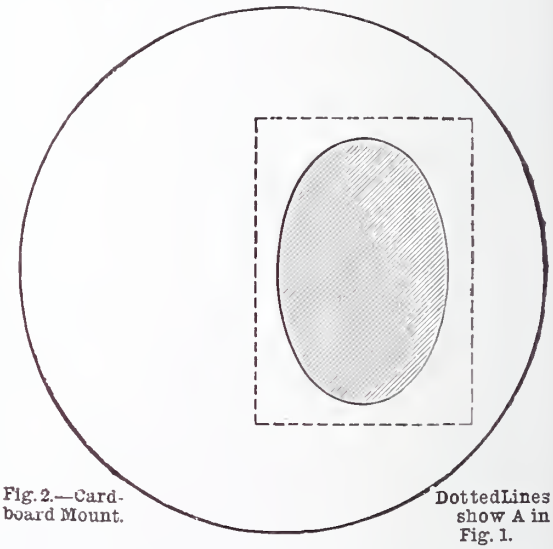


Fig. 2.—Cardboard Mount. Dotted Lines show A in Fig. 1.

viously planed and sand-papered. It is well to have the grain *across* the crescent, by which I mean that it should run between the two points marked X in Fig. 1, so as to have it running *with* the points as much as possible, as if running across them from top to bottom they will be very likely to get fractured during the progress of manufacture; when mounted, they will of course be protected.

The crescent has now to be enamelled. This sounds easy enough, and indeed is so if a little care is taken, but the enamelling or so called "Aspinalling" that I have sometimes

een, makes me think that a few words of dvice may not be out of place. To get a eally good surface it will be necessary to give t at least three or four coats of the enamel, lways letting one coat get *thoroughly* dry efore attempting to put on the next. The urface should be rubbed down quite mooth between each coat, either with fine well-worn sand-paper, or with pumice-tone and water; the latter being first round upon a wet flagstone to get a flat urface to work with. The last time, *i.e.*, before putting on the final coat, only just the gloss should be taken off, being careful not to make any scratches; by this means a smooth and even surface should be obtained. If it is intended to use bronze, a coat of the enamel should first be given, or even two, the bronze powder being dusted on with a camel-hair brush or pad of wadding when it is just "tacky."

All that now remains to be done is to glue the crescent in its place upon the plush mount. Be careful to get it set straight with the inner oval by trying it first and sticking a pin in the mount at each of the points; there will be no difficulty then in replacing and gluing it in position. Two eyes should be screwed into the edge of the wood at the back, by which the frame can be hung up.

The crescent might have a flower or small view painted upon it, or even a "Japanese" insect might be used; no doubt a painting would materially add to its effect, and if the trouble of enamelling is objected to, an alternative plan would be to use some ornamental wood, such as holly for instance, which could be left in its natural state. The diagrams given are drawn one-quarter size, the frame being intended for a cabinet photograph; they might, of course, be made for cartes-de-visite, but I think they would hardly be as effective on so small a scale.

MICROSCOPICAL WORK.

BY J. P. S.

MICROSCOPES are now so easily procurable at a cheap rate, that it is thought the following *wrinkles* on the preparation, etc., of specimens to be viewed under them may be of use to our readers.

Such objects are of two kinds as regards their optical properties—opaque and translucent. Many objects which in a state of nature are transparent can, however, be made objects of microscopic research by means of stains, of the use of which more anon. I intend in this article to treat only of botanical specimens. These are as a rule translucent—that is, they are viewed by means of light which is reflected from the mirror of the microscope, and then passes through the object to the eye of the observer. In order that the mounts may be a success, the specimens must be carefully prepared and handled.

As a preliminary, we may give a list of the materials which are required. The list does not pretend to be a complete one, but nevertheless it is one which will be found useful by the ordinary observer.

A good hollow ground razor, 3s. 6d.; two needles in handles; glass slides, 3 in. by 1 in.; one box of glass cover-slips, two camel-hair brushes, medium size; elder-tree pith; glass rods, 3 to 6 in. in length, about ⅛ in. in thickness, and sharp-pointed. A copper lifter (spatula); methylated spirit, 30 per cent., 60 per cent., and of ordinary strength; absolute alcohol; clove oil; Canada balsam dissolved in benzine; benzine; caustic potash (KOH), 1 to 5 per cent.; acetic acid, 1 per cent.; glycerine, 50 per cent. in water; glycerine jelly; olive oil, containing a very small quantity of carbolic acid; distilled water; and the following stains: aniline dyes, such as magenta and carmine, hæmatoxylin (logwood), Schultze's solution (chlor-zinc-iodine); iodine; methyl-green, etc.; a turn-table; a cabinet to hold slides—this may be made either of pine-wood or pasteboard. All the above may be obtained from the dealer's. The stains are, as a rule, sold in bottles, varying in price from 6d. to 1s. The different percentages of methylated spirit can easily be made up from the ordinary methylated spirit sold in shops by

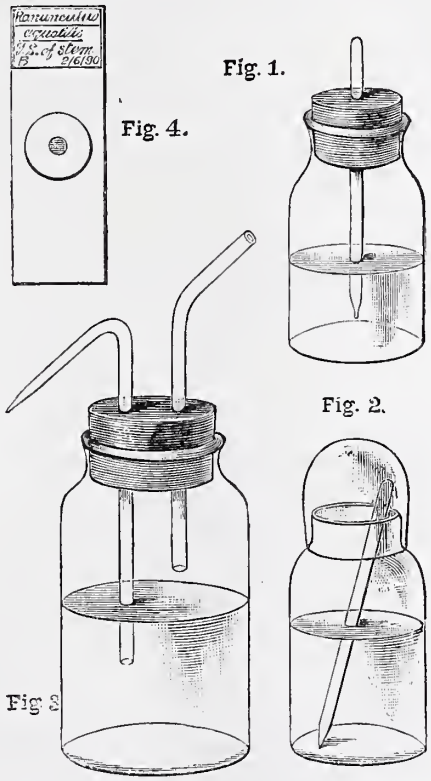


Fig. 1.—Bottle and Rod for Caustic Potash, etc. Fig. 2.—Ditto for Canada Balsam. Fig. 3.—Ditto for Methylated Spirit. Fig. 4.—Mode of mounting Specimen.

means of a graduated flask. These should all be kept well corked and carefully labelled. Bore a hole through the corks of the bottles containing the stains, caustic potash, glycerine, and glycerine jelly, and insert in each a glass rod. The size of the rod used will vary with the size of the bottle (see Fig. 1). The balsam should be put into a bottle having a ground glass stopper, and fitted to the bottle as in the diagram (see Fig. 2). It is convenient to put the methylated spirit in a bottle fitted up thus: select a bottle having a wide mouth; fit with an ordinary cork, in which bore two holes. In one hole place a glass tube bent at an obtuse angle; into the other insert a glass tube at an angle of 45° (see Fig. 3), and drawn to a point.

We are now in a position to commence work. Our method of procedure will be determined by the character of the specimen which we wish to mount. Suppose, for instance, we wish to make a transverse section of the stem of an herbaceous plant about ½ in. thick. Take a piece 1 in. or so in length; hold it in a vertical position in the left hand. Take the razor in the right hand, and blow some 60 per cent. of alcohol on the blade out of the wash-bottle; then cut the stem across at an angle of 90° with the vertical. The first section or two will not be of much use, but if care be taken the rest ought to be of such thinness as to warrant further trouble being taken with them. In cutting, draw the razor in a sliding manner from the heel to the tip of the blade; then take the section off the razor by means of a camel-hair brush, and place it in a watch-glass containing water (if the specimen is to be mounted in glycerine or glycerine jelly), and into one containing methylated spirit if it is to be mounted in Canada balsam. Always keep the razor wet with 60 per cent. alcohol.

When a thin object like the leaf of a plant, or a small object like an ovule, has to be cut, it is necessary to have some means of holding it. This is accomplished by making a slit in a piece of elder-pith, and inserting the specimen therein. Then pinch the slit portion tightly, and cut pith and specimen with the razor in the manner directed above.

It is sometimes unnecessary to cut the specimen into thin slices. If the epidermis, or outer covering, of a leaf, for instance, is to be examined, the leaf is placed in KOH for a short time, say a few hours, then wrapped round the first finger of the left hand, upper or lower, surface upward, as the case may be. After this, a slit is made by means of a sharp knife along the mid-rib, and the skin peeled gently off, from the mid-rib outwards.

There are three media in which botanists as a rule mount their objects. These are glycerine, glycerine jelly, and Canada balsam. To these may be added a third—acetic acid 1 per cent. We will proceed to consider in detail the processes that an object must go through before it can be considered ready for mounting in either of these. In the first place, we may remark that caustic potash and "eau-de-javellë" are used as clearers for those about to be mounted in glycerine, glycerine jelly, or acetic acid.

"Cleanliness is next to godliness" is an old saying which finds practical application here. Unless you keep your slides, cover-slips, and in fact all the paraphernalia of mounting, absolutely clean, your specimens will be spoiled as objects of microscopic research—which misfortune will not put you in a sweet temper, especially if elaborate preparations for mounting in Canada balsam have been completed.

1. *Mounting in Glycerine, or in Glycerine Jelly.*—The advantage of the use of glycerine is that it does not easily evaporate, and has a high refractive index. Objects which have been stained in carmine, hæmatoxylin dissolved in ammonia, or with aniline colours, also those cleared by caustic potash, etc., may be at once mounted in glycerine. Thoroughly clean your glass slide, and dry it with a linen duster. Then clean a cover-slip in the following manner: take the slip edgewise between the thumb and middle finger of the left hand; breathe gently on both sides of it, and rub it up with an old fine linen or silk handkerchief held between the thumb and middle finger of the right hand, being careful to keep the tips of the fingers always opposite one another, otherwise the thin glass will easily be broken in the process. When the cover-slip is clean lean it against some object; never place it flat on the table.

We are now in a position to proceed with the permanent mounting of the specimen. Place it in the centre of the slide and keep it

wet, otherwise air-bubbles will be sure to make their appearance. Should these be present, they can easily be got rid of by placing a little methylated spirit on the specimen. This operation may have to be repeated three or four times before the air-bubbles have quite disappeared. It is very important to get rid of them at this stage, especially if you are about to use glycerine as the mounting medium. The presence of air-bubbles has ruined many an otherwise fine specimen. We will suppose then that they are now conspicuous by their absence. Place two or three drops of glycerine on the top of the object by means of a glass rod; take the cover-glass *edgewise* in your left hand and a needle in your right. Adjust the edge of the cover-glass on the slide in a position near the specimen, and gently lower the glass with the aid of the needle on to the top of it. We say *gently*, because if done rapidly air-bubbles would probably appear. The specimen thus mounted will keep a very long time, but the cover-glass is apt to slip out of its place and leave it lying exposed on the top of the slide. It is advisable then to "ring" it. Clean off by means of blotting-paper any glycerine which may be on the slide outside the cover-slip. Fasten the slide to the brass disc of the turn-table by means of the clamps. Now see that the circumference of the cover-glass corresponds in position to that occupied by one of the concentric circles on the brass disc. Dip a camel-hair brush in the zinc white, hold the brush in the right hand, rest the hand on the turn-table, and cause the brass disc to revolve by turning the screw placed beneath it for that purpose. Do not turn it too quickly at first. While the ring is revolving, lower the brush in such a manner as to cause it to touch at once the slide and edge of the cover-slip. This must be done gently, as the cover-slip is apt to shift out of its place. A ring of cement will now be left round the object which will firmly fix the cover-slip to the side. The operation must be repeated next day or the day after, in order to make sure that the object and its surroundings are perfectly air-tight, else the glycerine will ooze out, and your work will have been of no avail.

Glycerine jelly is a mounting medium preferable to glycerine, because it hardens, and the mounts may then be kept without ringing any length of time, provided they are laid in a dry place. Raise up the cork of the bottle containing the jelly, and then place the bottle by degrees up to the neck in a vessel of boiling water. When the jelly has thoroughly melted, mount the object in it in the same manner as described for mounting in glycerine. Should air-bubbles be in the specimen after it is mounted, they may be got rid of by the following means, devised by Dr. Wilson, of St. Andrew's University. Heat the mount gently over a spirit-lamp until the jelly begins to boil, then rub the slide firmly over a *cold* glass surface. The contraction of the jelly, due to the sudden cooling, forces out as a rule the whole of the air-bubbles. The only disadvantage to this rather rough-and-ready method of procedure is that it cannot be applied to delicate structures. Allow the jelly to stiffen, clean off any superfluous material, and ring the slide as before. If, as stated above, the slide be kept in a dry place, it need not be rung at all.

2. *Mounting in Canada Balsam.*—This is the most complicated method of mounting, but the results obtained, we think, amply repay any trouble entailed. The object must in the first place be thoroughly soaked in methylated spirit, and then be well saturated in absolute alcohol. The absolute alcohol removes all traces of water which were in the methylated spirits. Clove-oil is the next substance to which it must be transferred. Here a remarkable change will be noted; the absolute alcohol is driven out, and the object becomes almost transparent. The methylated spirit, absolute alcohol, and oil of cloves should each be poured into a watch-glass. The specimen is placed in the watch-glass containing the methylated spirit, and when it is thought that the alcohol has had time to penetrate the whole of its tissues it is transferred to the absolute alcohol. Absolute alcohol is a somewhat expensive material, and evaporates readily, so place a cover over the vessel containing it, and always keep your supply in a well-stoppered bottle. When the absolute alcohol has taken the place of the methylated spirit—the time occupied by this process varying with the thickness of the object—transfer the object to the watch-glass containing oil of cloves. The transferences should always be done by means of a carefully cleaned camel-hair brush, especially if the specimen be a delicate one; if it be a coarse one, a needle or spatula may be used. The clearing process now undergone by the specimen renders it necessary that it should have been well stained before being put into the methylated spirit. After the oil of cloves has thoroughly taken possession of the object it is ready for mounting. Place it in the centre of the slide as formerly, and place gently a drop or two of Canada balsam on it, being careful about the presence of air-bubbles. These can, as a rule, be easily expelled by placing the slide in a water-bath or by heating it *gently* over a spirit-lamp. At the same time, the balsam hardens to such a degree that there is no necessity for "ringing" it. Should you wish, however, to make it appear neat, clean off the superfluous balsam, *after it has thoroughly hardened*, first by means of a knife, and then by using a cloth soaked in benzine. Now put a ring of gold size round the edge of the cover-glass, and then when this is dry ring as before. It must be well noted that the ring of zinc white must not be put on immediately after cleaning off the superfluous balsam: the result would be disastrous; the Canada balsam and zinc white are both dissolved in benzine, consequently they would mix, and so ruin the specimen.

3. *Mounting in Acetic Acid* (1 per cent.).—First ring the slide with zinc white, making a ring of such dimensions that its outer edge would come a little outside the edge of a cover-glass. When dry, place a drop or two of acetic acid in the cell thus formed, and transfer the object to it. Then lower the cover-glass on the top of it, wipe off with blotting-paper the acid outside the cover-glass, and ring as formerly. The superfluous acid is best dried off by using a piece of blotting-paper the size of the slide, and placing it flat on it. Be sure not to have air-bubbles in the cell. If the preparation be one of the green parts of plants, and it be wished to retain the chlorophyll, this method of mounting will be found very useful.

Now a few general hints as to the methods of procedure noted above. Always keep the razor and specimen wet with weak alcohol or water. Alcohol dissolves chlorophyll, so do not put a specimen in which it is desired to retain the whole of the chlorophyll among alcohol. If the presence of starch is to be detected, use a dilute solution of iodine. Iodine turns starch blue. Label a slide before putting it away. Supposing the specimen were a transverse section of the stem of *Ranunculus aquatilis*, you would label it as in the diagram (see Fig. 4), in which T. S. denotes transverse section, and B Canada balsam, the supposed mounting medium.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

110.—ASHLEY'S "CELUZON."

THE material to which Messrs. Ashley & Company, Crossgates, near Leeds, have given the name of "Celuzon," and which is manufactured by them, is a recently discovered composition for the bleaching, cleaning, and polishing pianoforte keys of celluloid, xylonite, and ivory. It is also effective in removing the gum that arises from the wood after being newly French polished, previous to using the reviver. "Celuzon" itself is in the form of a tablet, and resembles a small cake of soap, although it is of far greater density than that cleansing material; and though I do not for a moment pretend to say that this is its actual composition, it seems to consist of some highly levigated material, such as clay mixed with and held together by some saponaceous matter. Pianoforte keys of celluloid or xylonite, being composition, show scratches, and turn yellow much quicker than ivory keys; they are also subject to discoloration from perspiration of the fingers. Such keys should never be scraped on account of their thinness. In order to restore their pristine colour and to polish them at the same time, all that is necessary is to rub the key briskly from end to end, after its removal from the pianoforte, with a block of wood covered with leather, which must be damped and rubbed over with "Celuzon" before using it. As the work is so simple, it can be done by a boy or girl. Ivory keys are cleaned in the same way, if they are not much discoloured, but if very yellow with age they should be first scraped. For removing the gum or dulness that generally shows itself on all wood that has been newly French polished, all that has to be done is to scour it off by means of a piece of flannel damped and rubbed on the "Celuzon"; then apply a reviver, and the wood will appear as if newly French polished. Thus it is useful for renovating the polish of the wood case of a pianoforte as well as the keys. "Celuzon" is sold in tablets at 3d. singly, or at 2s. per dozen, or 18s. per gross.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

**** In consequence of the great pressure upon the "Shop" columns of WORK, contributors are requested to be brief and concise in all future questions and replies.*

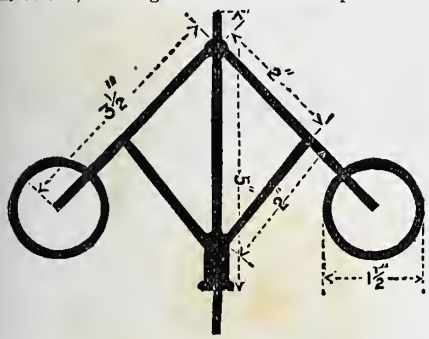
In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.

I.—LETTERS FROM CORRESPONDENTS.

Articles in WORK.—G. W. S. (*Stockport*).—A post-card has been handed to me, addressed by you to Mr. J. W. Harland, asking him if he can put articles in WORK on "Portrait or Landscape Painting" and "Heraldic Painting on Carriages."

and, if so, if he will do so as soon as possible. As I find from various letters that many seem to be under the impression that Mr. Harland's functions are editorial, let me at once remove this idea from the minds of all readers of WORK by saying that Mr. Harland's duties are simply those of secretary to the "Work" Exhibition, and that the editorial management of WORK, including the introduction of particular subjects, and the acceptance or refusal of papers sent on approval, rests entirely in the hands of THE EDITOR.

Governor for Half Horse-Power Engine.—J. M. P. (*Nottingham*) writes:—"In WORK, Vol. II., page 294, F. A. M. gives your correspondent W. W. (*Glasgow*) dimensions for a governor. Now, whilst agreeing with much that F. A. M. writes, I must say that his dimensions are too large for this sized engine. I was troubled in the same way as W. W., and could not get any proper dimensions, so set to work and experimented till I found one suitable. My engine is 2½ in. bore, 4 in. stroke, running at 200 revolutions per minute



Engine Governor.

at 40 lb. pressure. I enclose sketch showing measurements, which I have found suitable, and may say that my governor controls the engine immediately there is any variation of load or beam. It runs at a speed of 100 revolutions per minute, and develops a surprising amount of power. I do not think my engine varies so much as ten revolutions per minute, which I should take as a large amount of variation, and one that would cause irregular running. I can assure W. W. that he will be satisfied with this governor."

Weighing Machine.—ERRATUM.—In this reply (see page 618, Vol. II.), for "out" read *all*.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Condensers.—J. H. H. (*Belfast*).—The lantern described is intended to be fitted with 4 in. condensers. You will, therefore, find it quite correct to follow the dimensions given. The condensers are not to be fitted into the woodwork, as you appear to imagine, but they are fitted to a collar attached to the metal stage-plate of the lantern front, as you will find by referring to the description of the instrument on page 494, No. 83 of WORK. The openings in the woodwork must naturally be larger than the condenser, as they require to take the lens and its containing collar.—C. H. P.

Decomposition of Water.—H. T. M. (*Harwich*).—This is impracticable, owing to the high resistance offered by water. The experiment you mention is performed with a dilute solution of sulphuric acid electrolysed with a current of from four to six volts. Three Bunsen or bichromate cells arranged in series will provide sufficient E.M.F.—G. E. B.

Picture Frames. — AMATEUR. — For making compo. for picture frames, etc.:—To a stone of whiting take 7 lb. of resin, 7 lb. of glue, 1 quart of raw linseed-oil, 3 lb. of pitch; boil together in a large iron cauldron for three hours, then mix together with dry whiting (crushed); well knead it together upon a board; it will then be ready for your moulds, and will keep for months.—G. C. R.

Circular Saw.—H. G. (*Little Bolton*).—I know of no book treating on the practical working of the circular saw, but you can get books on woodworking machinery, published at 13s. and 25s. each (in which there may be some useful information in reference to the working of saws), of William Rider and Sons, 14, Bartholomew Close, London. There is a deal of information in back numbers of WORK.—A. R.

Mounts.—W. G. J. (*Portsmouth*).—For cutting card mounts for pictures, see "Shop," August 10, 1889, page 333, and again December 28, 1889, page 652. Tools are only knife-blades specially made for this trade, and shaped like a harpoon, both edges sharp; cost 1s., of any first-class tool maker; a screw-handle for about 2s. 6d.—G. C. R.

Book on Electro-Plating.—ARGENT (*Pendleton*).—Messrs. Crosby Lockwood & Co., London, publish a book on "Electro-Plating," by Mr. J. W. Urquhart: the price is 5s. Messrs. Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C., have a book in the press that will just suit your purpose. It is named the "Electro Plater's Handbook," and will be published at a low price, say 3s. or 3s. 6d., to suit amateurs. I am also preparing some articles on "Gilding and Silver-Plating Jewellery," and these will probably be published in WORK.—G. E. B.

Polishing.—JEAN.—In all probability your piano requires repolishing. It is not at all an uncommon occurrence for new polish to go more or less. The defect is frequently owing to what is known as "sweating"—*i.e.*, the oil in the wood exudes through the thin coating of polish, and by dust adhering to it the surface presents a reticulated appearance, being covered with fine dull thin lines. This sweating is to a great extent unavoidable, and Burr walnut is specially liable to it. If this is all that is the matter with your piano, you may be able to put it right by washing off the sweat with warm water; or, better still, with a reviver composed of linseed-oil, French polish, and vinegar. If all the polish has gone, there is no alternative but to repolish. If your piano is one of the low-priced Continental ones, and has not been repolished by the vendors here, very probably the polish has perished. I have often noticed on goods of this class that, though the polish while they are new is very brilliant, it does not last, there being apparently no body to it. You must not take any of these remarks as implying that the vendor is any way to blame. Read the article entitled "Hints on Repairing Furniture," which appeared in No. 93 of WORK, page 658.—D. D.

Patent—Altering Specification.—H. R. (*Paddington*).—Assuming that the two materials are merely for convenience of manufacture, and are not an essential part of the invention, we see no reason why H. R. should not use the one only, for the invention will then continue to be "substantially the same." In his complete specification, he can say that "by preference" he makes use of one material only. In our illustration of the wheelbarrow to which he alludes, the essential part is the use of the single wheel for removing burdens, and the thing will be substantially the same whether the barrow be made of wood or metal. We are presuming that the subject of our correspondent's patent is a mechanical invention, for if, instead, it were some chemical compound, the materials would probably be the essential part, and to change them would be to cause a "substantial" difference. H. R. may find assurance in the reflection that a main object of provisional protection is to enable the inventor to perfect his invention, and completely to ascertain its nature, and how it may best be carried out.—C. C. C.

Chimney Pot.—J. L. (*Guernsey*).—If your fire will not burn properly without a revolving top, you can get one made fireproof at an extra cost of 5s. to 10s. They are made of strong galvanised iron or steel, with riveted joints, or in case of very intense heat copper could be used, but this would be very expensive. Makers are Gibbs & Son, Liverpool; Boyle & Son, London; Kite & Co., London; and many others. You will probably get them through a local ironmonger, but are you quite sure a revolving top is needed? as I had a similar chimney with a revolving top, and on account of it getting stopped with soot, I tried the fire without it, and except in a severe gale it burns as well without the revolving top. You might try yours, and if it burns anything like without the revolving top, fix a fire-brick pot, of which I send two designs made for exposed

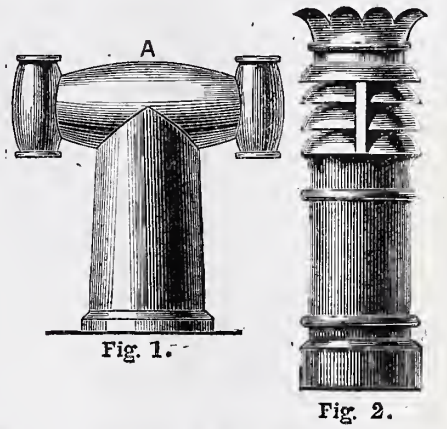


Fig. 1. Fig. 2.

Fire-Clay Chimney Pots for Exposed Situations—A, Wind Guard.

situations; I should recommend Fig. 2; they can be obtained from a dealer in builders' materials. If your chimney has only one flue, and is high and detached from the building, you should stay it by iron rods to the nearest wall or roof, or it may blow down with a heavy pot on the top.—M.

Winding Model Gramme Dynamo.—C. B. (*Chapel-en-le-Frith*).—Very little in the way of electric lighting can be done with such a small machine as that of which you send a sketch. It is a model of a Gramme dynamo. On the small cogged armature of 2¼ in. by 1½ in., with gaps between the cogs measuring ⅛ in. by 1/16 in. you will only be able to get forty-two yards of No. 24 silk-covered wire (weighing about ¼ lb.), as this will have to be wound in seven coils, and as only half of each coil can be reckoned upon as being efficient, you can only expect an E.M.F. of three volts from the machine when driven at a speed of 3,000 revolutions per minute. As No. 24 wire will only safely carry one ampère of current, you must choose a lamp of low resistance, such as a small pea lamp, requiring a current of less than one ampère, and this will give a mere spark of light. Do not mount the armature on a wooden hub, or it will soon shake loose, but mount it between two "three arm" brass spiders secured by studs to the cogs of the armature. Wind as much No. 24 wire on the armature as you can get on, and put 1 lb. of No. 24 on each core of the field magnets.—G. E. B.

Lathes and Smithing.—G. W. (*Brockley*).—All branches of smithing and lathe matters will be treated in course of time in WORK.

Marbling.—W. H. (*Benzon St.*).—You should obtain "The Whole Art of Marbling as Applied to Paper, Book Edges," etc., by C. W. Woolnough, 10s. 6d.; Bell & Sons, York Street, Covent Garden, London.—K.

Photo Tent.—R. H. (*Bradford*).—There are tents and tents. As to their construction, very much depends on the use to be made of them. In the wet collodion days they were portable laboratories of considerable weight, now they are seldom used except for the purpose of changing plates, and are, as a matter of course, very much slighter

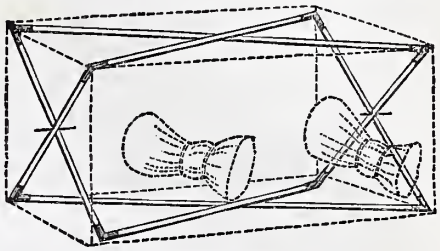


Photo Tent.

in make. A square or oblong bag of black and yellow twill, with sleeves, and distended with bamboo rods, is an efficient and light apparatus, one sleeve being of sufficient width to allow the dark slide to be passed inside; and the changing of the plates is effected by feel only, easily done with a little practice. The sleeves are constructed in two places a few inches apart, with indiarubber bands to prevent access of light. The framework consists of two end pieces, straight pieces of bamboo, crossed and riveted through, that can be folded parallel when not in use; four other pieces the length of the bag are fitted into sockets at each end of the cross-pieces, and when in place extend the bag to its utmost dimensions. When not in use, it rolls up together in a small compass, and is most convenient for travelling. The accompanying diagram will explain. The dotted lines show the bag and sleeves.—D.

Engine for Lathes.—F. P. (*Andover*).—A gas-engine is cheaper than any other form of motor, because there is no expense beyond the precise amount required for actual driving. It occupies least room, there being no boiler. Much depends on what opportunity you have for getting cheap gas; the best plan is to obtain prices of steam and gas-engines from different makers, and then estimate the relative cost. Crossley's, Manchester, are the best gas-engine makers; Hindley of Bourton, Dorsetshire, makes small cheap steam-engines.—J.

Paddles for Model Steamer.—T. H. B. J. (*Wesham*).—For a 4 ft. model, the diameter of the paddle-wheels should be about 9 in., but the exact dimensions, of course, will depend on your water-line. You should, if you have a high water-line, make the wheels smaller, or they will overpower your engines. It is much better to err on the side of having them too small than otherwise. A good size for the floats is 2 in. by ⅞ in.—G. J. E.

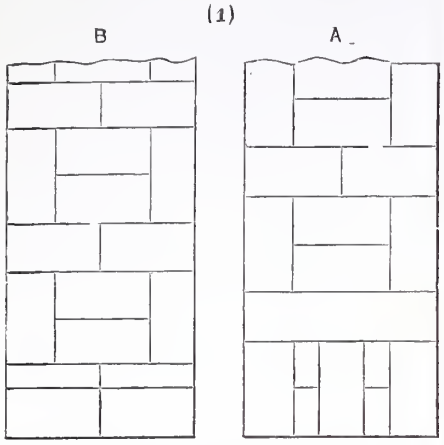
Overgraining Oak.—T. B. (*Northampton*).—With respect to putting in dark veins upon "maiden oak," I have made little if any reference thereto in the series on graining, because such markings are very scarce in real oak, and if imitated they do not conduce to natural and woody effect. The ordinary plan is of painting them in with vandyke in water, using a veining fitch after the work is shaded and softened. Those workers who use dark veins generally put them on rails or stiles. The most natural effect is got by wiping some of the colour out along the middle of the veins; we get transparency thereby and less "paintiness." Soften with the badger across the veins. Sometimes oak is shaded in oil glaze, and in such cases the same is used for the veins; but water-colour is the most convenient and quickest. The graining roller—viz., for dark pores—can be used either with oil or water-colour. If the latter, it is worked with a little vandyke after all other shading is done. Best burnt umber rubbed up with a little terebine is used for working it in oil. There is no reason why, with practice, you should not get perfect rolling.—DECORATOR.

A "Backlined" Drawing—NEMO—is one in which in order to show without shading all projections, the left-hand side and top lines are thin, whilst the right-hand and bottom lines of each part are drawn in rather thick and black. Mechanical drawings are always supposed to be shaded, as if the light fell at an angle of 45° from top left-hand corner; and every line opposite to the light, *i.e.*, on which no light falls, is *backlined* in unshaded drawings to express what shading would otherwise do.—J. W. H.

Elementary Examinations.—Answers to questions appearing on page 404, Vol. II, in the "Elementary Examination on Building Construction for 1890."

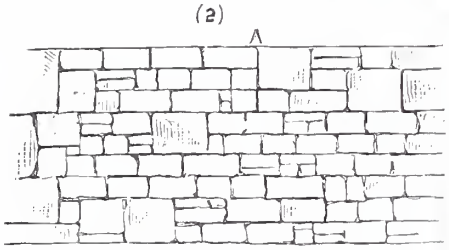
1. Plan of two courses of an 18-in. wall built in Flemish bond, showing the proper arrangement of the bricks in the two courses.

(1)



2. Elevation of part of a stone wall built of squared rubble worked up to courses. In this class of work vertical joints are sometimes allowed, providing

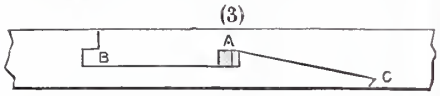
(2)



they are not more than the height of a course in work built in courses as at A.

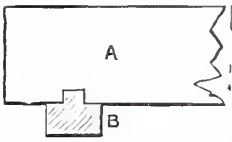
3. Elevation of two 13-in. square balks of timber

(3)



scarfed together, and secured with hard wood wedges at A. These wedges are drawn rather out of proportion for the sake of clearness. The scarf B is used to resist compression, and the one at C to resist tension.

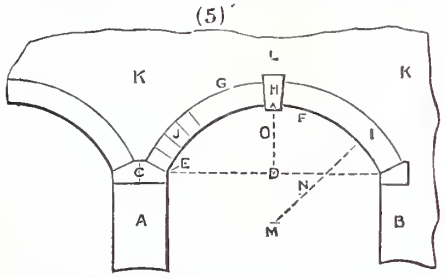
(4)



4. Section of a beam cogged on to a wall-plate. A is the beam that is notched, and B is the plate having the cog left on.

5. Elevation of a stone arch, giving the points of all the different parts of the structure.

(5)

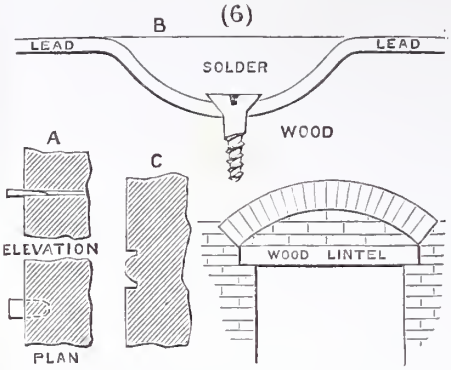


6. The wood plug as shown is the form generally used for fixing woodwork to brickwork when no provision has been made in building the wall. Lead dots are used where it is found necessary to screw the lead to woodwork. The woodwork having been previously hollowed out, the lead is dressed into the hollow and then screwed down sometimes with two screws in each dot slanting in opposite directions, and then filled with solder to protect the screws and cover the hole made by them, likewise to bring the whole to a fair level. The form of bead known as double quirk is more often used in plastering to indicate the skirting and dado when it is necessary to have no projections. In fixing a wood lintel, a rough relieving arch is generally turned over it to protect it from the weight of wall above, but the arch must abut on the wall, and not rest on the lintel.

7. Elevation of a queen-post truss, the iron straps at A being secured by means of iron wedges, etc., called gibs and cotters, at B by means of nuts and bolts, and at C by coach screws.

8. Plan of part of an 18-in. brick wall built in English bond, showing the arrangement of the bricks in one course. B is a vertical section of the above through A A with the footings.

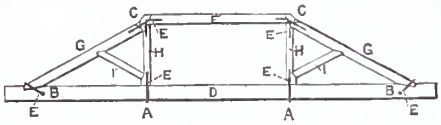
(6)



9. Section of a cast-iron cantilever, the upper flange of which, being in tension, is the larger.

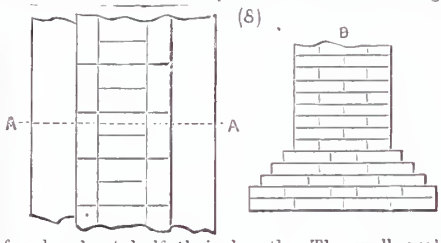
10. Elevation and vertical section of a four-panelled door, showing the top panels, bead, and butt, and the bottom panels, bead, and flush.

(7)



11. Section through the eaves of a roof, showing slates centre-nailed to a 4-in. lap. This is a good way of laying large slates, as from the position of the nails the wind acts upon them with a leverage

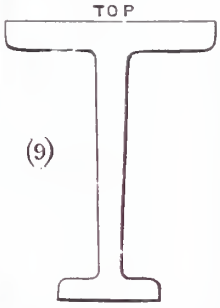
(8)



of only about half their length. The wall, wall-plate, gutter, etc., are omitted.

12. Elevation of part of an iron roof truss, consisting of T iron principals, two angle iron struts, and five tension rods.

(9)



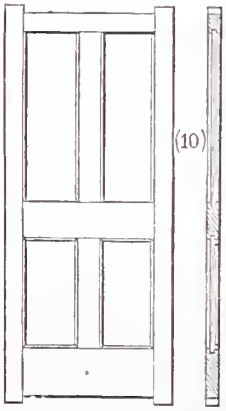
13. Section through an 8-in. lead gutter with step flashings formed at the end of a boarded and slated roof butted against the brick wall of another building. B shows the step flashing in elevation.

14. Vertical section through the foot of a wooden king-post, showing the details of a stirrup iron properly wedged up with gibs and cotters. This is the strap A mentioned in answer No. 7.

In consequence of the great pressure upon the "Shop" columns of WORK, I have been as brief as possible in my answers to the above question.

ANSWERS TO QUESTIONS IN THE SECOND OR ADVANCED EXAMINATION.

(10)

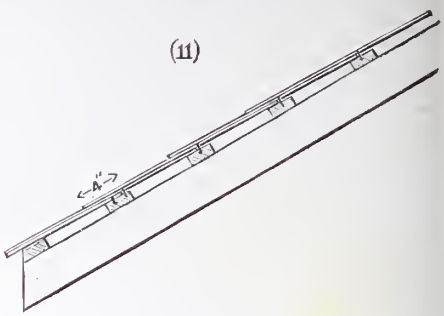


15. Single laths are about $\frac{1}{16}$ in. thick, and double laths are about $\frac{3}{8}$ in. thick. The first coat of plaster generally consists of clean sand, lime, and ox-hair.

16. In mid-summer or mid-winter in temperate climates, or during the dry season in tropical ones, because the sap is then at rest. For joiners' work in England.

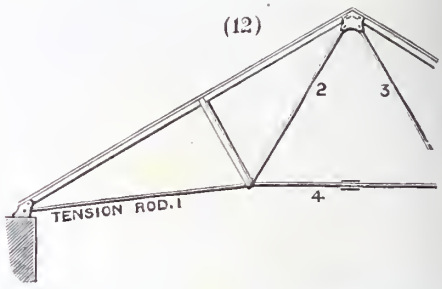
17. The joint A is known as tuck pointing. This makes a very effective joint as far as appearance goes, but it is open to the objections that the projecting ledge catches the weather and gets saturated, and is easily destroyed by frost; also that it lends itself so readily to the deception of making inferior work appear as if it had been done properly. The joint B is known as a struck joint, and if properly made is a very good plain joint, as the sloping surface throws off the wet; but care should be taken that it is not struck the wrong way, or too far in along the bottom edge so as to form a ledge to catch the wet.

(11)



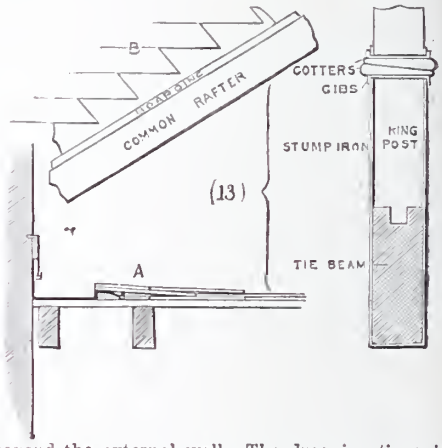
18. In building brick walls faced with ashlar, care should be taken that the stones are of a height equal to an exact number of courses of brickwork.

(12)



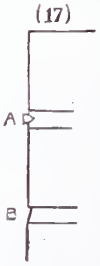
19. The facia board A is fixed to the ends of rafters, and supports the gutter. The soffit boarding B is for the purpose of making good the openings between the under side of the rafters which project

(14)

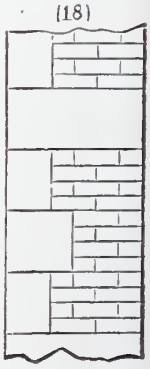


beyond the external wall. The dragging tie C is for the purpose of sizing the wall-plates together, and distributing the thrust of the hip rafter. The flitch D is an iron plate put between two wooden girders, and the whole screwed together. The sketch marked E is what is termed a torus moulded skirting.

(17)



(18)

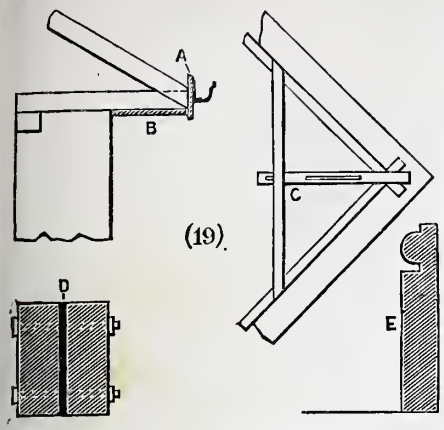


20. The elevation and section A and B give an illustration of what is known as a wiped joint, so called because the solder is wiped round, as it were, with small pieces of greased cloth when it is in a plastic condition. The elevation and section C D give an illustration of a blown joint, so called because the solder is blown round when in a molten state by means of a blowpipe.

21. The section on page 685 shows a hollow wall, with the hollow space next the outer face. The letters A A show the wall ties, which in this case are of iron, and bent in the middle to stop the passage of water along its surface. B B is the proper position for the damp-proof course.

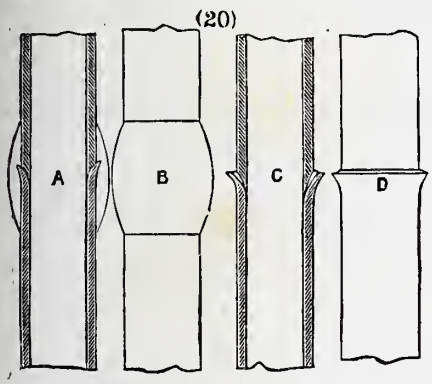
22. The plan on page 685 is called an Open Newel stair. A, A, are the newels; B, the handrails; C, the winders; D, the fliers; E, landings; F, the walls surrounding the staircase; the arrow indicates the

direction of ascent. The elevation at G shows the ends of two steps, with return moulded nosings and a sunk and moulded string.



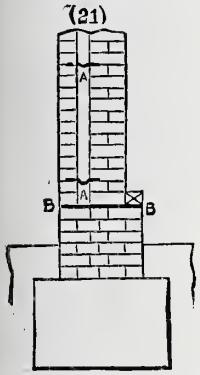
(19)

23. Elevation of an iron roof truss, the members being indicated by lines; the single ones show which are in tension, and the double ones those in compression.



(20)

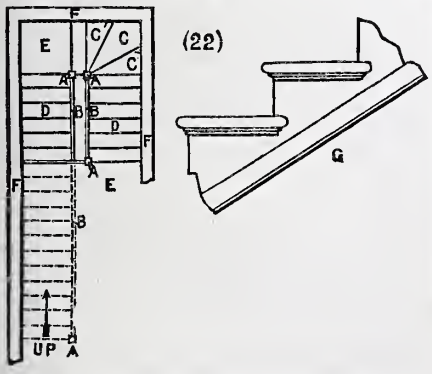
24. End elevation of a traveller running on a gantry. A, A, are the ends of the beams, the elevation of one of them being given in the question; B, B, are the wheels attached to the traveller, one of which is usually toothed or cogged, and connected to the crab or hoist for the purpose of moving the traveller along the gantry, resting on the iron rail C. The letters D indicate the different parts of the gantry, drawn somewhat out of proportion for the purpose of making the whole more plain.



(21)

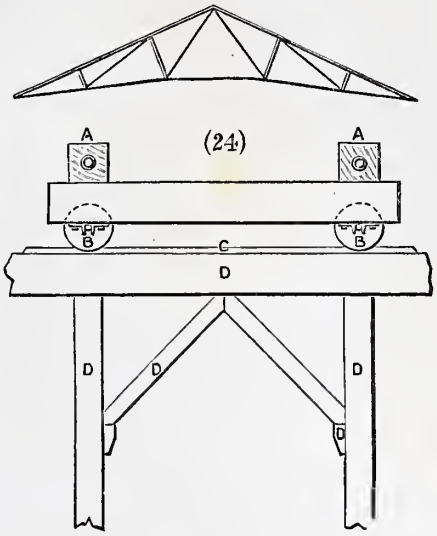
25. Section through a double cover riveted joint in a ¾-in. tie bar, called chain riveting, showing the rivets with snap heads at A, and pan heads at B, the centre plate C being the tie bar proper, and D, D, the cover plates. These are rather thicker than they need be, but it is a fault on the right side.

26. Vertical section through a window back, showing a coursed rubble wall 12 in. thick, with both

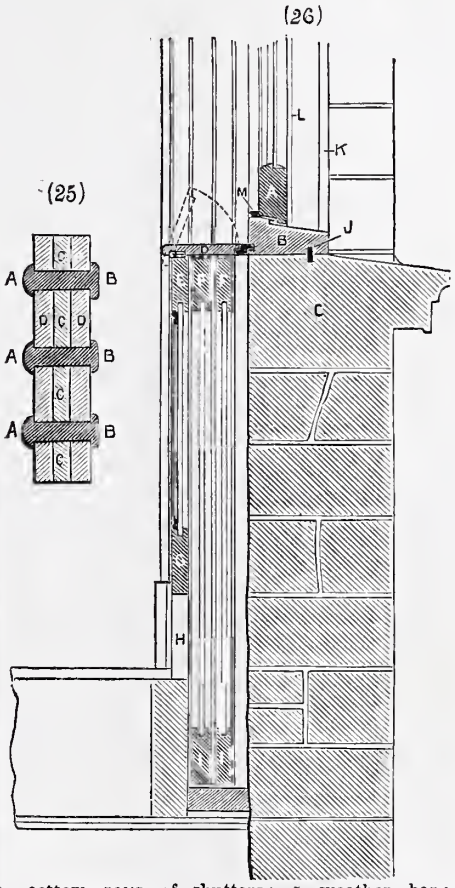


(22)

stone and wood sills, bottom rail of a 2½-in. double-hung sash, and vertical sliding shutters in two 3 ft. 6 in. leaves. The names of the different parts are as follows:—A, bottom rail of front sash; B, wood sill; C, stone sill; D, flap to cover sashes when not in use; E, top rail of apron lining; F, top rails of shutters; G, bottom rail of apron lining; H, skirting;



(23)
(24)



(25)
(26)

I, bottom rails of shutters; J, weather bar; K, outside lining of sash frame; L, parting bead; M, sash bead.—E. D.

Patents—Provisional Protection.—INDEX.—I am of opinion that any person acting with ordinary caution may virtually be safe in "using and publishing his invention," whilst provisionally protected only; but INDEX must remember that in granting provisional protection, the Patent Office does not undertake to secure the inventor from infringement; it merely confers the power to "use and publish" without prejudice to his patent-rights. Legal and absolute security is only to be obtained by the complete patent.—C. C. C.

Wax Moulds for Plaster.—R. O. (*Sheffield*).—The wax for this purpose such as one gets from ends of wax candles does very well. So does ordinary modelling wax. Were I about to use new beeswax, I should add some tallow and a little Venice turpentine. I scarcely understand R. O.'s query as to polishing casts. Does he mean waxing them? If so, the plan is, after the cast has become thoroughly dry, to heat it and lay it in a bath of melted white wax; when the wax rises to the upper parts of the cast, it may be removed, as saturation will then be completed.—M. M.

Upholstery.—J. L. (*Guernsey*).—You will probably find a suitable work in the following list:—"Art Furniture," by W. Watt, price 6s.; "Chippendale's Gentlemen and Cabinet-Maker's Director," price from £7 to £18 18s.; "Household Furniture and Interior Decoration," T. Hope, 18s.; "Original Sketches for Art Furniture," A. Junquet, 22s.; "Pattern Book for Cabinet-Makers," price 22s.; "La Tenture Moderne," Prignot, tinted plates, 20s.; "Cabinet-Maker and Upholsterer's Drawing Book," Sheraton, £6 10s. to £10 10s.; "Practical Illustrations of Upholstery Work," A. Standage, price 14s. 6d.; "Talbert's Examples of Ancient and Modern Furniture," price 28s.; "Upholsterer's Pattern Book," 6s.; "The Decorative Furniture in the National Collections of France," E. Williamson, £9. These can be had from Messrs. Batsford, 52, High Holborn, London. If these are not suitable, if you write to Messrs. Batsford enclosing stamp and stating exactly what you require, they will most likely be able to supply you, as they deal in both new and second-hand books.—M.

Work on Blacksmithing.—G. H. T. (*Ilfracombe*).—Blacksmithing is contained in "Knight's Mechanical Manipulation," price 18s., published by Spon & Co., 125, Strand, London. I know of no other work on the subject.—K.

Paraffin Lamps.—FRANKLIN.—The "Paraffin Lamp" papers will be continued ere you read this. The other subject you refer to will probably form a feature of Volume III. The question of space in "Shop" replies is already receiving stringent remedial treatment, but time must elapse to derive full benefit.

Lathe.—F. A. (*Portsmouth*).—You have made a good beginning by screwing iron bars down upon a teak bed. You want to complete the lathe yourself and do not like wooden heads. I advise you to buy iron castings, fit them upon your bed, and bore them out with a boring bar. Then as you can get brass castings, get some bushes cast for the mandrel to run in. You do not say whether you have access to a lathe. It is possible to make a lathe without a lathe, by turning the mandrel, etc., on dead centres; but I must not enter upon that here. Possibly it would cost you no more to buy a pair of "heads" second-hand, than to buy the materials to make them of, and the tools to work with.—F. A. M.

Rollers.—J. W. M. (*S. Shields*).—The rollers for wringing, mangling, or washing machines, are not in everyday request. Mr. McCrerie, of Henry Street, St. John's Wood, N.W., is a wood turner who advertises to supply them, but it would be better for J. W. M. to apply to Bradford, of Holborn, or Harper Twelvetrees, of City Road, both of London, than to buy wood and send to a local turner, which I fear is the only alternative. A great deal depends on how many such rollers J. W. M. requires, and he does not state that. If he elects to have the rollers turned to order by a local turner, he will find sycamore will do well, but it must be well seasoned.—B. A. B.

Litter.—JACK.—This subject will receive attention in due course.

Picture-Frame Making Book.—NOVICE.—Get "Picture-Frame Making for Amateurs," 1s.; Gill, 170, Strand, London.—K.

Waterproofing.—W. J. (*Elgin*).—See reply to J. R. (*Newton*) at page 505 of WORK, No. 83, Vol. II., under head of "Waterproofing." The results obtained by W. J. are another confirmation of the truth of what we told J. R., and is the result which must inevitably attend the use of all unsuitable materials or combinations of the same for the purpose to which W. J. applied it. It was used by the late Colonel Maccroni, who was the inventor, for his boots and shoes, especially when on the sea coast, and we used it with success under similar conditions.—C. E.

Gold Paper.—J. M. (*Bacup*).—The gold paper is bought in sheets ready gilded; many mount cutters, etc., supply it ready prepared for use. If, however, you have your sheet of gold paper, pin it down securely with drawing pins upon your bench with a sheet of tissue paper under it, prepare a pot of good clear glue, and strain through a piece of muslin, so that no grit of any kind is therein; with a clean brush glue carefully back of paper, with care that you do not miss any part; let it dry thoroughly, then cut in narrow strips to width of bevel; the usual six sheet mounts require it cut $\frac{3}{16}$ in. Take your mount, lay face uppermost upon your bench, cut the left end of gold paper mitre shape, and moisten as you would a postage stamp; lay it evenly upon the bevel, and rub well down with a cloth; turn mount over, and turn edge under, rubbing well down, and so continue until your mount is complete. The cutting makes a glassy bevel, and the above sticks very easily.—G. C. R.

Mirror Painting.—R. T. E. (*London*).—It would be better and cheaper for you to buy the medium mentioned by me (Vol. II., page 553) for use in mirror painting in large quantities from the manufacturer than to waste money in experimenting, to say nothing of the risk attaching to the manufacture of any kind of spirit mediums and varnishes at home, because I do not know how far you may be equipped with the necessary apparatus. If you are an amateur, I advise you more urgently still not to make your medium yourself.—H. J. L. J. M.

Grinding Razors.—W. H. R. (*Liverpool*) writes as to this. He should advertise in our "Sale and Exchange" column.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Draughtsmanship.—NEMO writes:—"Can anyone recommend me a good book on draughtsmanship?"

Heating Greenhouse with Paraffin Oil.—J. F. (*St. Day*) writes:—"Will any brother horticulturist tell me how I can heat my small greenhouse, 15 ft. by 6 ft., with a paraffin stove, burning paraffin oil? The great objection to utilising paraffin is its very disagreeable smell, and I am afraid it will injure my plants. I can get abundance of heat, but how can I get rid of the smell?"

Heating Tools.—A. T. M. (*Lichfield*) asks as to "the best way to heat bookbinders' finishing tools without the aid of a gas-stove, as we have not gas here."—[Some reader, no doubt, will enlighten A. T. M. In the meanwhile, possibly the ordinary fire or an oil-stove might be brought into requisition.]

Cedar Pencils.—CEDAR writes:—"I should like to know if there is any way of treating pencil cedar so as to render it tougher, and not so liable to split: when worked down thin, it is very brittle; my pieces are quite small, the largest not more than ⅜ in. diameter. Can this be done by steeping the wood in any liquid? If this discolours the wood it is no great objection, although better if it did not."

Points and Crossings.—W. G. (*E. Dereham*) writes:—"Will some reader kindly give me information on points and crossings? What I want to know is how to mark out the bends of point, and splay of the crossing ready for the planing machine, 4 ft. 8½ in. gauge. Or thus, the leads of the crossings and angles:—1 in 4, 1 in 6, 1 in 7, 1 in 8, 1 in 9, 1 in 10."

Patent.—G. L. S. (*Darlington*) writes:—"Can any reader of WORK kindly furnish me the name and address of a trustworthy London patent agent?"

Drive Gates.—WOODPECKER writes:—"Will any reader kindly inform me where I can purchase working designs for a pair of 'carriage drive' gates, constructed of wood panels filled in so that they cannot be seen through?"

Preparation for Blackboards.—M. (*Bolton*) writes:—"I should feel gratified if any reader could give me some information as to the making of a preparation for blackboards. I have tried several but they do not act. They leave a rough surface, and the chalk marks are often left on, even after a considerable amount of rubbing with the duster."

Tuning Concertina.—C. I. (*Addingham*) writes:—"Will any reader oblige me with instructions how to tune an Anglo-German concertina with steel reeds, and say if I could purchase steel reeds ready for insertion?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Paint for Tickets.—MIEUX QUE ÇA writes, in reply to A. J. S. (*Moseley*) (see page 601, Vol. II.):—"It is not necessary to stone them to obtain this end, unless you desire an extra amount of durability. For black letters with white ground, the following will do admirably. Break up a little white lead, plus a little clean driers, in a little raw linseed-oil and turps to about the consistency of cream, or perhaps a little rounder, as tin is apt to grin a good deal through white. Strain, and then give your tin tickets two coats of this. Now get as much as you require of white zinc and mix up with a nice clear drop of French oil (varnish); strain this through something fine—piece of an old cotton stocking or sock—and do not paint it on, but simply let as much stuff run on to a ticket as you think will flow to all its edges. Hold the article up sideways, now this way, now that way, giving it a little blow from the mouth to help it, and so on. Now make up your black in precisely the same manner as your finishing white, and one coat of this will cover well on your white; but if you require a black ground with a white letter, one coat of black as above flamed on will be quite solid, but your writing will require two coats of white at least."

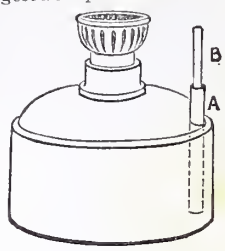
Hanging Paper.—A. M. writes to JACK OF ALL TRADES (see No. 89, page 602): "You may get Japanese leather paper from the original importer of this material, Mr. Robert Christie, 102, George Street, Portman Square, W.; or from another large importer, Messrs. Rottman, Strome & Co., 45, St. Mary's Axe. If he hails from the 'North Countree,' he will find a stock of these papers kept by Messrs. Wylie and Lockhead, 45, Buchanan Street, Glasgow. In hanging, use a stiff mixture of glue and paste; glue itself sets too quickly, and paste alone has not enough 'stickiness,' but when both are mixed a splendid adhesive is formed."

Paint for Tickets.—WORKER BEE writes to A. J. S. (*Moseley*) (see page 601, Vol. II.):—"I have used 'Aspinall's Enamel' with good effect. Doubtless 'Foo-chow' is equally good."

Gilding.—WORKER BEE writes to JACK (see page 602, Vol. II.):—"Had you looked at the Index of Vol. I. of WORK, you would have seen all about it on page 118, and saved your time in the bargain."

Waterproofing.—WORKER BEE writes, in reply to OLD TIPTONIAN (see page 602, Vol. II.):—"Hang up your cart sheet in a shed through which a current of air is playing, and give it two or more coats of boiled linseed-oil, allowing one coat to dry before applying another."

Indicator for Reservoir of Paraffin Lamp.—L. S. L. (*Kirkcaldy*) writes:—"Can any reader suggest a simple method of indicating the depth of oil in a *metal* lamp reservoir? The only way which occurs to me is to have a tube, A, on sketch, reaching to near the bottom of reservoir, in which another tube, B, with closed ends, acts as a float."



Oil Tester.

Bursting Water-pipes.—W. M. R. writes, in reply to GLASGOW (see Vol. II., No. 86, p. 554):—"Try Turnbull, Bishopbriggs, who has a new regulator in hand. The G. C. W. W. is compelling the use of a governor for parties using hoists; cost £4, if I remember correctly."

Camera Fittings.—E. H. (*Dartmouth*) writes, in reply to J. C. (*Glasgow*) (see No. 89, page 602):—"You can obtain all you require from Henry Park, 1, Orchard Buildings, Acton Street, Kingsland Road, London, N.E. Send three stamps for list; price, rack and pinion for ½ in. plate, about 6s."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—A. B. (*Kirkcaldy*); W. O. (*Liverpool*); METAL WORKER; J. H. (*Drybrook*); E. H. H. (*Chatham*); CONSTANT READER; E. M. A. (*Salisbury*); PATIENCE; J. P. (*Birkenhead*); L. G. (*Bradford*); J. H. (*Leicester*); W. M. (*Hereford*); C. E. H. (*Horwich*); L. P. (*Colchester*); P. M. M. (*Glasgow*); A. A. W. (*Leicester*); G. M. (*Romiley*); W. A. T. (*No Address*); F. S. (*Normanton*); ALONGOA; C. B. F. (*Sracombe*); F. C. (*Leytonstone*); NORTHERNER; YORKSHIREMAN; IGNORAMUS; W. E. D. (*Hull*); W. H. M. (*Preston*); W. A. Y. (*Cambridge*); J. N. (*York*); F. E. G. (*Norwich*).

NOTICE.—In connection with the "WORK" Exhibition now being held at the Polytechnic Institute, Regent Street, London, W., and to continue open till January 10, 1891, inclusive,

A Special Exhibition Number of

"WORK"

(*Separate from the Weekly or Monthly Issue*)

Has been published, and is now on sale, price 3d. This Number consists of 32 pages in a wrapper, and contains an **Illustrated Descriptive Account** of the most remarkable Exhibits.

From One to Two Thousand Examples of Art, Industry, and Invention, sent in by readers of "WORK," appear in this Exhibition, which, for the impetus it is calculated to give to Practical Education, may be regarded as one of the most important ever projected in this country.

The variety of the Exhibits is as remarkable as their character is interesting, and the very ample manner in which they are described in this Special Number will render it of value, not only to all workmen, professional and amateur, but to everyone who has at heart the progress of Technical Education in this country.

This **Double Extra Exhibition Number** of "WORK" may be considered as the Official organ of the Exhibition. It will also form a striking Illustrated Record of the First Exhibition ever held where the work of Masters or Journeymen, Apprentices and Amateurs, are judged, not by the actual result, but with allowances for concomitant circumstances, and therefore from different standpoints.

The SPECIAL EXHIBITION NUMBER of "WORK" contains a List of the Jurors officially appointed by the LONDON TRADES' COUNCIL, and an account of the working and effect of the Protection to Inventors afforded under the Certificate granted to the Exhibition by Her Majesty's Board of Trade—and many other articles too numerous to chronicle here.

CASSELL & COMPANY, LIMITED, *Ludgate Hill London.*

"WORK" EXHIBITION.

THE Proprietors have the pleasure to announce that this

EXHIBITION

IS NOW OPEN TO THE PUBLIC, AT

THE POLYTECHNIC INSTITUTE,

REGENT STREET, LONDON, W.,

AND WILL CONTINUE OPEN TILL

JANUARY 10th, INCLUSIVE.

The Exhibition will be open from 11 a.m. till 10 p.m. The Directors of the Polytechnic Institute make a charge of 6d. for admission before 5 p.m. or 3d. after 5 o'clock. This fee is the usual charge made by the Polytechnic Authorities for admission to their Exhibition at this season, and includes entrance to the "WORK" Exhibition.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [6 R

Just Published by Britannia Co., Colchester, the Buyers' Guide, containing notices of 749 books on mechanical subjects, with table of contents, price, etc. The most complete catalogue yet published. Post free, 6d. In cloth, 1s. 6d.—BRITANNIA CO., Colchester. [4 R

Fretwood.—The cheapest in England. Bilson's Cabinet Works, 21, Horsemarket, Northampton. [7 R

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [5 R

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured.—ETHELBERT HENRY, Alvaston, Derby. [3 R

Complete Outfit for Making Real Photographs; printed instructions; ready for instant use. Carriage paid, 1s. 9d. Particulars of £500 prize competitions free to all purchasers. No fees.—"Work" Dept., PHOTO NOVELTY CO., Alvaston, Derby. [2 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

Tools! Tools!! List, stamp. Cheapest in the trade.—STIFFIN & CO., 324, Essex Road, London, N. [1 S

Birdcages and Fronts for breeding made to order.—JAS. GRATTON, 3, Peel Terrace, Peel Street, Nottingham. [9 R

Patent Work.—Specifications drafted, 10s. 6d. per foolscap sheet; drawings, 21s.; duplicates, one-third. Twenty years' experience.—J. MANGNALL, Harpurhey, Manchester. [2 S

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [2 S

Bicycle Ball Pedals, nickel plated, post free to any address, 10s. 6d.—CARVER STREET PEDAL WORKS, Birmingham. [3 S

Splendid Lathe.—Numerous appliances. Cost £2,000. Offered for £350. Cards to view.—BRITANNIA CO., Colchester.

Lettering and Sign-Writing made Easy. Illustrated instructions, and diagrams for marking out eight alphabets, 1s. Lists, post free.—F. COULTHARD, Terrace Road, Bournemouth. [5 S

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,
84, 85, 87, Fetter Lane, LONDON.

WATKINSON & LONSDALE.

MANUFACTURERS OF
Photographic Apparatus,
NEW BRIGGATE, LEEDS.

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,
TOOL MAKERS,
DUBLIN.

On WEDNESDAY, JAN. 7th, will be published the First Volume of the New Weekly Issue of

CASSELL'S NATIONAL LIBRARY,

Price *3d.*; or cloth, *6d.*

The following is the order of issue for January :—

Jan. 7.—*The Haunted Man* ... ... DICKENS.
,, 14.—*Utopia* ... ... Sir T. MORE.
,, 21.—*Lays of Ancient Rome* ... MACAULAY.
,, 28.—*Essays on Burns and Scott*... CARLYLE.

Important Announcement.—Several NEW VOLUMES will be added to this re-issue, which will consist of a **Selection of the most popular Works** in the Library. The Cloth binding of the Volumes will be greatly IMPROVED in style, and this feature alone is likely to render the Series even more popular than the original issue.

*** *Intending Subscribers are requested to order the Volumes* ***by Name*** *(not by Number), and to ask for the* NEW ISSUE.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill,** with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design SENT GRATIS with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

English, Colonial, and Foreign Patents at Reasonable Charges.

SPÉCIALITÉ.

The Patenting, Working out of Inventions, and making Practical Models, Special Tools, Drawings, Engravings, &c.

If you have a novel idea which has merit, provisionally protect it at small cost, and you can make money out of it.

PARTICULARS FREE.

ESTABLISHED 1851.

BIRKBECK BANK,
Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

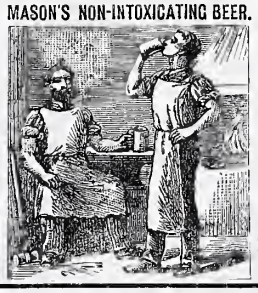
STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER. MASON'S WINE ESSENCES.



These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. One Tablespoonful of Mason's Extract of Herbs makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON,
Nottingham.

Monthly, price 4d. Post free on application.

CASSELL'S TIME TABLES. CASSELL'S CLASSIFIED CATALOGUE.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

PREPARED CALIFORNIAN BORAX.

RELIABLE, SAFE. "The Household Treasure." "Pure Antiseptic."

Specially Prepared for Personal and Domestic Uses. Marvellous Purifier, Water Softener, Dirt Expeller, Taint Remover, Food Preserver, and Arrester of Decay.

Spécialité for Toilet, Larder, Laundry, Kitchen, Bedroom, Greenhouse, etc.,

In 1d., 3d., and 6d. Packets. Directions and Valuable Recipes for the Household, the Toilet, etc., on each.

BORAX EXTRACT OF SOAP.

The Great Dirt Extractor. Excellent for washing glasses, crockery, kitchen utensils, etc. Makes Linen white as snow, sweet as new-mown hay.

BORAX DRY SOAP.

Is the best and most convenient for daily use. Dissolves instantly in hot or cold water, is far superior to all others, leaves no unpleasant smell on hands or clothing. In quarter, half, or pound packets.

The greatest boon conferred by our Queen has been the recognition of these Preparations—suited as well to the home of the Cottage Housewife as for the Mansion of Her Majesty, and the comfort of all her subjects, whether on Land or Water, throughout the World. **THESE PREPARATIONS ARE SOLD IN PACKETS BY ALL GROCERS AND SOAP DEALERS.**

Discovery, Uses, Recipes, etc., free, with Sample Packet, for 2 Stamps from Works.

Registered in Europe, Asia, Africa, America, and Australasia.

PATENT BORAX COMPANY, BIRMINGHAM.

London Export Offices—101, LEADENHALL STREET; City Offices—St. GEORGE'S HOUSE, EASTCHEAP, E.C.

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

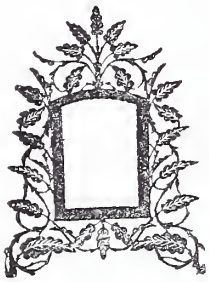
LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.



The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

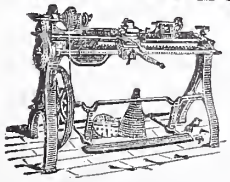
Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.

SAMPLE BOX 6D. OR FOR 7 STAMPS BIRMINGHAM.

[33

London Warehouse: **124, NEWGATE ST.**

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

Vol. II.—No. 95.] SATURDAY, JANUARY 10, 1891. [Price One Penny.

DECORATIVE WINDOW FRAMES IN CAST IRON.

BY HIRAM PRICE.

Cast iron is not a material which we are accustomed to consider as suited for the window frames of buildings of any high architectural pretensions. For this use, regarded from the artistic point of view, it has thus far achieved anything but a favourable record. We chiefly associate cast-iron windows with such matter-of-fact structures as factories—structures in which ugliness rather than beauty would seem to be the result aimed at. We are also tolerably familiar with them in the rural districts as associated with cottages of the "model" order, and in which they have generally much about as cheering an effect as iron gratings have in a prison.

Nevertheless, it cannot be doubted that the capabilities of this material for this purpose are great. That such is the case has been recognised by able architects. Rickman, who some half a century ago earned the (not undisputed) title of "Restorer of Gothic Architecture," thought so, and tried hard to utilise it. It appeared to him that to shape in stone the intricate forms of Gothic tracery—which are often mere repetitions—was a slow, laborious, and wasteful process; and that it might be accomplished as well, and much more economically, in cast iron. In St. George's Church, Birmingham, he has placed on record an attempt to act on this conviction. Some of his cast-iron Gothic work there, as, for instance, the parapet of his tower or the applied ornament of his buttresses, is good enough to pass muster; but even this cannot be said of the tracery of his windows. The leading lines in them are by no means bad; carried out in stone, they would have looked well; but there is about them an attenuation which ruins their effect. The architect felt that it would have been absurd to have given to a strong material like iron the bulk demanded in stone, and thinned down his tracery accordingly; but he neglected at the same time to give to his work any of the distinctive characteristics of metal. The result therefore was a feeble caricature of stone tracery.

Fig. 1.—Head of Decorative Window in Cast Iron.

The teaching of this and similar failures is not that the material is necessarily unsuitable, but only that it must be used on sounder principles. Good rarely comes of trying to make any material pass for what it is not. Honesty is essential in æsthetics as well as in morals. A material will rarely look satisfactory if it does not by its treatment frankly declare what it is. Our metal frames, to be truly artistic, must plainly say that they are metal, and nothing else.

I believe in cast iron for decorative window frames because I know of no other material in which so rich an effect is to be obtained, combined with equal strength, and at as low a cost. Mr. Ruskin has, indeed, said something to the effect that it is impossible to produce anything artistically good in cast iron; but with all due deference to Mr. Ruskin, I must be allowed to differ with him on this point, when I reflect that the old work of Sussex and the modern work of Norwich are in evidence against him.

Although in the designs now laid before the reader the lines of flamboyant Gothic have to some extent been followed, I must disclaim any attempt to give distinctly Gothic windows suited for Gothic buildings only. The flamboyant lines are merely used because they seem best to bring out the capabilities of the material. The patterns given are intended to fill ordinary square-headed windows. It should also be observed of these

designs that castings from them will be in no danger of being mistaken for stone or anything else than what they are: and this point it is proposed should be still further emphasised in painting them, such colours only being used as we are accustomed to associate with ironwork.

I offer these designs to those interested in building as so many suggestions merely, to be taken for what they are worth. For, though the writer of this paper may not be absolutely without experience as a modeller of ornamental iron casting, he makes no claim to be considered a practical pattern-maker; and he does not question but that a practical man, setting himself to carry out one of these designs, will be able to introduce various technical improvements in it. Nevertheless, he has a confident hope that as suggestions his designs may prove of value.

As it is proposed to cast the ornamental parts in panels, the designs, with the addition of plain bars to form mullions and transoms, can be combined so as to form windows of almost any size or shape; and with the various designs are given hints for screwing together the different portions of a frame in such a manner as not to be unsightly. By these arrangements, and by the use of iron-glue at the joints, the whole frame may be made as rigid as if cast in a single piece.

A glance at one of the more important illustrations (say Fig. 1) will show that the ornamental work is of two kinds—the thicker members which follow somewhat Gothic lines and which carry the glass, and the flatter intermediate work, against which the glass simply lies. The illustrations are not drawn to any exact scale, but supposing the repeating panel in Fig. 1 to be a foot across, those members of the design which carry the glass would measure about three-quarters of an inch from side to side and from front to back. Something of the general section of these members may be seen in Fig. 6; and on each side of them is a rebate on which the glazing is done in the ordinary way with putty. The glazing is supposed to be on the *inner* side of the window.

The intermediate work is supposed to be cast quite flat on its inner side, and it might have a general thickness of about a quarter of an inch. On its outer side it would be slightly relieved by either raising or incising the fibres of leaves and similar markings: emphasis would afterwards be given to such markings by paint or gold.

An alternative treatment of this intermediate work might, however, be found in piercing it, as indicated in the leaves and flowers of the side panels in Fig. 1, and inserting small discs or other pieces of coloured glass. The small section (Fig. 7) shows how, in case this latter arrangement should be followed, a little rebate is formed in the flat surface of the intermediate work to receive the coloured piece. For this scarcely any putty would be needed, as the coloured disc would be kept in place by the large pane of glass against which it would be pressed.

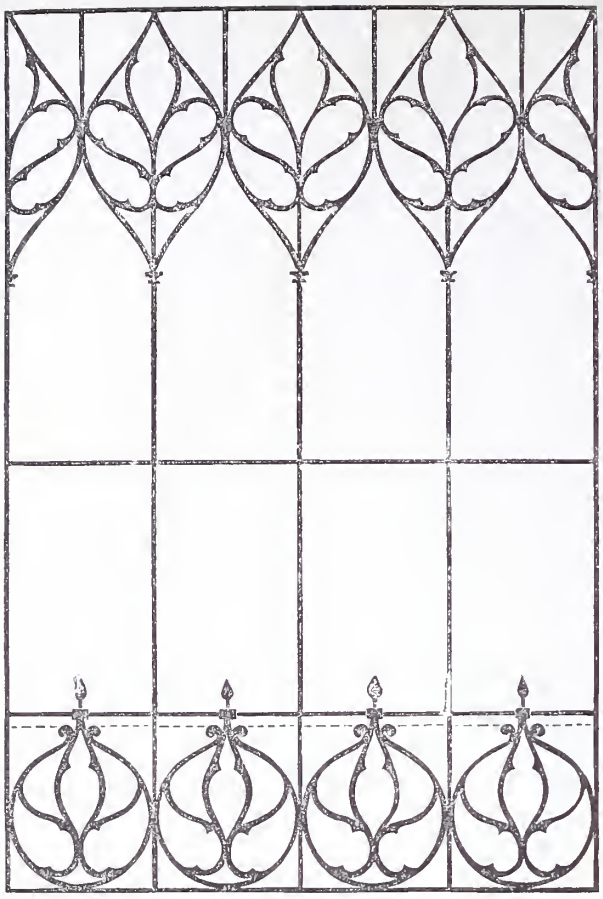


Fig. 3.—Skeleton Plan of Window.

But to speak particularly of Fig. 1. We have in this a repeating panel for the head of a window. At its sides are drawn two half-repeats, to show something of its effect when in position; but those portions of these half-repeats which approach it are left merely dotted, that they may less interfere with the actual panel. The supposed size of this panel is 12 in. wide by 21 in. deep, but it would in no way suffer by being cast on a somewhat larger scale. The flowers and leaves are shown in this as being "cut up" on their outer surface by incisions in the flowers and by raised fibres on the leaves, to be picked out in painting with black or gold. But in the half-panels at the sides is indicated, as we have already seen, the alternative method with coloured glass. As seen from the outside of the window, the "cutting-up" method will be most effective; but the coloured glass will give greater variety as seen from within.

It will be observed that at C D, Fig. 1, is given a section at the top of the panel on the line A B, showing how each repeat of this panel is made to overlap its next neighbour, and is attached to it by screws from behind. By "behind" we should perhaps explain that the inner side is meant, these diagrams in a general way representing the *outer* side of the window. From B to E are shown the screw-holes in the back portion, and from A to F the rounded front moulding into which the screws are driven. At G appears the capital of one of those mullions on which such an ornamental head is supposed to rest.

In Fig. 2 is drawn an ornamental base panel to accompany the head in Fig. 1. Of course it will not be in every instance that such a base will be required. If an unimpeded view is desired, or if it is necessary that the lower part of the window should admit as much light as possible, no base panel will be used. If, however, a certain amount of obscurity is wished for—indeed, in all cases where it is usual to insert ground glass, or to use wire-blinds, or anything of a similar nature—the base panel will come in admirably; and, artistically speaking, render the window most complete. In the mere skeleton sketch (Fig. 3) is shown a window with these ornamental panels at base as well as head. At H and I, Fig. 2, may be seen a method of fixing the base panel by screwing it to rebates in the upright mullions.

The bottom bar of the frame at K, Fig. 2, will of course be moulded sloping on its outer side to throw off rain, and the bases of the mullions L and M will probably be cast in the same piece with it, the mullions being made to fit into them with mortice and tenon joints. L is a corner base, and as there will be a necessity for keeping it square to fit the angle of the brickwork, it is shown as finished with merely a nail-headed ornament.

In Fig. 4 we have an intersection of mullion and transom. It is proposed that the ends of the latter should fit with tenons into mortices in the mullion, and there be fixed. The small flower ornament at the intersection, shown at N, is attached by a screw through its centre. The transoms can, of course, be so arranged as to divide the space into panes of any desired height. Fig. 5 illustrates a method of fixing the head panels to the caps of the mullions by screws, which will be concealed by the putty used in glazing. Fig. 6 is a general section of the glass-carrying members. Fig. 7, to which allusion has already been made, is a section in a leaf or flower of the intermediate flat work, and will give some idea of the method proposed for fixing in small pieces of coloured glass by means of shallow rebates.

The above suggestions for fixing the

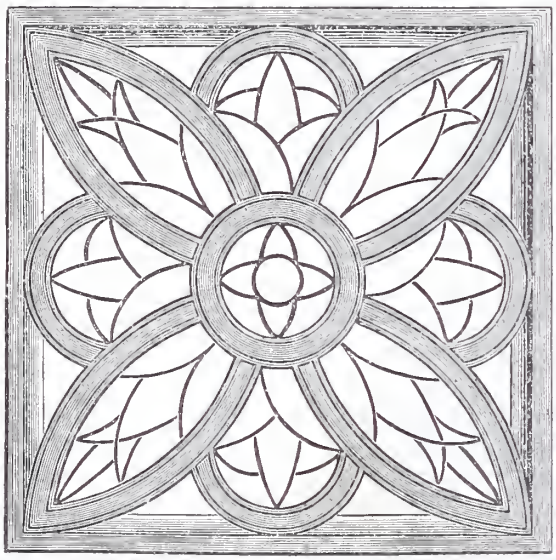


Fig. 9.—Iron Frame with Lead Glazing.

Fig. 11.—Plan, showing Mode of joining Square Forms.

ifferent parts together will sufficiently demonstrate that these designs are practicable, nd from them any amateur who may choose o make his own patterns for casting will be ble to work. The professed founder, however, if he takes this work in hand, will oubtless modify hem to a certain xtent, so as to nake them conorm to the ordiary rules of his wn practice.

By combining the bove-described deorative panels and lain minor parts, t will be seen that vindows much aried in form and ize may be proiced. And they nay be produced t little cost, for as he parts repeat he expense of naking very few ifferent patterns eed be incurred. Where the winlows are of conideration size, let is say of half a lozen repeats or pwards of the tead panel, a better ffect will be atained by breaking he work at interals with thicker nullions, and thus orming separate ights of two, three, r four repeats ach; and to give o each light its est effect, it should ave a *central* panel n its head—let it ave, say, one reeat and two halves, r three repeats and wo halves. These lesigns, it should e borne in mind, re not suited to lat windows only: hey will have an xceedingly good ffect if introduced n the projecting Windows so frequent in the Elizabethan style; only special angle-pieces will then be required.

The panel shown in Fig. 8 is one which may be either extended over a whole window or used in connection with plain panes. In a window which is wanted to admit a certain amount of light, but not to be looked through, these panels would be placed resting on one another from bottom to top, and would have the effect of rich lattice-work. In a lighter window, one to be looked through, the panels might be disposed in horizontal bands, alternating with plain panes divided by mullion bars. A window of moderate height would look well with three rows of panels—namely, at top, middle, and bottom.

These panels are shown as fixed to each other by screwing upon them, where the glass-carrying lines come in contact, small bands, like that at *o*, Fig. 8. If the entire window is filled with them, the tops of one row would be in a similar manner fixed to the bottoms of the row above it by a series of small crowns screwed on, like that at *p*. The flowers also, at Q, Q, are connections, being screwed on to half discs of metal in the panels, such as are shown at R, R. When mullion bars are made to alternate with the panels, the connection between panel and mullion would be as shown at S. The dotted portion above the line T U gives a suggestion for finishing the top of the window, but this might be done more simply by ending instead with a straight bar at that line, and screwing to it and the panels the alternate flowers and crowns.

Fig. 9 is intended to illustrate the combination of lead glazing with our ornamental iron frames; taken with Figs. 10 and 11, it will also show a method of joining square panels together. No overlapping edge is necessary, they being united by screws through their rebate projections, whilst to cover the joint an iron moulding with a tongue is inserted between; this shows in section in Fig. 10, and in plan in Fig. 11. Either plain white glass geometrically arranged or coloured glass might be used to fill the spaces in this design; if the latter, some sort of kaleidoscopic disposition of the coloured glass would tell best. The leaded work would, of course, be first soldered together, and then puttied into the iron frame. For this, somewhat wider rebates would be desirable than for glazing without lead. With the omission of the intermediate flat ornament, the designs Figs. 1, 2, and 8 might also be made to serve for leaded work.

Some reference has already been made to the manner in which these window frames should be painted. The colouring of them ought, as I think, to be looked upon as a matter of some importance. It should not be of such a character as can in any way cause them to be confounded with stone or wood. Such colours as we are accustomed to associate with decorative ironwork should rather be chosen. It will be with the outside of our windows that we shall chiefly have to deal, for the predominant colour of the inner

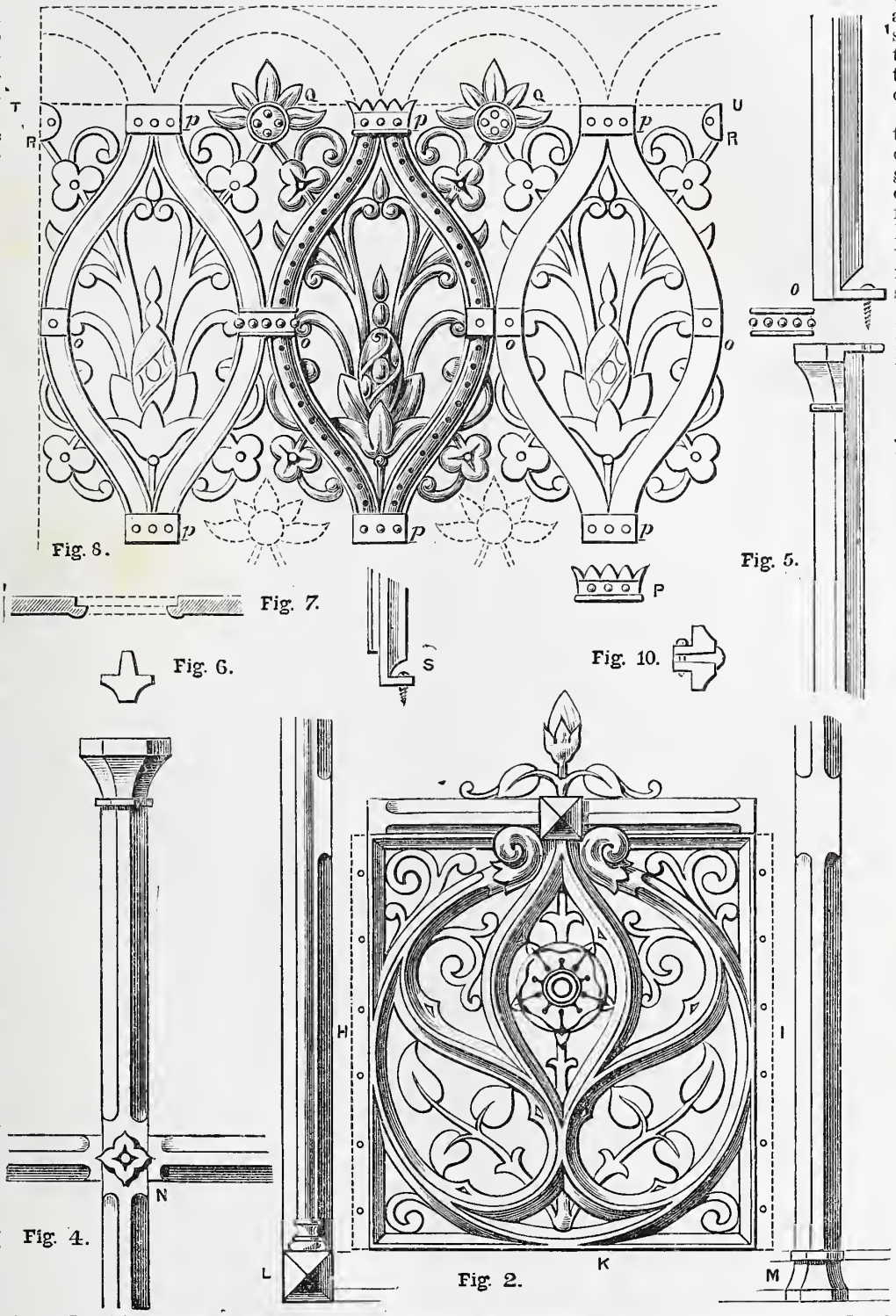


Fig. 2.—Panel for Bottom of Window. Fig. 4.—Mullion and Transom. Fig. 5.—Attachment of Head Panel to Mullion. Fig. 6.—Section of Glazing Bar. Fig. 7.—Rebate for Coloured Disc. Fig. 8.—Ornamental Window Panel. Fig. 10.—Section showing Mode of joining Square Forms.

side will have to depend on the decorations of the room which it forms part. But the inside colour will show but little: from within, seen against the light, the ironwork will tell as little else than black; gold only will tell upon it with much effect, and it may, therefore, be well to a certain extent to employ gold.

To speak then of the outer side. It is suggested that for the heavier, glass-carrying lines a deep dull red will, in a general way, be appropriate, and for the intermediate work a moderately deep dull green; the prominent parts in each being picked out with the opposite colour, whilst for certain specially prominent points and slight markings black or gold might be employed. As regards the use of gold, however, care will always be needed to avoid a "spotty" effect, and a gilded surface will often require a gilt line near adjacent to carry it off properly.

Again, bronzing would not be improper for our purpose. The whole frame might be painted of a dull green, and relieved in its prominent parts with bronze in the ordinary way. This would preserve its character as metal, and would look well, though whether it would have so artistic an effect as the former scheme may be doubted.

Mention has been made of iron glue for uniting into a solid mass parts which have been merely wedged or screwed together. It is familiar under some name or other to most practical iron-workers; but the amateur may need an explanation of it. The common way of making it is with iron filings and sulphuric acid. This laid on the parts before they are screwed together unites them so effectually that the joint becomes harder than other parts of the casting. It can, of course, only be used when no future unscrewing or taking to pieces is contemplated. It is said that the French claim that their "iron mastic" (as they call it) has more strength than ours: they use in addition a little sulphur.

In addition to their primary purpose, it may be found that our designs for iron window frames may be adapted (without glass, of course) to verandahs, balconies, and similar uses. It may be observed that the design Fig. 8 especially would make an exceedingly rich substitute for lattice-work.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

WAX SMELTER—HONEY RIPENER AND STRAINER—FEEDERS—THE RAYNOR—DUMMY FEEDER—AMERICAN RAPID FEEDER.

A WAX smelter is a very useful piece of apparatus to have in an apiary, as by its means wax may be kept in a fluid state for a considerable time without any danger of being overheated.

It is on the well-known principle of the glue-pot: an outer vessel contains water, while the wax is placed in the inner one, which cannot then be made hotter than the boiling point of water. The manufacture of a smelter will be found to be a very nice job, entailing some rather clever tin work.

The outer case is oval, and rather like a tin tea-pot, for which it might, at first sight, be easily mistaken.

Its dimensions are $3\frac{1}{2}$ in. long, $2\frac{1}{2}$ in. wide, 3 in. high; the inner receptacle is $\frac{1}{2}$ in. smaller every way, so that $\frac{1}{4}$ in. is left between both for water and steam.

A pattern for the bottom of the water case should be cut from a piece of cardboard. To do this, drive two strong pins vertically in the cardboard $2\frac{7}{8}$ in. apart, and make a loop of thread $3\frac{1}{2}$ in. long; pass this loop over both pins, and run a pencil round the loop. An oval figure about 3 in. by 4 in. will then be described, as in Fig. 2.

This oval may be cut out of the cardboard with scissors, and used as a pattern by which the tin or copper for the smelter bottom can be marked. A $\frac{1}{4}$ in. may then be cut off the edge of the cardboard all round, and the bottom for the inner receptacle cut from the reduced pattern. It is much better to make the outer case at least, of copper, as it will last much longer than tin, be pleasanter to work, and look better. A smelter made of copper also is more valuable than a tin one, even beyond the difference in the value of the materials. If tin is used, acid should on no account be employed as a flux for the solder, as it would soon eat its way through the plates.

The sides of the outer case are formed of a strip of tin $3\frac{1}{8}$ in. wide and about $9\frac{7}{8}$ in. long. $\frac{1}{8}$ in. is turned over at each end, one end up, the other down; they are hooked together, hammered flat, and soldered. $\frac{1}{8}$ in. of one edge is then flanged out at right angles to receive the bottom, which has the same amount of its edge turned up and then down over the flange, the whole being finally hammered flat against the sides, as I described in the Little Wonder extractor.

The inner case may now be taken in hand, its dimensions being 3 in. long, 2 in. wide, $2\frac{1}{2}$ in. high, the strip which forms its sides $\frac{3}{4}$ in. shorter than that for the outer case, and the bottom $\frac{1}{4}$ in. smaller all round. The bottom and sides may be attached as in the outer shell, or the bottom may be flanged like the cover of a canister and soldered to the sides. The top had better be beaten into a dome shape, as shown in Fig. 1, for which a wooden block with a hollow gouged out to the correct size and shape will be required. The top is flanged down, and fits the body to which it is then soldered. A hole is made in the centre of the top to take a piece of light brass or tin tube $\frac{3}{4}$ in. in diameter and 1 in. long. A hole is also bored about 1 in. from the bottom to take the nozzle, which is a piece of tube 4 in. long, and tapering from $\frac{3}{8}$ in. to $\frac{1}{4}$ in., but it is not soldered in place yet. It would be well to solder three little feet $\frac{1}{4}$ in. high to the bottom of the inner case to keep it a proper distance from the outer; these can be of pieces of tin bent round to about the size of a lead pencil and cut the correct length.

A handle, as shown in Fig. 1, should be riveted to the outer case after the manner of a tin pannikin handle, and the top made to fit nicely over the sides. A hole should be made, and a bit of tubing soldered in the outer cover towards the handle, through which water is to be introduced into the boiler. An oval hole about 1 in. long and $\frac{3}{4}$ in. wide must be made over which the outer nozzle is soldered.

The inner case is now to be put into the other, and the smaller nozzle soldered firmly into place, having its point as high as the top of the smelter when horizontal. The soldering can easily be done through the large hole in the outer case. The top of the boiler may now be put on, the tube communicating with the inner receptacle passing through a hole made for its reception, and solder should be applied all round the tube and the top. The outer nozzle can then be soldered in place both to the boiler and the inner nozzle.

This will complete the smelter, which should, of course, be water-tight as to both the outer and inner receptacles. Corks may be used for the tubes on top, but it would be neater to have little brass caps to fit tightly or even to screw on. The wax is introduced into the smelter usually when in a molten state, but small pieces could be put through the tube if desired.

Care should be taken to have the inner case as nearly as possible concentric with the outer, so as to have the same space left for water all round. This, however, is not very difficult with the legs, if the hole in the boiler top is in the correct position.

A Honey Ripener, Fig. 3, may be made of any tin receptacle large enough to hold the quantity of extracted honey likely to be in hand at one time. A vessel 12 in. diameter and 18 in. high will, probably, hold more than most of my readers require. It can easily be made after the manner of the barrel extractor, having a wired edge top and bottom, and a honey valve soldered in the side close to the bottom. It is scarcely necessary to have the bottom sloping, as the can may be tilted over without much trouble, but most amateurs will find it easier to have the slope in the bottom. It will then be made a little larger than the space which it has to fill, and turned until it fits tightly all round against the sides of the can. The bottom might also be put in like that of a tin saucepan, with the folded joint such as we used in the smelter.

If this last plan is employed, it would be advisable to solder three or four circular pieces of tin, about the size of a crown and slightly saucer shaped, to the bottom, to prevent it from being worn at its junction with the side.

A strainer might conveniently be added to the ripener. This is either of perforated tin, or simply a piece of muslin or cheese-cloth. If the former, it should be made in the form of an inverted cone in such a way that the cover of the can will fit also over the strainer. It would be better also to have a rim of plain tin over the perforated cone, so that a quantity of honey could be poured in, and let percolate slowly through the holes.

If the muslin is decided on, all that is required is a rim which fits into the top of the can and holds the muslin all round. This rim can be made of doubled tin, 1 in. wide, first made into a hoop to fit the can, and then having a $\frac{1}{4}$ in. turned out at right angles over the wired edge of the can. The cover will fit over this as in the other.

Feeders are legion, but I will describe only those which I have made and used myself. One of the best for all round purposes is "The Raynor," of which I give three diagrams in Figs. 4, 5, and 6.

It will be seen to consist of a bottle with screw on cap, which is perforated with a dozen holes in a semicircle in such a way that one or more can be brought over the circular slot which is shown in the stand, Fig. 5. A pointer soldered to the cap indicates the number of holes which are uncovered to the bees underneath.

I make the base of my feeders of hard wood, turned to the section shown at Fig. 6. They are 6 or 7 in. across, and $1\frac{1}{2}$ in. high.

The recess in the top is made to fit the 2 lb. screw-top bottles, which can be bought from all dealers in bee appliances for about 4s. a dozen.

The top of the dome is turned to about

$\frac{1}{8}$ in. thick, a circle marked round while in the lathe with the corner of the chisel, and the slot $\frac{1}{8}$ in. wide, cut out with a narrow chisel and penknife.

The slot is to be half the circle round—no more. The feeding bottle is then laid in place and holes pricked through its cap through the slot of the stand, with a darning-needle or fine awl. These holes may be about a dozen in number, as shown in Fig. 5. A pointer of tin must be soldered to the cap, and numbers stamped on the stand corresponding to the number of holes open.

When the bottle is inverted, the syrup will not run out of the holes, owing to the air pressure and capillary attraction, but the bees can easily suck the syrup through the holes. I frequently line the dome with cloth or chamois leather to keep it snug.

When I am in a hurry for a stand, I sometimes use a piece of pine 5 in. square, and tack a slip 1 in. wide and $\frac{3}{8}$ in. thick all round, as in Fig. 7. I then cut a hole right through the top large enough to take a tin canister cover of the correct size, which I flange over and secure in place with a couple of tacks.

I cut the slot in the tin and make the holes in the bottle cap as before, and the work is done. A pointer, of course, will be needed as before.

Another feeder on this principle is a dummy feeder, invented by, I think, Mr. Hone. A slit is cut in the dummy to enable the bees to take the syrup, which is contained in an oblong tin box with perforated edge placed at the back.

Fig. 8 is a section of the dummy and feeder which I used successfully as an experiment last season. The slot in the dummy is 6 in. long, and the tin box 8 in. by 5 in. by 2 in.; a dozen holes are made along the lower edge opposite the slit, and a screw plug and leather washer keep the hole through which the tin is filled perfectly tight. The tin is kept in place by two pieces of wood 2 in. by 5 in. by $\frac{3}{4}$ in., nailed edgeways to the dummy, and two other pieces 5 in. by 1 in. by $\frac{1}{2}$ in., nailed to the backs of these, so that $\frac{1}{4}$ in. embraces the back of the tin. The whole works like the female portion of a slide. A small strip (E) underneath prevents the tin from going too low.

If the screw cap is an objection, it could be replaced by a tube and good cork, an indiarubber one being the best.

For spring feeding, when only a small quantity of syrup is required to be given at a time, some of the holes in this feeder may be plugged up with wax.

The principal objection to all these feeders is that they must be frequently attended to, on account of the small quantity of syrup which they contain. This has been overcome in the American rapid feeders, of which there are many now in the market.

Fig. 9 is a general view, and Fig. 10 a cross section, of one of these feeders which I have in my possession.

It consists of a trough holding about 10 lbs. of syrup. This is supported over the brood nest by the ends and a pair of supplementary sides, which allow the bees free access to the top of the trough without permitting them to escape, a thin board acting as a cover. The vertical lines in Fig. 10 denote a sort of ladder made of very thin wood, its object being to prevent the bees being drowned in the trough.

To make this feeder, two pieces of clean pine $10\frac{1}{2}$ in. by $4\frac{3}{4}$ in. by 1 in. are made out for the ends. Rebates $1\frac{1}{8}$ in. wide by $\frac{5}{8}$ in. deep are then to be cut round three sides of each.

Two pieces 14 in. by $3\frac{1}{4}$ in., and one 14 in. by $9\frac{3}{4}$ in. by $\frac{3}{4}$ in., are to be got for the sides and bottom of the trough. This may be now completed by nailing the sides and bottom to the rebated parts of the ends, forming a trough $8\frac{1}{4}$ in. wide and $3\frac{1}{4}$ in. deep, and with the ends projecting $\frac{3}{8}$ in. beyond the sides and bottom.

The outer sides, which are $14\frac{3}{4}$ in. by $4\frac{3}{4}$ in. by $\frac{1}{2}$ in., are now to be nailed to the projecting parts of the ends, which will leave a space of $\frac{3}{8}$ in. between the sides of the trough and these outer sides.

If the whole structure be now laid upon a table, it will be found that the bottom of the trough is $\frac{3}{8}$ in. from the surface of the

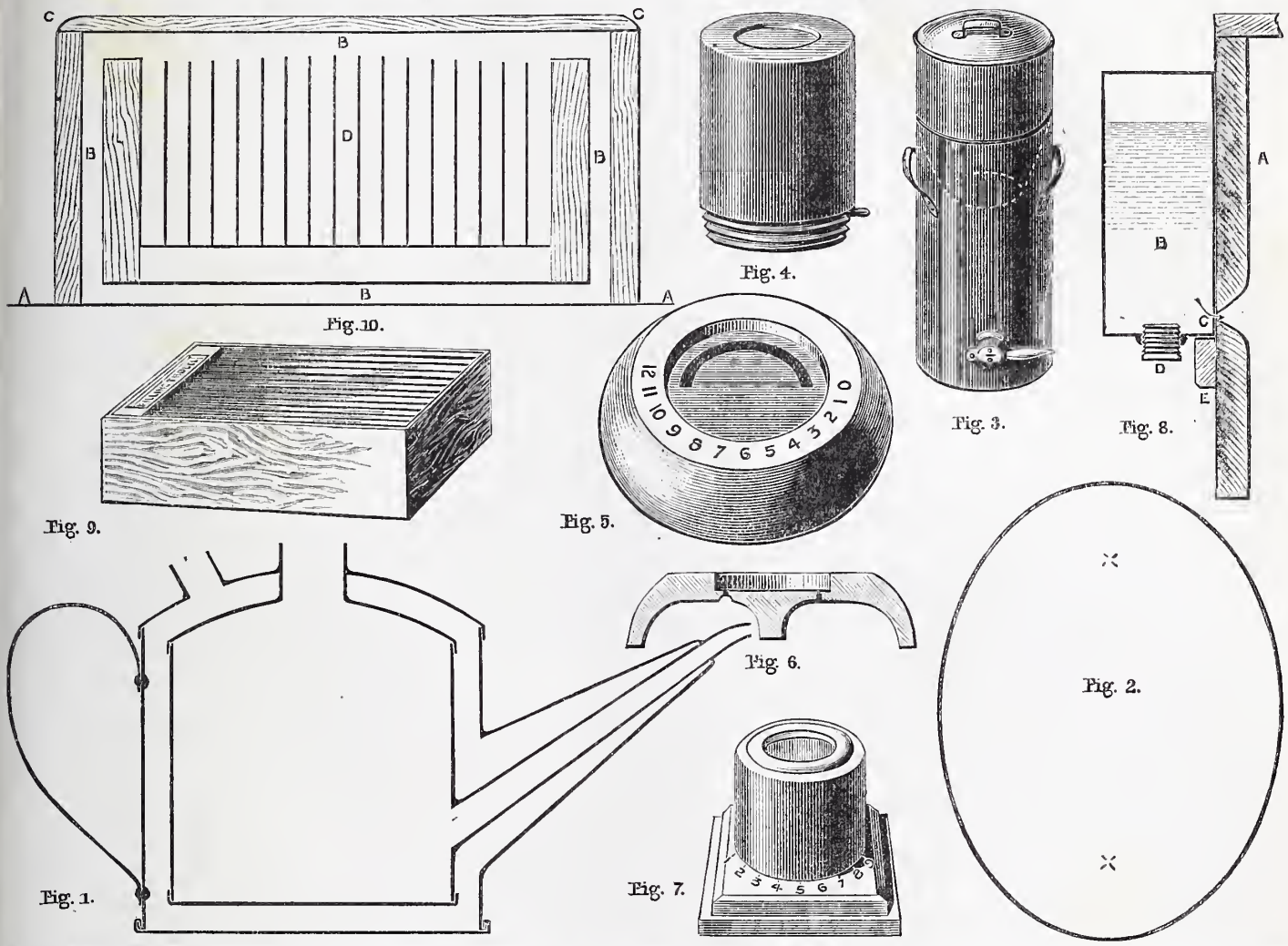


Fig. 1.—Section of Wax Smelter. Fig. 2.—Pattern of Bottom. Fig. 3.—Honey Ripener and Strainer. Fig. 4.—The Raynor Feeder: Feeding Bottle. Fig. 5.—Ditto, Stand. Fig. 6.—Ditto, Section of Stand. Fig. 7.—Square Base Feeder. Fig. 8.—Section of Hone's Dummy Feeder—A, Dummy; B, Syrup; C, Holes; D, Screw Cap; E, Slip to sustain Tin. Fig. 9.—General View of Rapid Feeder. Fig. 10.—Cross Section of Ditto—A A, Level of Top of Frames; B, Bee Space; C C, Top; D, Trough.

table. A partition is now placed 1 in. from the end of the trough to form a filling space. This partition is pierced with ⅛ in. holes, so that when the syrup is poured into the smaller compartment, it will run into the larger, which can thus be filled without removing its cover. The cover may now be made of ¼ in. stuff of such a size as to cover the larger compartment: viz., 10½ in. by 13 in., and a couple of little cleats put on to prevent it from warping. If an examination is now made, it will be found that the bees can crawl up between the inner and outer sides of the feeder and over the side of the trough into the food. A careful examination at this stage will show the course the bees will take; and if any passage is less than ⅜ in., it should be enlarged. The top edge of the trough will evidently be ⅜ in. lower than the sides of the feeders and the under surface of the cover. The bees could, at this stage, find their way into the smaller or filling compartment through small spaces which communicate with the hives. These can now be stopped up with scraps of wood tacked over them, and a long narrow strip of glass cut to cover the compartment.

The ladder which enables the bees to take the food without the risk of being drowned can now be made. About the best material to employ is the wooden dividers which are used to separate the sections in the section crate. They can be cut 12 in. by 3⅛ in., and seventeen or eighteen of them will be required. Twice as many pieces of wood ⅜ in. thick by about ¾ in. by 1¼ in. will also be required. One of the thin dividers is then taken and marked with a pencil 3½ in. from each end. A couple of the small pieces of the wood are then laid on these marks and equidistant from the edges of the divider; another divider is then laid on top, and a tack through each thick piece secures the three together; another couple of thick pieces are put next, again a thin one, and the tacking continued as before until the pile is high enough to fit the breadth of the trough.

The thin wood dividers of which this ladder is made are kept ⅜ in. apart by the little blocks between, and that is the whole secret of its manufacture. The outside dividers will, when in place, be ⅜ in. from the sides of the trough, being kept so far away by similar blocks. To prevent the ladder from floating in the syrup, a couple of little wooden buttons attached to the sides of the trough can be turned over it, while two strips ⅛ in. thick are tacked to the bottom of the trough on the inside to enable the syrup to flow freely to every part.

This is an excellent feeder. It takes the place of the section crate, but of course is only suitable for use in the autumn, when stocks have to be fed up rapidly before the winter.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

Imitations of Woods by Plain Staining and Graining upon Unpainted Wood.

The Practice of Staining light and inexpensive woods to the colours of more rich and costly varieties is a branch of graining—"sham" though it still is—that few persons will object to. The advantage of being able to get a permanent and decorative finish upon new wood without the important outlay of preparatory painting is so apparent to all, that a first place of interest will readily be given to a paper dealing with such.

Under this heading we have two distinct treatments of imitations—the first wherein the colour effect alone is sought after; and the other, that in which the figure and particular characteristics of the wood are also imitated. Without attempting to follow the theory of the matter beyond the simplest lines of consideration, it will be readily granted that both of these methods have their proper sphere and limitations. The description and quality of the wood stained is a most important factor of its successful treatment. For instance, we may stain white wood with the colours of light oak or maple, and obtain a rich and satisfying effect. Apply, however, the same transparent glaze to sappy and knotty deal, or, on the other hand, to light pine with a strongly marked grain, and we feel at once colour and grain do not agree. Pitch pine of the ordinary class, such as its imitation described in No. 84, may be greatly improved by staining to the effect of American walnut; but were we to grain upon it afterwards the figure of ordinary knotted, or Italian, walnut, then an unnatural attempt at combination is at once apparent. The very common and popular red staining of the poorest and cheapest articles of furniture—presumably in imitation of mahogany—strikes in the mind at once a note of discord. Mahogany is an expensive wood, we know, and therefore imitations of its colour on wooden rubbish are rather objectionable. Then, again, the colour of even the cheapest mahogany cannot be obtained by a bare coating of stain, so that it is not satisfactory from either point—consistency or appearance. Mahogany, walnut, maple, and other choice woods—particularly those which are best imitated in distemper colour—can, however, be beautifully grained upon prepared plain wood, with results almost equal to anything we may execute upon painted grounds. As in most of these dark varieties it is necessary to first stain the wood a general colour, we will now briefly notice the pigments and fluids most serviceable for plain-staining purposes, considered not from a dyer's or polisher's, but from the painter's and grainer's point of view.

Preparation for Plain Staining is a matter of circumstance, depending upon the nature of the wood stained and of that to be colour-imitated. If the timber is of the poorest quality, soft and sappy, the better plan for cheap work is to ensure more regular colour by first giving it a coat of patent glue size of fair strength. This is no "lost labour," since all common staining requires to be sized to enable the varnish to bear out. It is, however, advisable that, for floors and all similar surfaces exposed to hard wear, the stain should be applied first; otherwise, instead of sinking into the wood, the colour is merely lying on the surface, and is more easily worn away. In dealing with ordinary house woodwork, cheap panellings, etc., the size before oil-stain is recommended. When the former is dry, it will be found that the oil-stain, or "graining colour," can be spread much better and more regularly, and that those sappy places which would otherwise have absorbed much stain are scarcely noticeable. In sizing white or stained wood, poor work often results from the "quirks" and mitres of mouldings being overcharged with the "froth" of the warm size. This can be easily avoided by adding a little turpentine—about one teaspoonful to the pint of size—which will prevent much of this "frothing" nuisance. For preparing a higher class of woodwork the colour of which we chiefly desire to alter, there are several better methods open to us. When we have a good specimen of pitch pine which is required to be stained down, say to an American walnut shade—and in which it is most effective—we may first coat it with either japanner's gold-size diluted with one-third of turpentine; or with raw linseed oil, a little "turps," and about one-tenth part of good liquid driers, or terebine. The dilute gold-size is the most costly and quickest, as it may be stained upon in a few hours; but for equal permanence and cheapness the drying-oil is the best. Both are brushed on in the same manner as varnish is applied, only rather more sparingly. When plain-staining or varnishing very white wood, it is often necessary to avoid all possible after-discoloration arising from the oil darkening with age; and since it is prepared from the same source, the gold-size, unfortunately, is liable to the same defect. Here, then, it should be substituted by using "clear" size, or Young's colourless patent size, and then the whitest copal oil varnish for the finish. One drawback common to sizing is the tendency of the fluid to raise the surface grain of the wood: this is particularly the case when the size is used hot, and therefore such must be avoided.

Mixing Oil Stains—viz., those prepared with a drying-oil and painter's pigments—is a simple matter. We may take three parts oil to one of turpentine, add the liquid, or even paste, driers as above-mentioned, and then the simple addition of "stainer" completes the mixture. As advised for preparatory coating, Japan gold-size and "turps" may be used for the liquid, or, better still, copal varnish may be stained and diluted with "turps." The advantage of using the two last-mentioned is their quickness of hardening; whilst the cheaper oil mixtures are far better for spreading evenly and regularly over large surfaces. I have gone somewhat minutely into this preparatory consideration, knowing from practical experience how often the want of a little elementary explanation will mar the whole work on completion. I now append a few details of colour-stains, which, with the foregoing, should suffice the worker for all ordinary purposes:—

Light Oak Oil-stain may be made from raw terra di sienna, with the addition of a little raw Turkey umber.

Medium Oak Oil-stain from raw sienna and burnt Turkey umber.

Dark Oak Oil-stain is best made from burnt Turkey umber alone; the yellow cast of the copal varnish, which it is supposed and intended should be used for finishing this class of work, is here sufficient to give the required trace of yellowness.

For Antique Oak-stain, a mixture of ivory black, finely ground, with a very little burnt sienna. Vandyke brown alone makes a deep rich stain, its colour, when ground in oil, being not so red as when used in distemper. This pigment, being a notably bad drier, requires fully double the usual quantity of terebine added to the oil fluid.

Walnut Oil-stain for varnishing upon, without any after glazing and figuring, may be coloured with burnt Turkey umber and a little ivory black. For a "ground-colour" stain—viz., whereon we wish to grain walnut figure—raw umber is the better pigment, since its subdued tone contrasts more naturally with the after figure work.

Oil-stains for Pitch Pine.—Raw sienna, with the addition of a little burnt ditto, make a rich pine colour for staining on light wood; a little burnt umber can be added if the siennas alone are too red. Real pitch pine is very largely used for house woodwork

at the present time, especially in the neighbourhood of seaport towns, when it is usually imported direct from the Baltic. In most instances the pine is cheaply prepared, and varnished with copal. The presence of so much resin and matter of a discolouring nature in pitch pine soon causes a very appreciable darkening of the original colour; hence, when it is desirous to keep the wood permanently light, the copal varnish used should be of the whitest make, and the size be either "Young's Patent," strong "parchment," or the special "light japanners." All holes, etc., should be carefully stopped with common putty of two shades, coloured to match both the ground and grain of the wood, *after the sizing*. A day or so to allow it to harden before varnishing is advisable. When the real pine is desired to be stained much darker, besides the umbers, vandyke brown, and black pigments, we may use diluted washes of either black japan or Brunswick black. Only those of a thoroughly good quality should be used, and with pure turpentine for thinning. Messrs. Mander Bros., the well-known Wolverhampton firm, make an "antique oak" stain, which is an admirable article for this purpose. It is rather costly, but, being a strong and powerful liquid, it stands much dilution; whilst, being purely an oil-stain, it can be worked and spread better than the quick-drying preparations of the two previous articles. When staining pine dark, it is preferable to use the stain *before* sizing; if the grain is desired to be very prominent, a full coat should be spread, and then shortly afterwards all the stain lying on the surface may be rubbed off with old cloth or rag free from "fluffiness."

Mahogany Oil-stain can scarcely be obtained of a good colour by ordinary brush staining. Burnt sienna alone is somewhat gairish; and the only perfect substitute for the Victoria lake used in distemper graining is madder lake, which is too expensive for ordinary cases. Whenever cheap mahogany stain is required, it should be made nearest to ordinary baywood. For furniture and "better-class" work, a good mahogany effect may be obtained by oil-staining with burnt sienna and vandyke, and, when dry, overglazing with ordinary Victoria or mahogany lake in water. If the wood is at all sappy and strong in markings of a nature contrary to mahogany, it must first be sized, stopped, and then oil-stained.

Cheap Water-stains may easily be made from any of the above pigments. Whether used for oil or water mixtures, they should always be purchased ready ground and of decorators' quality, those in pound and half-pound collapsible tubes being by far the best and cheapest for good work. Nearly all these colours have a natural binding quality with water alone, but the addition of a little beer will easily secure the stains of ivory or vegetable black. Water-stains must always be applied directly upon the wood; we therefore are at a double disadvantage when using such. The stain itself has no "filling" power, so that a *second* coat of either size or varnish is necessary; and water-stain does not spread so nicely with the brush as oil. A piece of sponge is preferable for using the former, and the best effect is got by wiping all superfluous stain off the surface.

Maple and Satin-wood Imitations, when grained on white wood, are executed with the same water pigments and process as upon paint. The wood for these two varieties must be very free from grain or knot, and must first be once sized and varnished with the whitest materials. This gives a non-absorbent ground for working the distemper stains upon. When the figure is completed, another good coat of varnish gives a capital surface.

Walnut, mahogany, and similar dark woods must have the grounds sized, and then coloured with oil-stain to the nearest shade of the usual grounding paint. The size and stain together will suffice for working upon, but two coats of varnish are required for dark imitations of this kind. With walnut and mahogany the first coating is applied *barely* before the glazing, and a final flowing coat afterwards.

Notwithstanding this paper is compiled solely with reference to the painter's and grainer's usual work and requirements, the simplicity of most of these preparations will commend them to the occasional wants of all readers. A saving of labour is nowadays a primary consideration, and in this connection oil-stains, requiring only *once* sizing, are most useful. For floors or other large surfaces, the advantages of using the "Scumbling," or staining, preparation of Mathieson Bros., Ardrossan, near Glasgow, are worth mentioning here. They consist of prepared drying pigments, requiring only linseed-oil for dilution. They are both cheap and good. (See Vol. II., No. 69). With the "semi-chemical" stains of dyer and polisher we have no concern here, although in a short lesson on inlaying methods some particulars of other permanent *coloured* stains will be given.

Flat Varnishing or Dull Polishing may be used to much advantage in finishing any kind of copal-varnished or oil-stained surface. A simple preparation of the former can be made from a piece of genuine beeswax (size of walnut) dissolved, and thoroughly mixed by heat in pure turpentine (½ pint), and 1 oz. copal varnish added thereto. The latter method may be done by carefully dulling either varnish or polish with finely-ground pumice-stone and felt (or a piece of soft cloth), used with water; then rubbing with putty-powder and Lucca oil for a final soft gloss.

PARAFFIN LAMPS.

BY THOMASO.

Small Hand Lamp — Spirit Lamp — Hanging Lamps.

Fig. 12 is a handy, inexpensive little lamp, suitable for any purpose requiring only a moderate amount of light, such as to carry about when looking for anything. Its shape allows it to be hung up anywhere, stood between shelves without burning the one above it, or held close to the ceiling without blackening it.

The burner I took off of one of the very small tin lamps, sold at 6½d., having a wick about ¼ in. wide. It gives a fairly good light considering, but it wants cleaning frequently.

I made my lamp of tin, but I find it has got rusty inside. Sheet brass is the best metal to make it of.

Cut a circular piece 4 in. in diameter. Draw a line across the centre, and $\frac{5}{16}$ in. from each end punch an ⅛ in. screw hole, and cut a hole in the centre a trifle smaller than the screw collar of the burner, which is to be well scraped and soldered on from the inside. This is a neat way of soldering on burners. The other lamps can be done the same way. See that when the burner is screwed on, the wick-winder comes midway between the holes you punched. Cut the bottom ½ in. smaller all round than the top; lay it on the top, and mark round it for a guide in soldering the sides. Cut the piece to go round the sides 2 in. high, and solder it on to the top, joining the ends as described in the reading-lamp. Cut a 3¾ in. circle of brass, draw a line across the centre, and out of the middle cut a 2 in. circle, leaving a ring-shaped piece. Punch an ⅛ in. hole each side of this hole on the line you marked $\frac{5}{16}$ in. from the outer edge, and punch holes in two pieces of brass the size of a sixpence. Cut two pieces of ⅛ in. brass or tinned iron wire, 8 in. long, and bend one end of each into a loop first, as shown by the dotted lines of Fig. 13, and then backwards. Neglect of the backward bend gives these sort of loops a clumsy, amateurish appearance. Now push the wires through the holes in the ring, the brass sixpences, and the top of the reservoir, and solder them on the under side. When quite even, you can solder in the bottom, and solder the ring to the wires about 6 in. from the top of the reservoir. You will, of course, put the solder on the under side of the ring, so that it does not show. Now bend a piece of wire to form the handle to carry it by, make loops on the ends same size and way as the others, link them together, and close up. To make the little cap over the top of the chimney, cut a 3 in. circle of brass, cut a wedge-shaped piece out of it (⅙th of its circumference), then lap the edges and rivet; the smaller the rivet the better. You can solder the join if you like, as the heat would not be sufficient to melt the solder. Cut two strips of brass, ⅜ in. wide, bend them as shown in Fig. 14 (full size), and solder one end of each on the under side of the ring at the top of the lamp. The cap can now be slipped into the free ends of the slips, as shown in Fig. 14, the black line representing the section of the cap.

Cut a 4¾ in. circle of brass for the shade. Cut a hole in the middle to admit the chimney, and a piece out as you did for the conical cap, but only $\frac{1}{12}$th of the circumference, lap the edges, solder, and finish up with a file. Cut a notch each side of this shade for the wires to go in, and then solder the little pieces of brass, which you left loose on each side wire, at about 2¾ in. from the top of the reservoir. Now, when the shade is put on, the side wires should fit the notches, and hold the shade firmly, the little discs of brass supporting it. Polish up the shade and the rest of the lamp brightly. I prefer brass to plated copper for reflectors for such purposes as this. They are practically everlasting—there being no silver to rub off—and the difference is very slight.

This lamp is perfectly safe. I have knocked it on to the floor a number of times, and the only result has been darkness. I had to pay for my unintentional experiments though, in the shape of new chimneys. As to simple upsets they are too common to notice.

Fig. 15 is a little spirit lamp which I have found useful. The wick tube being cut at the angle shown, permits the flame to be directed downwards, if required, better than if the tube was cut parallel to the base—height 2 in., diameter 3½ in., size of tube say ½ in. Make a small hole near the top of the tube to draw the wick up by, and make a cap to prevent the spirit evaporating when not in use. A small brass bottle-top should be soldered in the top for filling purposes.

Some sheet metal workers may perhaps feel inclined to take exception to the method described of making joins in the sheet-brass work without any overlapping edges. To

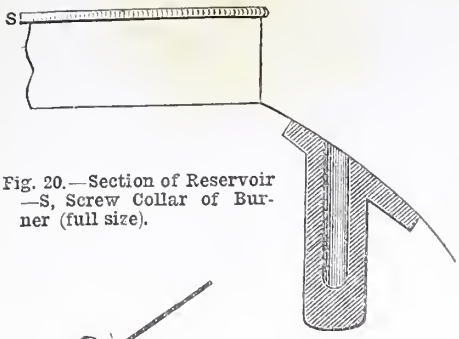


Fig. 20.—Section of Reservoir—S, Screw Collar of Burner (full size).

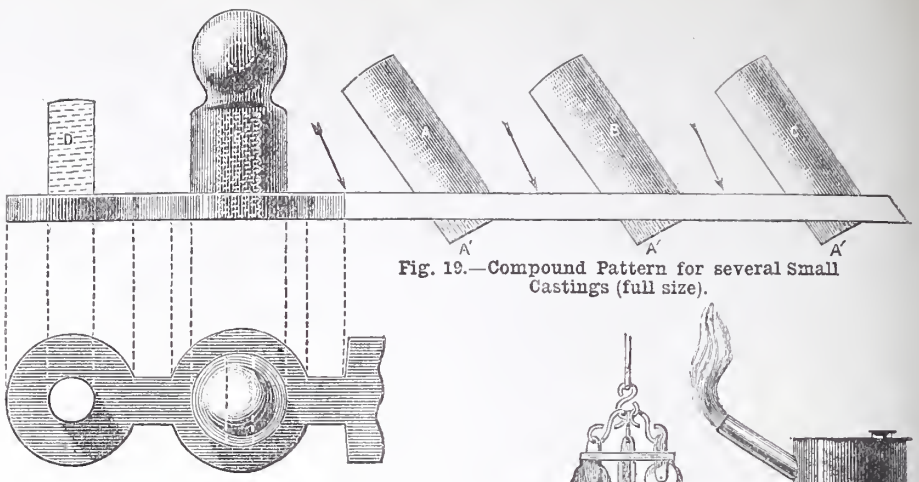


Fig. 19.—Compound Pattern for several Small Castings (full size).

Fig. 14.—Clip for holding Cap.

Fig. 15.—Spirit Lamp.

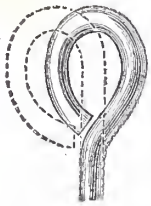


Fig. 13.—Loop.

Fig. 18.—Section of Edge of Brass Hemisphere.

Fig. 16.—Hanging Lamp, complete.

Fig. 22.—Method of joining Flat Brass Wire (full size).

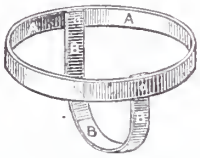


Fig. 21.—Ring to support Reservoir.

Fig. 17.—Alternative Form of Hanging Lamp.

Fig. 12.—Small Lamp, complete.

except with skilful sheet-metal workers. Amateurs would almost certainly fail to get nice lapped edges round curved work, even supposing the necessary tools were at hand.

The next lamp to be described is a hanging lamp. This style of lamp seems very popular, is certainly ornamental, and very useful if you are in the habit of dealing with large drawings or plans that need all the table for their support. But the special function of a hanging lamp is to illuminate a room, and accordingly I have designed a lamp which is suitable for any room from dining or drawing-room downwards. It is made of polished brass throughout, and of a simple pattern. The simplicity of the pattern is, I think, its chief recommendation—it is such a complete contrast to the flimsy, intricate metal work found in the cheaper kinds of over-ornamented lamps.

In Figs. 16 and 17 different modes of suspending the lamps are given. The first (Fig. 16) is intended to replace a gas chandelier, the wheels at the top of the latter over which the chain passes being retained. The chain, and probably the weights belonging to the chandelier, might also be used for the lamp. This method has one drawback. The long piece of tube, which is left behind when you take down the chandelier, must be cut off just below the wheels, causing a lot of trouble if it is desired to resume the gas.

such an objection I can only remark "that the proof of the pudding is in the eating," and the same remark, with some slight alteration, is applicable to the present case. The joins made as described are strong, do not leak, and, being out of sight, are quite good enough for the purpose. Indeed, I think that it is a case of Hobson's choice,

The other lamp (Fig. 17) is intended to be suspended from a hook screwed into the ceiling. This method is much to be preferred, as it does not interfere with existing gas-fittings. The damage to the ceiling is not worth mentioning. All that is necessary in the way of repairs, should you no longer require the lamp in that position, is a small plug of wood knocked gently into the hole left by the screw, until it is flush with the ceiling. A little whiting and water applied on the finger finishes the job.

We will start on Fig. 16. The oil reservoir is composed of two hemispheres of brass (the trade name of which I believe is "shells") soldered together to form a ball 5½ in. in diameter. They, and other shapes, can be obtained of Messrs. Stanton, 73, Shoe Lane, E.C., for about 1s. 6d. the pair. See they are neither dinted nor cracked. The edges of both halves are turned outwards and upwards like Fig. 18. With the soldering-iron tin the whole of the inside of both halves. This is necessary to prevent leakage—the brass being so tortured into shape that it is very probable fractures exist which are too small to be detected until the paraffin is put in on the completion of the lamp.

Find the exact centre of each half, and then drill a small hole there. Cut a hole in the half intended for the top (which should be the best one, by the way) $\frac{1}{16}$ in. smaller all round than the collar into which the burner screws. Before cutting out, however, mark another circle with the compasses, about ½ in. larger all round, and divide it into three. Solder on the collar from the inside. Drill holes at the three places marked on the larger circle, and enlarge them with a broach or round file, letting the edge of the metal rest on the bench and holding the tool perpendicularly. Make them large enough to admit a piece of ⅛ in. wire when held in the same position as the broach while enlarging the holes.

A pattern must now be made like Fig. 19 (full size), and a brass casting obtained. Divide it where indicated by the arrows. A, B, and C are to have a ⅛ in. hole drilled nearly through them, the little bit of metal A¹ being cast on as shown in order to enable you to start the drill. File up A, B, and C to roughly fit the curved surface, and then solder one under each of the three holes in the top of the reservoir. The section, Fig. 20, should make this clear. The utility of these holes will be seen presently, when I come to the description of another kind of lamp. The piece D, Fig. 19, is to have a screw thread cut on it, and the hole in the bottom of the reservoir is enlarged to admit it from the inside. When the screw is projecting evenly, solder it firmly on the inside. E, Fig. 19, is to be drilled and tapped to fit this screw, as shown by the dotted lines. A hole is also to be drilled transversely to admit a wire ring to pull the lamps down by. Be careful with the soldering, as, if anything went wrong inside, the reservoir would have to be separated—an awkward job. Always brighten up the metal where the solder is to go.

File the edges of the two halves, and finish off with a rub on a sheet of emery cloth. On putting them together, only a trace of the join should be seen. Secure them in place with a dot of solder here and there outside, and then solder all round from the inside. To do this it will be necessary to drop little bits of solder into the hollow formed by the join, and then curve the end of the soldering-iron by hammering, when, if the iron is hot, the solder will easily follow it round, the previous tinning facilitating matters. Test with water (leaving it in all night), and if all is right, clean up, polish, and put on one side. Another way of joining the two halves of the reservoir is given further on in the description of the weights.

We now have to make the arrangement for holding the reservoir. Fig. 21 gives a view of this without the ornamental arms. A is made of ½ in. by ⅛ in. flat brass wire. It should be of such a size that the reservoir will drop through it up to the join, but no further. File the ends, as shown in Fig. 22, while the wire is flat, and then bring them together and tin, lap, solder, and rivet, tapering the holes and filing off the ends of the rivets as shown. A tinman would be able to bend this part round nicely in his machine, or a casting could be turned up in the lathe.

B, Fig. 21, is now to be made of the ½ in. by $\frac{1}{16}$ in. flat brass wire. Before bending it to fit the curve of the reservoir, make a hole in the centre large enough to admit the screw which projects from the bottom.

If the reservoir fits A well, it will be necessary to halve the two ends of B into A, soldering and riveting; but if it fits loosely this need not be done. In either case, taper the rivet holes and file off the ends flush. When you come to the fixing on of the arms, see that they do not come on any of the rivets in A.

A pattern must now be made for the arms. One of them is shown half size in Fig. 23 (see my next paper). Inasmuch as shades vary in size, it will be necessary to make a full-sized drawing in order to get the right position for the lugs by which the arms are attached to the shade-holder and A, Fig. 21. If you go to work haphazard, you will probably find that when the arms are riveted to the ring they will not allow the shade-holder to be fastened to them. As so much depends on the correctness of this drawing, and so many of the readers of WORK are amateurs, I think I cannot do better than commence my next paper with a description of the process.

HOW TO SHARPEN A PENCIL PROPERLY.

BY JAMES SCOTT.

"WHAT a sharp point!" I have often had remarked to me when my pencil has been travelling over a sheet of paper upon which probably I have been rough-sketching a piece of furniture in a workshop or warehouse. At first it may seem extremely superfluous to give a few hints how to properly sharpen a pencil, but I have frequently met with workmen who, although they say they *will* and certainly *do* have all their tools nicely sharpened, have, supported behind one of their ears, a pencil with a point the appearance of which almost makes me feel ill, and causes me to wonder how on earth men who are so used to working generally with sharp tools can progress favourably with such a piece of bluntness. It is far from improbable that many workmen of this class are gazing at this note, and to them, I am sure, this little mite of instruction will prove useful. It will come as handy, too, to the reader who, although he does not often find it necessary to use a pencil, now and again has a desire to trace or reproduce drawings given by the writers of this Magazine. Ninety per cent. of men—(we will not consider women, for in this matter a smile of intense pity always creeps over my features when I behold the excessive mutilation a woman inflicts upon a pencil)—ninety per cent of men hold the pencil in the air, with the end to be sharpened furthest from them, and slash away at it vigorously, and mentally curse the quality of the lead when they see piece after piece fall off, forgetting that after every stroke of the knife the pencil naturally springs upwards, its extreme point suddenly catching against the knife blade, and, consequently, standing a chance of being broken. In a draughtsman's office, almost the first lesson taught is how to properly sharpen a pencil, and it is no easy matter to the beginner to thoroughly accomplish this work, as I have personally experienced. There is more than one reason why a pencil point should be well sharpened: when the pencil is passing along outside the edge of a T-square or a mould, it should be close up against either of the latter, as the case may be; and when in ordinary drawing or tracing, a clear view should be obtained completely around

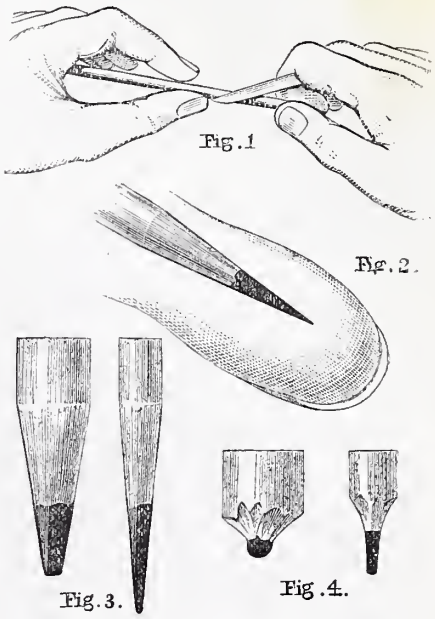


Fig. 1.—Beginning the Point. Fig. 2.—Where to place Point to finish. Fig. 3.—Good Points. Fig. 4.—Bad Points.

it on the paper. Then again, if properly sharpened, one operation of the knife in connection with the wood will be sufficient for a lengthy period; whereas, with a badly sharpened point, every time the lead is slightly worn, further hacking of the wood is necessary. The method I was taught, and one which I can honestly say I believe to be the best, is shown in Fig. 1, which represents the commencement of the sharpening process. While the wood is being cut, the pencil should be regularly and slowly turned in the left hand. When the wood is partly cut away, the finishing of it and the lead should be performed by holding the point embedded slightly in the top of the left-hand thumb, with the top of the right-hand thumb pressing against the left-hand thumbnail. All the time the knife is working *towards* the operator; and it will be clearly understood why, by such means, there is very little chance of any sudden concussion on the part of the pencil point against the knife blade, which chance is further lessened in the finishing process by the pencil point lying in the flesh of the thumb, and being slowly turned the while.

THE ART AND PRACTICE OF SCENE PAINTING.

BY WILLIAM CORBOULD.

THE COLOURS—PREPARATION OF THE CANVAS.

The Colours.—I will first give a list of the colours most suitable for scene painting, and then proceed to describe their properties and the mode of blending some of them in order to obtain the different tints required.

Reds.
Damp lake.
Vermilion.
Chinese red.
Venetian red.

Blues.
Azure blue.
Celestial blue.
Indigo.

Yellows.
Yellow ochre.
Lemon yellow (pale).
Do. do. (deep).
Orange chrome (pale).
Orange chrome (deep).
Dutch pink.
Raw sienna.

Browns.
Brown lake.
Burnt sienna.
Vandyke brown.
Burnt umber.
Raw umber.

Whites.
Whiting.

Some medium size, with water, as explained further on, must be used when mixing the colours. I will now explain the properties of the colours enumerated, as some require different treatment to others in their mixing and using.

Damp Lake.—This, if good, should be of a bright crimson, rich and transparent; it will blend with any colour, forming hundreds of tints of great beauty. It is bought in a paste ready for use, requiring no preparation. It should be kept covered with water.

Vermilion.—Of this colour several kinds are manufactured; the best is crimson, which is the most durable. To prove whether or not it is good, rub a small portion on a piece of white paper; if adulterated it will change to a deep chrome yellow, if pure it will not change its colour. Being a heavy pigment, it would, if mixed with water only, for your palette box, sink to the bottom, forming a hard cake, and cause a deal of trouble. The best way is to mix it with sufficient size, so that when cold it would be a soft jelly. As the colour is thus held in solution, it will be much easier to work with.

Chinese Red.—This is a sort of mock vermilion, very serviceable, but not so bright as vermilion. This pigment is best mixed for the palette box in the same way as vermilion. It is specially useful for painting old red brick walls, chimney-stacks, tiles, etc.

Venetian Red.—This is a useful colour to the scenic artist, and may be mixed with water only for the palette box.

Azure Blue.—This is a beautiful colour when good, and is very useful; being a light pigment, it may be mixed into a paste with water for the palette box.

Celestial Blue.—This is a much darker colour than azure blue; it may be rubbed up with water for the palette box, and will form a variety of tints when blended with other colours. There is good and bad of this pigment; if a small portion is rubbed up with white it ought to be a bright blue, approaching azure in tint. It will make good greens when mixed with different yellows. It is a capital glazing colour, and good for shadows.

Indigo.—This is a good colour for various purposes. It is rather expensive, but a little goes a long way. A good substitute for it is celestial blue subdued with a very little vegetable black. A long range of greens may be got from indigo and yellows, particularly Dutch pink. It is also a good glazing colour. Being a light pigment, it may be ground up with water into paste for the palette box.

Yellow Ochre.—This is a good, useful pigment; it should be of a good bright tint. It may be mixed with water into a paste for the palette box. No other yellow is so good, when used with white, for large clouds in the sky, particularly for the high lights.

Lemon Yellow (pale or deep).—This colour will be found to be very useful for high lights and bright touches. A great variety of green tints are made by blending lemon yellow with other colours.

Orange Yellow.—This is another chrome, and may be got pale or deep, for uses similar to those for which the lemon chrome is applied. Both may be rubbed up with water for the palette box.

Dutch Pink.—This is a brownish-yellow tint, and is a most useful colour for greens, when mixed with blues chiefly. It is bought in lumps, and may be ground up with water for the palette box.

Raw Sienna.—This may be procured ready ground in water; it is similar to Dutch pink in colour, and useful for the same purposes.

Brown Lake.—This is a beautiful rich pigment, very useful to the scene painter. When in juxtaposition with greens it tends to take the rawness or cold look out of them, imparting a richness to the foreground. As it mixes kindly with all colours, its several uses are too various to describe. This pigment may also be rubbed or ground up with water for use.

Burnt Sienna.—This most useful colour is of a rich red brown; it may be purchased ground in water ready for use. It is a transparent colour, and will make good greens when used carefully, imparting a richness to foliage, especially autumnal tints. Raw sienna and orange chromes are useful for the same effects.

Vandyke Brown.—This colour may be purchased ground in water ready for use. It is a very valuable pigment.

Burnt Umber.—This is another colour that may be procured ground in water ready for use. It is useful for a variety of things, giving good stone-colour tints, when used with white and yellow ochre, for rocks, old buildings, etc.

Raw Umber.—This, too, may be ground up with water; it is lighter in tint than burnt umber, and is useful for similar purposes, as well as for clouds, when mixed with yellow ochre and white, which will be explained further on, when I come to sky painting.

There are, of course, other colours besides those described which are used by the scenic artist, but those which have been enumerated above are all that is required for the present.

Preparation of the Canvas.—This operation requires care, so that the canvas may have a good flat surface to work on. The best plan is to have a frame of the size of the cloth you are going to paint on. This can be made for temporary use with battens. It is most desirable not to allow the canvas to touch the wall or anything behind, except at the extreme sides, top, and bottom, because in the painting whatever the brush comes in contact with leaves a mark if the artist is not very careful, which spoils the work when dry. It would not matter if the wall were plastered and thus presented a flat surface, but a brick wall would be very objectionable. Supposing that the battens which are to be used are 3 in. by 2 in., the artist should place the two-inch side to the wall, which would keep the canvas three inches off the wall. If the stretching is not done well the canvas will touch the wall in the centre. In stretching, take up one corner and tack it to the top of the frame; next take up and tack the other top corner, and then the top centre. The cloth is now hanging down from the top, and the artist must now tack the two bottom corners, and then the bottom centre, and lastly, the side centres. Having done this, pull the cloth as tight as you can. The cloth is now tacked at the four corners and centres; proceed to tack it all round by dividing the centres and corners, stretching the cloth tightly at every tack, until the tacks are about six inches apart all round. The cloth will then be ready for priming.

I have shown the way to mix the priming in page 642, when writing about whiting. This priming of the canvas must be well done by crossing and recrossing the brush, rubbing it well into the cloth; not a square inch should be missed in any part, and great care should be taken in this part of the work, so that when dry the cloth shall present a broad flat surface, as tight as a drumhead.

When joining your canvas, always put the selvedges together, and have them over-sewn. Supposing your cloth to be 15 feet high and 18 feet long—or, in other words, six yards by five; as the canvas is two yards wide, it would take fifteen yards of stuff to make the cloth. Two lengths of six yards each must first be sewn together. The piece that is left, which is three yards long, must be cut through the length. The two pieces thus obtained are put together so that the selvedges are on one and the same side. Join the selvedge of this piece to one of the selvedges of the large piece. The cloth is now ready for the frame. In hanging up the cloth, keep the part where the two small pieces were put on at the bottom, as the extra seam that it has been necessary to make would not show in the foreground painting, but it might in the sky. Of course, if the cloth was eighteen feet high the three lengths would go together simply enough. I have explained this in case it should be necessary to join in the way described.

To repair a cloth that has a hole in it the patching must be done before priming in this way:—Cut a piece of canvas a little larger than the hole to be repaired, have some thin glue, and glue the piece to be put on all over; have a piece of flat board held behind the hole, place the piece over the hole, and rub it down with a damp piece of rag or canvas. If done neatly, it will not be seen when the painting is finished.

OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

111.—THE "RIDSDALE" FIRELIGHTER.

THE "Ridsdale" Firelighter is a handy contrivance that has been recently patented and introduced to the public by the Ridsdale Patent

Firelighter Company, and is manufactured by them at Crewkerne, Somerset, and sold by them, and will be sold in due time by all ironmongers and oilmen on account of its obvious utility. As may be seen from the illustration, it consists of a diamond-shaped cast-iron box, 3¾ in. long and 2¾ in. wide, with a handle 8½ in. long attached, having a hole at the end by which it may be hung up against the wall. The depth of the box externally is 1 in., and at the top are the letters **R F**, forming a kind of grating, under which is a packing of asbestos. To use the Lighter, paraffin oil must be poured on the asbestos until it will take in no more; a lighted match must then be applied, and the lighter passed between the bars of the grate and allowed to rest on the bottom. Coal must then be placed

The "Ridsdale" Firelighter.

lightly and loosely around and over the lighter, which, being of cast iron, cannot be injured by the flaming paraffin or burning coal. When the oil is burnt out, the Lighter should be withdrawn, to be refilled with oil and used again when wanted. A fire of coal only, without sticks or paper, will be well alight in a quarter of an hour, and in much less time if sticks are used. Boiling or frying may be effected by its aid, if the Lighter, charged with oil and alight, be placed between the bars of the grate and the kettle or frying pan placed over it. Bakers, it is said, may use it as a lamp for lighting up their ovens at the time of filling and drawing. It is economical in its use, for ten or twelve fires may be lighted without wood or paper for a penny, and doubtless, considering the cost of bundle-wood, many will buy it and use it for this reason. Bachelors and others living alone, or with a chum in chambers, will find it most valuable, as it saves the trouble inseparable from laying in a fire. It is ready for use in a few seconds, and is safe, reliable, cleanly in use, and free from smell.

112.—Elementary Chemistry for Science Schools and Classes.

I have had occasion to speak before of the excellent series of practical illustrated manuals specially prepared for the use of the students of the Polytechnic Institute, Regent Street, London, W., but designed to meet the wants of all students in Science and Art Schools, and to satisfy the requirements of the new Syllabus issued by the Science and Art Department, South Kensington. The preceding volumes of the series, which are noticed in page 74 of this Magazine, as well as the volume now under consideration, are published by Messrs. Cassell and Company, Limited, La Belle Sauvage, Ludgate Hill, London, E.C. The author is Mr. Robert Avey Ward, Lecturer at the Polytechnic, Cooper's Grammar School, etc. etc., and its price is 1s. 6d. Its contents are arranged in twenty-three chapters, commencing with an exposition of the elements of which all matter, be it what it may, is composed, their mechanical mixtures and chemical compounds, and ending with a review of the known metals and their alloys. To go through the chapters seriatim is impossible through want of space, but after showing that matter is practically indestructible, and that what we regard as its destruction is in reality nothing more than change of form, or resolution into its original elements or their combinations, the writer proceeds to explain the symbols and formulæ used in chemistry, and the modes of chemical action, and then to deal with the properties of oxygen and ozone, hydrogen, water, nitrogen, the air, carbon and its compounds and oxides, and sulphur and its oxides. Naturally this is but a very rapid and imperfect summary of the well-ordered contents of the volume, and all that can be done in addition to this is to recommend in the strongest terms this excellent treatise, which is most clearly and tersely written, and with whose aid no intelligent student can fail to acquire sufficient knowledge of chemistry to pass any elementary examination, and even more. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Formulæ.—Brass writes:—"I see A. R. (*Scorrier*) writes in 'Shop,' No. 89, page 599, complaining of the use of formulæ in replies to questions which are submitted by correspondents. At first sight, one is inclined to imagine A. R. has reasonable grounds for complaint, but on giving the matter a little thought, a few ideas occur to me showing good reasons why formulæ should be used. There can be no question that the primary object of Work is for educating its readers in the theory and practice of all kinds of mechanical labour, and the best way of doing so is by using methods which will help to impress upon the minds of readers the manner by which various results are attained. Thus, formulæ are of great benefit in helping us to remember how to solve many and complex questions in mechanics and other sciences, many problems of which it would be almost impossible to work out without their aid. Then, if it is as A. R. says, 'questions so answered may be very clear to some, and puzzling to others,' some correspondents may, perhaps, not understand arithmetic beyond simple multiplication and division; how is anyone to know to what extent readers have such knowledge? If readers were to be replied to as A. R. would like, how would questions be answered such as the one asked by Nero on 'The flow of water through syphons' (see page 503), and many others which are answered similarly from time to time? When complicated formulæ as the above-mentioned are given in reply to a correspondent and he cannot understand it, it is generally the correspondent's own fault that he gets such formulæ for an answer. The fault lies in this: if the reader, instead of asking for the rule or method for solving a question, would state the question itself that he wants to be solved, he would then get for reply an answer which he could understand; and not a rule in which the use of terms or arithmetic are used, the explanation of which would probably take up all the columns allotted to 'Shop,' the space of which is very much taxed as it is. Then supposing that there was sufficient space in 'Shop' to allow of questions being dealt with as A. R. suggests, it must be remembered that those who have to answer the questions have not always so much time on their hands that they would be inclined to go into the elementary details of any subject. The formulæ used by me, to which A. R. objects, is of the simplest character, and with the explanation which is given with it, could, I think, be readily understood by anyone. It would not have been a difficult matter to have dispensed with the formula, but it would have necessitated the reply being about twice the length. Why the question at the end was asked, was that if any certain point could not be comprehended (we all do not read Work through the same pair of eyes), the correspondent could point out that particular portion and have it explained further."

Draping an Iron Bedstead.—J. H. B. (*Pendleton*) writes:—"I read the article on the above with great interest, and now send you sketches of a simpler plan which, though not so picturesque perhaps, will be found more easy to construct for anyone who is not very cute at joinering. Fig. 1 shows the

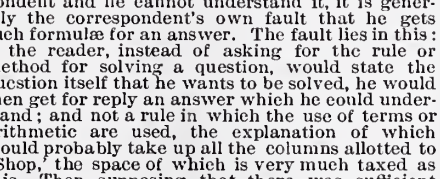
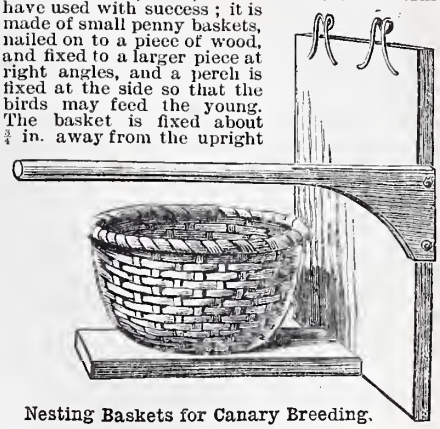


Fig. 1. Fig. 2. Fig. 3.

Iron Bedstead Hangings.

arrangement without the curtain. It is merely a pole fastened horizontally to the wall (Fig. 3). Fig. 2 shows it with the curtain over it. If it (the curtain) be box-pleated along the top, there will be quite enough to meet at the back and keep out the draught."

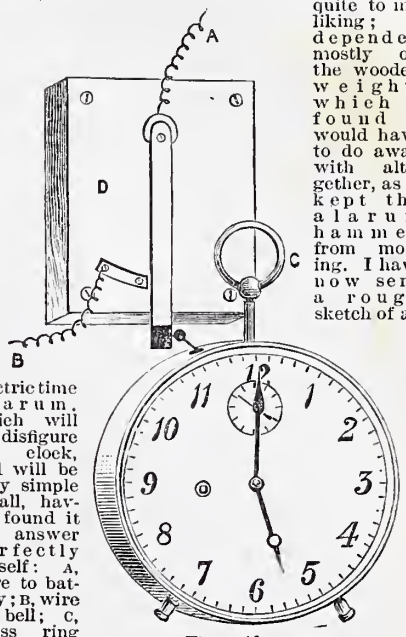
Nesting Baskets for Canary Breeding.—F. H. (*London, S.W.*) writes:—"Here is a form I have used with success; it is made of small penny baskets, nailed on to a piece of wood, and fixed to a larger piece at right angles, and a perch is fixed at the side so that the birds may feed the young. The basket is fixed about ¾ in. away from the upright



Nesting Baskets for Canary Breeding.

piece, so that the droppings of the young may fall away from the nest all round."

Time Alarum.—H. F. S. (*Hammersmith*) writes:—"Having followed up the plan of L. Pendred (see page 416, No. 78, Vol. II.), I found that it did not act quite to my liking; it depended mostly on the wooden weight, which I found I would have to do away with altogether, as it kept the alarum hammer from moving. I have now sent a rough sketch of an



Time Alarum.

electric time alarum, which will not disfigure the clock, and will be very simple to all, having found it to answer perfectly myself: A, wire to battery; B, wire to bell; C, brass ring to unscrew to remove gong; D, box to be made in width to suit clock, and screwed to wall; the clock can be removed at pleasure. When the alarum has been wound up and set to time wanted, the hammer strikes the switch bar enough to join the circuit, and continues ringing the bell till someone gets up and stops it."

II.—Questions Answered by Editor and Staff.

Bright Copper Deposit.—A. H. D. (*Birmingham*).—I have frequently deposited a thin film of copper on a burnished surface without impairing the brilliance of the burnish to any great extent. This has been done in an alkaline solution of copper, and working at a temperature of about 160° Fah. Thick deposits of copper from any solution must have a dull appearance, because the copper is deposited in small grains massed together, but bright deposits of copper may be got on *highly polished* brass or any other metal, if a thin film only will suffice. This coat will soon discolour on exposure to the air, and will even lose its lustre whilst drying unless kept covered with hot sawdust. The coppered article should be lacquered whilst hot from the drying oven, to preserve its lustre. The surface of the article must be previously highly polished to ensure success.—G. E. B.

Nickel-Plating Bicycle.—G. F. M. (*Bristol*).—You are about to take a high flight in nickel-plating by attempting to re-nickel the worn parts of your bicycle, and this is a job beyond the province of an amateur. It requires more than ordinary skill born of experience, and is best relegated to the professional plater. The greater part of your questions relative to this job will find complete answers in the replies to J. C. J. (*Hepworth*), on page 551, and M. R. (*Huddersfield*), on page 552, Vol. II. of Work. You will probably require three Bunsen cells in series, and these should be large, holding over one gallon of liquid. Vessels of zinc or of tin are unsuitable as plating vats. One pound of the double

sulphate of nickel and ammonia dissolved in one gallon of hot rain-water and allowed to cool, or two pounds in three gallons of water, will both make good depositing solutions of nickel. You should practise for a few weeks on other smaller things before attempting to plate your bicycle.—G. E. B.

Half-Plate Camera.—A. B. C.—If A. B. C. procures the Index to the first volume of WORK, he will find reference to working diagrams for making a camera with a reversible back. The size given is for 8½ in. by 6½ in. With a very little ingenuity he will be able to adapt it to the size he requires, the design being the same in both cases. A little lighter material is, of course, permissible.—D.

Ornamental Turning.—F. P. (*Andover*).—You are accustomed to wood turning, and wish now to do spherical and plain fluting. For fluting you will require a slide-rest, a division plate and index, a drilling spindle and an overhead motion; also you would want fluting stops. For spherical fluting you would require either a dome-chuck or a spherical rest in addition to the foregoing. Now, you see all this apparatus will be very expensive, and if you make it, it will require very good workmanship. Also it would be a pity to add very valuable apparatus to an indifferent lathe. Probably your best plan would be to look out for a second-hand ornamental turning lathe, and you may, perhaps, get one with the above apparatus at from £50 to £100. Suppose, however, you are satisfied with your present lathe, and wish to add the required apparatus yourself, then try to pick up a slide-rest, say £4; driller with half dozen drills, say £2; your pulley divided, or brass plate fitted to it containing three rows of holes, also index spring and peg, say £2; you must then make the overhead motion and fluting stops. A dome-chuck costs about £10, and a spherical rest £50; the best, when new, cost £15 and £75.—F. A. M.

Lathe Mandrel.—W. E. P. (*Manchester*).—Papers on mandrels by me are in hand, which will, perhaps, help you. Your brass step pulley may come in, but the ½ in. spindle is not worth making a mandrel of. If you are determined to use it, you might have a ¼ in. screw cut on one end, with a shoulder for chucks; and have two necks turned in it for the bearings. ⅛ in. extreme diameter is so very small, you would only have a lathe fit for turning chess-men.—F. A. M.

Acorn and Cone Work.—JACK will find some hints on this work in an answer to F.H., in WORK, Vol. I., p. 685, No. 43.—M. M.

Watch Matters.—LEO.—(1) Mainsprings. To gauge the strength of mainsprings, I use a Jacot pivot gauge, and find it answers the purpose well; it is sold by the tool shops for about 1s.; it is two pieces of steel about 1½ in. long, held together by two short cross-pieces and having scales one each side; at one end the two pieces meet; at the other they are about $\frac{1}{16}$ in. apart, and being 1½ in. long, this gives a fair fine gauge. To use it, pass the end of the spring through the open end, and gently let it drop, and note what figure it is against, then test the new one same way. (2) In ordering springs, you must have a mainspring gauge, or send the barrel if you have the gauge; see that the old piece of spring is the right height; if so, gauge it for height by fitting it in the notches till it fits one tight, take number of it, and then take the barrel and fit it over or in the rings or countersinks that are turned on the flat sides of the gauge; take the number of the sink it fits in, and order the spring, you will then find it is the proper strength for the watch. There are two mainspring gauges, one for the English watches, and one for Geneve. (3) Geneve mainsprings will not do for English lever watches. (4) A good spring when wound up hard several times in the winder, and then let out, should keep its form and size, but a soft bad spring after a few windings will not open out as it should; the general finish too is indifferent, and the price is also different; order at a good shop and pay a good price, and, no doubt, you will get a good article. (5) You cannot alter a spring, or, if you could, it would be useless. (6) Punches for riveting, etc. "Boley's" make in boxes, twenty-one punches, 3s. 2d.; thirty-two punches, 4s. 6d.; forty punches, 6s.; and fifty, 7s. 6d. You will find the box of forty will be a good assortment and will do all general work. Punches for hole closing, "Boley's" to 3m., per dozen, 13s.; to 6m., per dozen, 14s.; to 9m., 17s.; or in sets of six, 6s. 6d.; twelve, 13s.; sixteen, 18s.; these prices I take from Haswell and Son's list, 49 and 50, Spencer Street, Clerkenwell. There is a barrel-hole closing tool which will close any hole from a large barrel to a small fourth-wheel hole, price 22s. 6d.; also another riveting stake and punches complete at 16s. 6d.; these two I take from Grimshaw & Co.'s list, 35, Goswell Road, Clerkenwell. (7) Dooming punches are used by case makers for making the shaped cases. (8) The Hammond wheel I know nothing of, so cannot say, and I have not Cohen's list to judge from. (9) I use small emery wheels. I have several down to 1½ in. diameter and smaller, and any thickness down to about ⅛ in., also different coarseness and fineness. I obtained these also from Grimshaw & Co.; write and get their list, enclosing, say, six stamps, and you will have a list of nearly everything you will want and a great deal you will not want. I trust these remarks will be of use to you, and that you will obtain what you require.—A. B. C.

Wooden Printing Press.—J. A. G. (*Sunderland*).—As you are doubtless aware, there is many a slip 'twixt the cup and the lip, and many an awkward hiatus between promises made in all good faith and the fulfilment thereof. It was found necessary to return the manuscript of "A Wooden Printing Press" to its author for compression and division into parts, as it was too long to appear in a single number. With regard to replies in "Shop," they are still on the increase, but everything that can be done to relieve the congestion is done.—ED.

Dialyte Telescope.—AM ASTRO asks for instruction for making a telescope of the Dialyte form in "Shop," 8 in. or 10 in. Also cost of same with diagrams of instrument, if possible. I am afraid this is rather a large order for "Shop," but I will do my best. I have never made an instrument of this form, though I am fortunate to possess nearly all the literature there is on it, and will give AM ASTRO the benefit of it. On paper it is a most simple instrument to construct, in practice it is somewhat difficult. One of our principal manufacturing opticians said a few years ago that, being desirous of placing such an instrument on the market, he made the attempt; but, though he had ample appliances, he failed to produce one to his satisfaction. The principal advantages are that, as the correcting lenses are placed at a distance from the front O.G. about one-half of its focal length, they need not be more than one-half the diameter of the O.G., which, consequently, makes a great difference in cost; and secondly, that by slightly shifting them experimentally, the best position may be found for correcting spherical aberration. The great difficulty is that of properly centring the three lenses—as if they are not accurately centred, they will be utterly useless. The following combination gives good results:—Object lens, 8½ in. in diameter; white crown equi-convex, 130 in.; radius of curvature, 10 ft. focus; corrector, 4½ in.

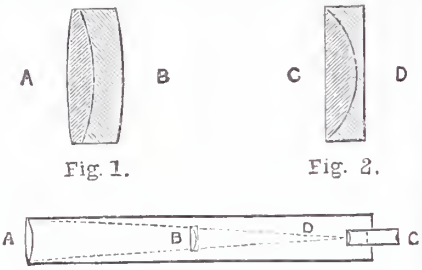


Fig. 3

Dialyte Telescope. Fig. 1.—A, Crown Glass; B, Flint. Fig. 2.—C, Dense Flint; D, Plate Glass. Fig. 3.—Section of Dialyte Telescope—A, O.G. Plano Convex; B, Correctors, Plano Convex and Plano Concave, half diameter of O.G.; C, Eye-Piece; D, Cone of Light.

diameter; crown double convex, 12·5 in. and 130 in.; 4½ in. flint; a miniscus concave 12·5 in., the two faces 12·5 together; convex, 130 in. These may be cemented as in Fig. 1, and are placed from the O.G. about one-half of its focus. If AM ASTRO considers the cost of such an instrument too great as an experiment, I will give him another formula:—Object glass, 4½ in. diameter, focus, 60 in.; double convex radi, 24 in. and 240 in.; correctors, 2½ in. diameter; plano concave, 3½ in. radius of double dense flint; plano concave, 3½ in. radius of plate glass; the concave and convex faces together, Fig. 2. It is sometimes an advantage not to cement them, as the best performance is given when they are slightly separated. The compound corrector should be mounted in a separate tube, so as to allow of adjustment. In Fig. 3 is given a section of the instrument. The eye-piece is an ordinary one. The Editor has in hand a short article on the building of eye-pieces which, no doubt, will in due course appear, and will supply the rules for constructing any given power. The mere mechanical work I must leave, as it would be too long to give such details in "Shop." Now as to cost, I cannot give any estimate that could be valuable, but accurate information can be obtained from any of the practical opticians who advertise in any of the scientific papers. One other word; in my judgment the corrector should be slightly larger than one-half of the clear aperture of the O.G., as it may require to be placed a little less than one-half the focal length from the O.G. If so, it cannot take in the whole of the cone of light; consequently, a portion of light will be lost.—O. B.

Gilding Coin.—R. H. (*Accrington*).—You can gild the coin yourself, but an outfit of some sort must be obtained. As you seem to know nothing of gilding, I think a new arrangement, called "The Practical Electro-Plating and Gilding Outfit," will suit you best. The price is 21s. This includes Bunsen battery, gold, silver, copper solutions, scratch-brush, sawdust, etc. etc., and these are enclosed in a box, along with directions for use. Plucknett & Co., 29, Poland Street, London, W., are agents, and will reply to any inquiry for further particulars. If you do not intend to go in for anything like that, you might send it to some electro-gilder. Pairpoint & Sons, 7, Green Street, Leicester Square, are the best firm I know. There is *no* process whereby merely painting powder on will stand wear.—H. S. G.

Lathes in WORK.—SNOBBY.—Several articles on making lathes have appeared in WORK by SELF-HELPER, entitled "Lathes for Everybody." You should get an Index to Vol. I., post free for 1½d., from Cassell & Co., and you will then be able to see what numbers you should purchase.

Wire Thread Fret Saws.—D. D. (*Aberdeen*).—I mentioned Messrs. Moseley (not Mosley) and Son, 323, High Holborn, London, W.C., as a firm from whom you would be most likely to obtain the wire thread fret saws. It is, as I call it, an "old-established" firm, and still flourishing. Why you have not received any reply, as you state, to your two letters is more than I can say. When I myself give an address, you may rest satisfied that the address is correctly given. Your letter, which bears initials only by way of signature, and no name or address beyond Aberdeen, has been sent on to Messrs. Moseley and Son, and they, doubtless, will be able to explain why your letters have not been answered if they have received them. At the same time, if readers of WORK write to addresses given, and do not get replies, they cannot reasonably expect me to expend both time and trouble in ferreting out the reason. In the majority of cases in which I have done so, I have found that the non-receipt of a reply is to be attributed to some shortcoming on the part of the writer. Possibly, as in your letter to me, you have omitted to give your name and full address.

Cabinet Photo. Frame.—P. W. (*Leeds*).—I note that you complain of the ill effect of the narrow margin of the cabinet photo. frame given in page 533 of this volume. The pattern, as you say, certainly looks very well in the page, but as I have not seen it cut, I cannot speak to its appearance in this condition. My plan of finishing it would be to back the outer portion to which the folding-doors are attached with a wood contrasting with the fret-cut wood in colour, forming a rebate wherein to set the photo., which must itself have a backing. If to stand on a table, I should then have placed it on a miniature easel. If hung against a wall, I should certainly have placed the cut panel in its entirety in an external frame, the fretwork thus serving as a sort of mount for the photo.

Rubber Oddments.—RUBBER could not make a bicycle tyre unless he worked in a factory where rubber tyres are made. His plan is to sell his rubber to a manufacturer and get equivalent in a new tyre.—A. S. P.

Fresco Cement.—A. G. A. (*Sand Pits*).—I could place at your service any part of the practice or compounds used by the celebrated French fresco artist, M. Borromée, did I know what you want. If you mean by "a permanent cement called fresco cement," the basis of the painting upon, or mixed with, which colours are applied, there are several such compounds believed to be permanent, but each prepared for different exigencies of the work. Permanent fresco painting is a difficult matter, requiring skill and experience from the first scraping of the stone wall, through the necessary two or three coats of "anti-absorbent" mixtures, and then in the final waxing—all irrespective of the artistic aspect of the work.—DECORATOR.

Indiarubber Process.—W. H. R. (*Birmingham*).—The process consists in coating one side of each piece of cloth with a solution of indiarubber in naphtha, placing the coated surfaces together whilst still wet, and passing the whole between steam-heated cylinders, to secure contact and evaporate the solvent.—QUI VIVE.

Stamp Mounting—Prices—Level.—H. O. B. (*Peckham, S.E.*).—You might help readers by making this known gratuitously through Section I. of "Shop." Also make known the addresses of any dealers of articles by going to whom money can be saved. Any carpenter will make you a level.

Electrical Resistance.—DENNY.—First abandon the idea of a battery being made to give a certain number of ampères at the terminals under all circumstances. The current given there will depend upon the voltage of the battery, divided by all the resistances in the circuit; the internal resistance of the battery cells as well as the external resistances of every connector and conductor in the outer circuit. Suppose we have a battery with an E.M.F. of 4 volts and an internal resistance of 1 ohm. Then, 4 volts divided by 1 ohm will equal four ampères, and this will be the volume of current obtainable at the terminals at the moment of closing the circuit—that is, of connecting the zinc at one end with the copper at the other end of the battery. But the internal resistance of the cells will rise at once, and the current will fall when the circuit is closed. When a resistance of 1 ohm is put in the outer circuit, the volume of current will then be $\frac{4}{2}$ = 2 ampères. Part of the current is absorbed in heating the conductors, but less current is generated in the cells with a high resistance in the circuit.—G. E. B.

Internal Resistance of Battery Cells.—DENNY.—If I put it to you in the following manner, I think you will see clearly that the resistance of the battery is one-fourth instead of one-half. Suppose the internal resistance of each cell to be 1 ohm, then four cells placed in series will have an internal resistance of 4 ohms. If we now take off two of the cells, the remaining two will have a resistance of only 2 ohms, since one-half the number of cells will have only one-half the resistance of four cells, and $\frac{4}{2}$ = 2. If now we place the two halves of the battery side by side and connect the ends together so as to form a battery of two rows of cells with two cells in series in a row, we shall provide two paths for the current instead of one path, and as this will halve the internal resistance of the cells, the total resistance will be $\frac{2}{2}$ = 1 ohm—that is, one-fourth the resistance of four cells placed in series.—G. E. B.

Employment in Electric Engineering Firms.—A. B. C. (*Malta*).—As you have had ten years' practical training in the use and repair of electrical instruments, you would stand a good chance of obtaining employment in an electrical engineering firm making a speciality of electric light installations. Your first-class certificates of ability and character would secure you favourable attention from the heads of such firms, but you must be prepared to wait for a vacancy after you have made application. A gentleman who does business in this line says you must also be prepared to begin at the bottom and *work* your way up to the higher branches of the profession. You might make written application to some of the firms mentioned in the Electrician Trades Directory, 1891 edition, published at 5s. 6d. by the *Electrician* Publishing Company, 1, Salisbury Court, Fleet Street, London, E.C.—G. E. B.

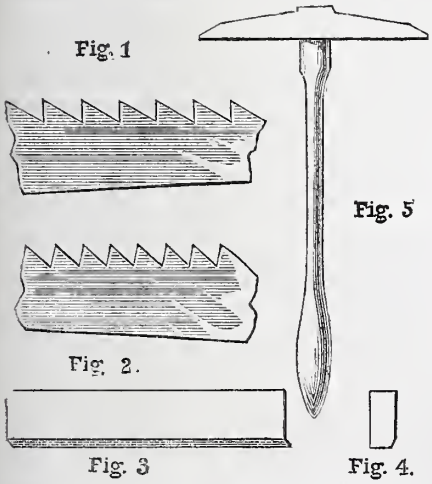
Dog Cart.—F. F. (*Cardiff*).—An article appeared in WORK, No. 19, entitled "The Battlesden Cart," which you might accommodate to your requirements.

Chiffonnier.—F. E. (*Bagnall*).—Thank you for your design "drawn from one at home" for DUSTY-POOL.

Globe Maps.—R. J. (*Glasgow*).—Messrs. G. Philip & Son, Map Publishers, 32, Fleet Street, London, E.C., are pretty sure to sell what you require—namely, maps to recover an 18-inch globe.

Compo.—F. F. F.—As to the ornamental pomatum-pot top, if a few hints are of any use, we give them. The substance appears to be prepared in a paste, and to undergo thorough grinding, mixing, and probably then is pressed into metal moulds, as "lincrusta" is made. Its component parts appear to be gypsum—finest plaster—a little indiarubber, linseed-oil, and probably some shellac. The oxidisation of the oil after the moulding process would cause it to harden. It is not of a china or clay nature. Notice that it is a patented thing.—F. P.

Hand Saws.—AMATEUR.—You say it is awkward to get a competent man to sharpen your saws. I experience this often, as saws that have been sharpened by a travelling man on a Friday have been sent some two or three miles to me on the following Monday to be resharpened. You wish to know what tooth is best for ripping, and what kind of shape is best for cross-cutting. To make it very clear, I give rough sketches of teeth for both ripping and cross-cutting. Fig. 1 will be found the most suitable for ripping, and when sharpening, shoot the file almost straight across the teeth, which will give the front of teeth but little bevel. It will be seen that for ripping, the teeth for general work are a little coarser than for cross-cutting. Teeth, Fig. 2, are suitable for cross-cutting; it will be seen that the front of these teeth are not upright, as you asked in your letter, but they lean back a little; this is to prevent the saw pitching, as we term it. Again, the front of these teeth should have a deal more bevel than the rip-saw teeth, for the following reasons. It will give the teeth a keener edge to cut across the grain or the fibres of the wood, and in cutting across very soft wood the bevel should be greater than for cutting across hard wood. In reference to patent saw sets, parties from time to time have brought patent saw sets to me asking my opinion of them, and in all cases I disapproved of them. The following will be the best and quickest way to set your hand saws. Get a piece of steel 6 or 8 in. long, 1½ in. or 2 in. wide, and bevel as in Figs. 3 and 4; put it in a vice, then place the



Hand Saws. Fig. 1.—Ripping Teeth. Fig. 2.—Cross-Cutting Teeth. Fig. 3.—Setting Anvil. Fig. 4.—Steel Bevel. Fig. 5.—Setting Hammer.

saw flat on it, letting the teeth project over the bevel. If setting a rip saw, do not let the teeth project so far over as when setting teeth for cross-cutting, as less set is required for ripping. When the saw is in position for setting, take a hammer about 5 or 6 in. long, as in Fig. 5, and strike the point of teeth with it, holding the handle of hammer from you if the points of teeth are toward your left hand; if toward the right hand, keep handle of hammer toward you, striking in each case every alternate tooth.—A. R.

Chiffonnier.—J. C. B. (*Glasgow*).—This article can hardly be called a chiffonnier; the term "bookcase" would be more appropriate. The height you mention—8 ft. 6 in.—is very excessive, and I should advise you before adopting it to roughly indicate dimensions upon a wall. It will be best to make the job in two carcases, screwed together at A. Scan index and back numbers of WORK for methods of construction. Instead of carrying the internal top break continuously to bottom of job, I have introduced in bottom carcase an external break, as presenting a much better appearance. To save labour

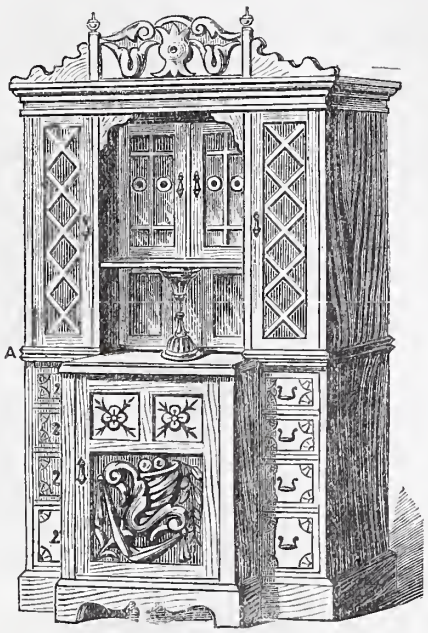


Fig. 1

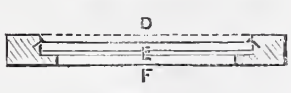


Fig. 2.

Fig. 3.

Fig. 1.—Chiffonnier or Bookcase. Fig. 2.—Section of Top Doors. Fig. 3.—Pilaster at each Side of Bottom Cupboard.

by mitreing up a break cornice (six mitres), I have intended that a straight one (two mitres) should fit in the usual manner over a four-cornered top board joined to top of upper carcase. The canopy thus formed will prove effective. The small shelf is not intended for use—it is merely a front continuation of top cupboard bottom board, to break the plain appearance of job. Underneath it you could have a narrow fixed upright board, with a clear space behind it and the two doors forming one cupboard, and on the front of it glued the halves of a turned ornament, each reversed; the top doors to contain fret and plain glass, but, of course, you may substitute carvings. A shaped plinth is preferable. Face up bottom middle cupboard sides as at B (Fig. 3). I prefer this way. If you wish, lessen the depth from back to front of top carcase. Do not have too large a shaped piece in each corner under cornice and frieze, as doors then will not open far.—J. S.

Bismarck Brown, etc.—FIRST AND LAST.—For large quantities of goods near Bolton, write J. Williamson & Son, Lion Varnish Works, Lancaster. For same of Bismarck brown and aniline dyes, write direct to Judson's, the well-known vendors of many small things of that nature. Yes, there are two kinds of aniline black; one will only dissolve in spirits, and the other will in water. When ordering, state for spirit solution, if such is desired.—F. P.

Gilding.—W. H. A. (*Canterbury*).—Re-gilding a French timepiece is a matter best given to a local silversmith. Articles upon these processes appear in WORK, Vol. I. For fretwork and frame material in large quantities, apply to Melhuish & Sons, Fetter Lane, E.C., and H. Morell, Great St. Andrew Street, W.C., respectively.—F. P.

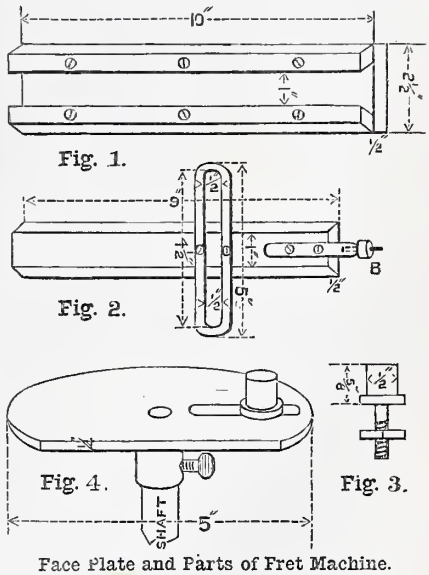
WORK Volumes.—J. H. S. (*Burnley*).—Volume I. of WORK is already published, and Volume II. will soon be ready. You can order these of any bookseller. The published price of each volume is 7s. 6d., bound in cloth.

Glass Letterings.—T. W. V. (*Leicester*).—I know of nothing that you can pour on glass to produce letters but hydrofluoric acid. Refer to my answer in No. 82, p. 487. This is the first method given, the one you refer to being the second. Cover with wax or Brunswick black, if you like that better, lay the glass level, building up a wall round the edges to prevent the acid running off, and pour hydrofluoric acid on. To give the letters a ground appearance, rub with glass-cutter's sand, and finish with emery.—W. E. D., JR.

Painting on Velvet.—J. C. (*Aberdeen*).—Light-coloured velvets are the best for painting upon, since the surface may be acted upon in the manner of dye colours without much detriment to the surface of the fabric. The velvet must first be tightly stretched upon a frame. Draw your design upon paper, prick through the outline, and transfer to your velvet with a pounce of very fine talc powder; tracing-paper may, of course, be used for both copying and pouncing if the design is a borrowed one. Now commence the painting by putting in the bright colours nearest the high lights of the painting; then paint in the shadows and blend the two into the half-tones. Use sable pencils for first outlining the design lightly, and then paint in with hog-hair fitches, preferably those well worn in. Work delicately and patiently from light to dark tones, remembering a little strength of colour can always be added, when it cannot be taken away so readily. Avoid flattening the pile, if possible, painting rather the sides of surface, and not "caking" it with colour. When it is necessary to use white either for high lights or for use upon dark velvets, take a little of the finest powdered gilder's whiting, or Paris white, and to this add powdered gum arabic in one part of the latter to four of white; use diluted with water. This white is then tinted upon with the pigments to the desired colour. The colours advised for this process are permanent liquid dye colours, thinned with water. The chief point is to dye or colour the pile without destroying its texture. When painting curtains or draped velvet, it is advisable to reproduce the pounce upon the back of the fabric, using a dry positive powder. We then paint the back texture of the velvet where all the strong and deep colours are, and these colours soaking through the back, but not touching the pile, very much enhance the effect of the painting when the light plays upon the folds of the velvet.—DECORATOR.

Staining.—FAUST, ETC.—As a "port-wine colour" is not a recognised tint to which mahogany is stained, I am unable to tell you how to get it. I should just experiment till I got it with various reds, and you should do the same. Of course you must take into consideration the colour of the unpolished wood. Good mahogany is generally considered rich enough when oiled and polished in the ordinary manner, and to stain it a "port-wine colour" would generally be regarded as spoiling the appearance. Mahogany naturally is not by any means the colour of port-wine. If you particularly want this, you might try a decoction of logwood, but I cannot say if it would give exactly the tint you desire. If you simply want a good deep rich mahogany colour, use weak walnut stain, and finish with red polish. If the wood is already very dark, omit the stain.—D. D.

Fret Machine.—F. T. C. (*Bristol*).—I have put down all you want to know. The face plate is cast iron, with a slot 2 in. in length, so that I can regulate the stroke of the saw to any pitch. I move the stud in the face plate of course. In my machine I have the stud 1½ in. from the centre of the face plate. This makes the cutting part of saw 3 in. in every stroke. You can use the saws that are short by moving the stud. You can make the wood slide



Face Plate and Parts of Fret Machine.

yourself without any wood turner. All you need will be four pieces of straight wood. Make one piece work smoothly in the other three. I append drawings.—G. C.

Small Electric Lights.—W. H. H. (*London, S.E.*).—The smallest electric lamps are those of 1

c.p., taking a current of from ·3 to ·8 ampères at a pressure of from 3 to 8 volts. These cost about 5s. each, and can be obtained from Messrs. F. C. Allsop & Co., 165, Queen Victoria Street, E.C.; Messrs. Cathcart & Peto, 57B, Hatton Garden, E.C., or any other firm making a speciality of electric lighting apparatus. Six of such lamps, taking, say, from 5 to 6 volts each, placed in parallel series of two lamps in series, could be lighted by a small two- or three-celled chromic acid battery, or the current from a small accumulator of two or three cells.—G. E. B.

Re-Spoking Bicycle Wheel.—G. W. B. (*Lancaster*).—If G. W. B. wants to make a laced wheel, he will only require half the number of holes in the hub—namely, sixteen in each flange. The way to set about it is: put the hub in the lathe, hammer the flanges till they run true, and cut off the parts with the present holes, leaving the flanges as in Fig. 1. Bore sixteen holes through the thickness of each flange ¼ inch distant from the edge, as in Fig. 2. Round the holes a little on both sides, to prevent cutting the spokes. To build the wheel, find the proper length of the spokes by drawing the ring on the floor with the hub in the centre. Cut the wires long enough for two spokes and screw the ends, and see that the nipples will screw on with the fingers without difficulty, then double up the spokes exactly in the middle. Then

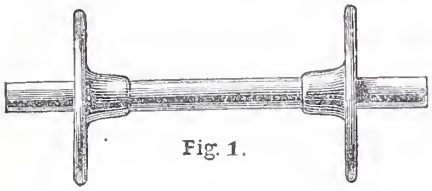


Fig. 1.

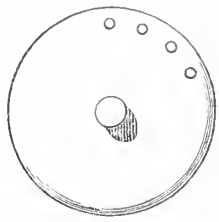


Fig. 2.

Fig. 3.

Re-Spoking Bicycle Wheel. Fig. 1.—Hub, with Flanges prepared for Laced Spokes. Fig. 2.—Hub Flange, showing Holes in Edge. Fig. 3.—Edge of Flange, showing lacing of Spoke.

lace through the flange, as in Fig. 3. Fix one end of the first spoke with a nipple in the rim, count twelve holes in the rim, and fix the other end. The second spoke will go through the next hole in the hub; at the rim it will miss one hole, and the other end of spoke will miss one also on the same side as the spoke first put in, and so on round the wheel on that side. The other side is treated in exactly the same manner. What is called a true laced wheel, with thirty-two spokes on each side, would miss about thirty holes, each wire thus running almost straight across the wheel, but laced wheels are mostly built by missing from eight to twelve holes. What remains is to true up the wheel by operating the nipples with a nipple key. Unless G. W. B. has some experience in wheel-building, this job will trouble him, as it is by no means as easily done as a direct spoke wheel. The spokes are usually tied with fine wire where they cross farthest from the hub flanges.—A. S. P.

Magic Picture.—S. R. (*Newry*).—I do not know the picture to which you refer, but can give you a hint or two on the subject. A picture may be made up by arranging strips of tin foil on a pane, as in the diamond and spotted Leyden jar. A transparency on a pane of glass may be also illuminated by a vacuum tube or two placed at the back. The outlines of these would only be visible whilst the spark is passing.—G. E. B.

Model of Electric Railway.—W. H. H. (*London, S.E.*).—You will find an illustrated description of the City and South London Electric Railway in the *Electrician* of November 7th, and more details of the same in the *Engineer* of the same date. The electric circuit is made between a flexible steel conductor run on glass insulators between the rails and the rails themselves, which take the place of a return wire. The current is picked up by "shoes," which slip along on the steel conductor, and then passes through the magnet coils to the frame of the locomotive and through the wheels to the rails. The reversing gear is on the locomotive. I do not clearly see how you can manage to work a model with three trains on it, so as to stop, reverse, and shunt them at will. The current from a battery can be arranged to work the trains, providing you have a large battery with large cells. Small cells holding, say, only one pint of solution, are useless for such work.—G. E. B.

Electrical Engineering Apprenticeship.—DENNY.—The usual premium is £100, the apprentice to be bound for two years. You would have but little chance of employment in a good firm unless you had previous experience with an electrical engineer. Of course it is possible for a young man to work his way up and into the profession by sheer force of will without having to spend his hardly earned savings in a premium. By attending science and art classes, and by reading suitable books, he can master the theoretical part of the subject, and put these theories into practice by making apparatus at home. If you think of entering a school of electrical engineering or a college to learn the practical part of the profession, I should advise you to consult your science teacher or write to the principals of either the London College of Electrical Engineering, 9 and 10, Railway Approach, London Bridge, S.E., or the School of Electrical Engineering, 12, Prince's Street, Hanover Square, London, W.—G. E. B.

Electric Bell Circuit.—DENNY.—There can be no leakage from one wire to the other if one is insulated. Neither can there be any electrolytic action on either of the wires, and it matters but very little whether the upper or lower wire of the push is run to carbon or zinc of the battery. My opinion is quite in accord with Mr. Allsop's on such matters as these, but I have asked him to give you a word or two on the subject, and here it is:—"Provided the battery is properly insulated (and in what electric bell system is it not?) there can be no leakage. If the insulation of the battery is defective, there can, of course, be leakage from either pole, but in ninety-nine cases out of a hundred, the battery is placed in dry situations and on a dry wood shelf."—G. E. B.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. D. (*Glasgow*); AMATEUR ORGAN BUILDER; F. W. C. (*Amritsar, India*); D. E. E. (*Banchory*); APPRENTICE; TURNER; J. S. (*Halifax*); A. G. (*Hanley*); HOPEFUL; F. S. (*Normanton*); L. S. L. (*Kirkcaldy, N.B.*); H. X. (*Kent*); ELECTRIC; H. A. (*Birmingham*); R. H. H. (*Shutter Oak*); C. D. (*Bury*); R. H. (*Glasgow*); S. R. (*Newry*); A. E. S. (*Abingdon*); H. H. (*Cambridge*); W. B. (*Bridlington*); GISSIPIS; STAGE CARPENTER; A READER; J. R. (*Helmshore*); THISBE; PRINTER; C. W. S. (*Liverpool*); J. E. S. (*Finsbury Park*); COUPLER; C. W. B. (*London, W.C.*); A. G. S. (*Edinburgh*); C. J. G. C. (*Brighton*); A CONSTANT SUBSCRIBER; W. W. L. (*Wrexham*); SEQUAH; J. H. (*Bristol*; A. A. (*Coventry*); W. G. (*Erith*); F. R. B. (*London, E.*); W. P. & Co. (*Bristol*); J. W.; G. W. (*Blackburn*); H. M. (*Herts*); W. H. (*St. Helens*); J. C. (*Belfast*); H. B. C. (*Sunderland*).

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [6 R

Fretwood. — The cheapest in England. Bilson's Cabinet Works, 21, Horsemarket, Northampton. [7 R

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [5 R

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured. Money returned in full if not entirely satisfactory.—ETHELBERT HENRY, Alvaston, Derby. [18 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

Splendid Lathe.—Numerous appliances. Cost £2,000. Offered for £350. Cards to view.—BRITANNIA Co., Colchester.

Splendid Violin for disposal; beautiful, clear, powerful tone; lined case, mounted bow; only 15s. 6d.; rare bargain. Sure to please.—TEW, 6, Tower Street, Ipswich. [1 S

Concertina. Medium size. Warranted all steel reeds. 10s., or exchange for ratchet brace, chisels, or other tools.—BARNES, Wallington, Baldock.

"WORK" EXHIBITION.

THE Proprietors have the pleasure to announce that this

EXHIBITION

IS NOW OPEN TO THE PUBLIC, AT

THE POLYTECHNIC INSTITUTE,

REGENT STREET, LONDON, W.,

AND WILL CONTINUE OPEN TILL

JANUARY 10th, INCLUSIVE.

The Exhibition will be open from 11 a.m. till 10 p.m. The Directors of the Polytechnic Institute make a charge of 6d. for admission before 5 p.m., or 3d. after 5 o'clock. This includes entrance to the "WORK" Exhibition.

NOTICE.—In connection with the "WORK" *Exhibition,*

A Special Exhibition Number of

"WORK"

(*Separate from the Weekly or Monthly Issue*)

Has been published, and is now on sale, price 3d. (post free, 4d.). This Number consists of 32 pages in a wrapper, and contains an **Illustrated Descriptive Account** of the most remarkable Exhibits.

Amongst the contents of the Special Exhibition Number are:—

Working Model of Steam Fire Engine.
The Story of the "Work" Exhibition.
Protected Exhibits under Certificate of Board of Trade.
The Value of Art Training to the Professional Workman. By C. R. ASHBEE.
Sir John Lubbock, Bart., M.P.: His Services to Science and Labour.
Fifty Years of Recreation Work. By the Rev. C. C. ELLISON.
Our Exhibits and Exhibitors.
Work and the "Work" Exhibition. By the SECRETARY.
My Ideas about Hobbies. By OPIFEX.
Special Gift Books to Exhibitors.
The Story of the Prize Certificate and Medal Competition.
Certificate Granted to Prize Winners.
"Work": Its Utility and Importance to all Workmen, Professional and Amateur—
I. From the Professional's Point of View.
II. From the Amateur's Point of View.
Statistics of the "Work" Exhibition.
"In Memoriam."
The Polytechnic Institute: Its Work and Its Workers.
The Jurors: How Appointed.
The Jurors' Awards, "Work" Exhibition, 1890-91.

Upwards of One Thousand Examples of Art, Industry, and Invention, sent in by readers of "WORK," appear in this Exhibition, which, for the impetus it is calculated to give to Practical Education, may be regarded as one of the most important ever projected in this country.

The variety of the Exhibits is as remarkable as their character is interesting, and the very ample manner in which they are described in this Special Number will render it of value, not only to all workmen, professional and amateur, but to everyone who has at heart the progress of Technical Education in this country.

The **Special Exhibition Number of "WORK"** may be considered as the Official organ of the Exhibition. It also forms a striking Illustrated Record of the First Exhibition ever held where the work of Masters or Journeymen, Apprentices and Amateurs, are judged, not by the actual result, but with allowances for concomitant circumstances, and therefore from different standpoints.

The SPECIAL EXHIBITION NUMBER of "WORK" contains a List of the Jurors officially appointed by the LONDON TRADES' COUNCIL, and an account of the working and effect of the Protection to Inventors afforded under the Certificate granted to the Exhibition by Her Majesty's Board of Trade.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

English, Colonial, and Foreign Patents at Reasonable Charges.

SPÉCIALITÉ.

The Patenting, Working out of Inventions, and making Practical Models, Special Tools, Drawings, Engravings, &c.

If you have a novel idea which has merit, provisionally protect it at small cost, and you can make money out of it.

PARTICULARS FREE.

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER. MASON'S WINE ESSENCES.

These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. One Tablespoonful of Mason's Extract of Herbs makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, *Nottingham.*

SANDOW'S famous Trainer, Attila, writes:—"Pumiline Liniment is the finest thing in the world to relieve the muscles and to impart strength. I strongly urge its use to all athletes."

NEVER FAILS to give immediate Relief and finally to Cure all cases of **Muscular** and **Chronic Rheumatism, Gout, Stiffness of Joints, Sprains, Bruises,** etc. Also most efficacious in **Bronchitis** and **Throat** and **Chest Affections.**

OVER 700 TESTIMONIALS FROM MEDICAL MEN.

One of the Physicians to H.R.H. The Prince of Wales writes:—"Nothing gave my patient so much relief as Stern's Pumiline." Sir Morell Mackenzie writes:—"Admirable in Throat Affections." Dr. Stevens writes:—"Pumiline cured me in a severe bronchial attack." *The Medical Press* says:—"Stern's Pumiline is reliable and curative."

Price 1s. 1½d. and 2s. 9d. per Bottle.

From all Chemists, or 3d. extra for postage, from

G. & G. STERN, 62, GRAY'S INN ROAD, LONDON, W.C.

A work on the "Home Use of Pumiline" sent free on application.

MONTHLY, 4d.

CASSELL'S TIME TABLES.

PICTURE FRAME MAKING.

FOURTH EDITION. Enlarged and Revised.

THE FRAME MAKER'S INSTRUCTION BOOK.

150 *Diagrams, Designs, and Patterns.*

Instructions in Joining, Fitting, Mount Cutting, &c. Also Prices of Mouldings, and every requisite for the Trade. Post Free, **6 Stamps.**

GEO. REES, 115, Strand (Corner of Savoy St.);

Moulding Dept., 41, 42, 43, Russell St., Covent Garden, London.

CASSELL'S

Classified Catalogue,

containing particulars of upwards of One Thousand Volumes, published by Messrs. CASSELL & COMPANY, ranging in price from

THREEPENCE to FIFTY GUINEAS,

will be sent on request post free to any address.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

The Important New Serial Publication.

In Monthly Parts, price 7d.,

CASSELL'S STOREHOUSE OF GENERAL INFORMATION,

FULLY ILLUSTRATED with HIGH-CLASS WOOD ENGRAVINGS, and with MAPS and COLOURED PLATES.

PART 1 READY JAN. 26, 1891.

This is an **entirely New** Dictionary of General Information, written by the best authorities, comprehensive in subject and detail, brought up to the latest date in all departments, and fully Illustrated by clear and skilfully executed Engravings, in addition to Maps and Coloured Plates.

With *Part 1* will be presented a Series of *Four Coloured Plates,* illustrating in a novel and attractive manner, *Botany, Geology, Architecture,* and *Physiology.*

*** Full Prospectuses may be obtained at all Booksellers', or will be sent post free from the Publishers,

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

Bovril. Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

For Home Decoration!!

USE

JUDSON'S LIQUID GOLD 6d., 1s., and 5s. per Bottle.

(READY MIXED).

SOLE MANUFACTURERS,

DANIEL JUDSON & SON, LIMITED.

SOUTHWARK, LONDON, S.E.

Prevents and relieves INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE, and all other Stomachic Irregularities. PURIFIES the BODY, imparting NEW LIFE and VIGOUR. Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL

BRIGHTENS and CLEARS the COMPLEXION, and is highly recommended by the MEDICAL Profession. Corrects all ERRORS OF DIET, eating or drinking. Is a most pleasant effervescing morning drink, STIMULATING the APPETITE, and giving tone to the entire system.

NEW SERIAL ISSUE, IN MONTHLY PARTS, price 7d.

THE LIFE AND TIMES OF QUEEN VICTORIA.

With SEVERAL HUNDRED ILLUSTRATIONS. PART 1 *ready* Jan. 26th, 1891.

*** With Part 1 will be given a magnificent portrait of *Her Majesty the Queen*, in her State robes, taken at the time of the Jubilee in 1887. The Portrait will be printed on a tint, and will be produced on plate paper, size 30 in. by 20 in.

Prospectuses at all Booksellers', or post free from

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill**, with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design SENT GRATIS with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 96.] SATURDAY, JANUARY 17, 1891. [PRICE ONE PENNY.

A FIRE SCREEN WITH FOLDING DOORS.

BY OPIFEX.

IN Vol. I., page 568, of this Magazine, Mr. Fred Miller gave some very valuable hints on the subject of "Glass Painting and its Application to Domestic Purposes"; and in page 625, F. B. contributed an interesting article on "Silicine Painting"; and I am sure many readers of WORK profited by these papers. Some who are fortunate enough to reside in or near a city have, doubtless, tried their hand at glass painting, and are now rejoicing in the possession of stained glass of their own manufacture: enjoying that sweet satisfaction which is known to those who are sufficiently energetic and skilful as to be enabled to supply their own wants, or the wants of others, by the work of their own hands.

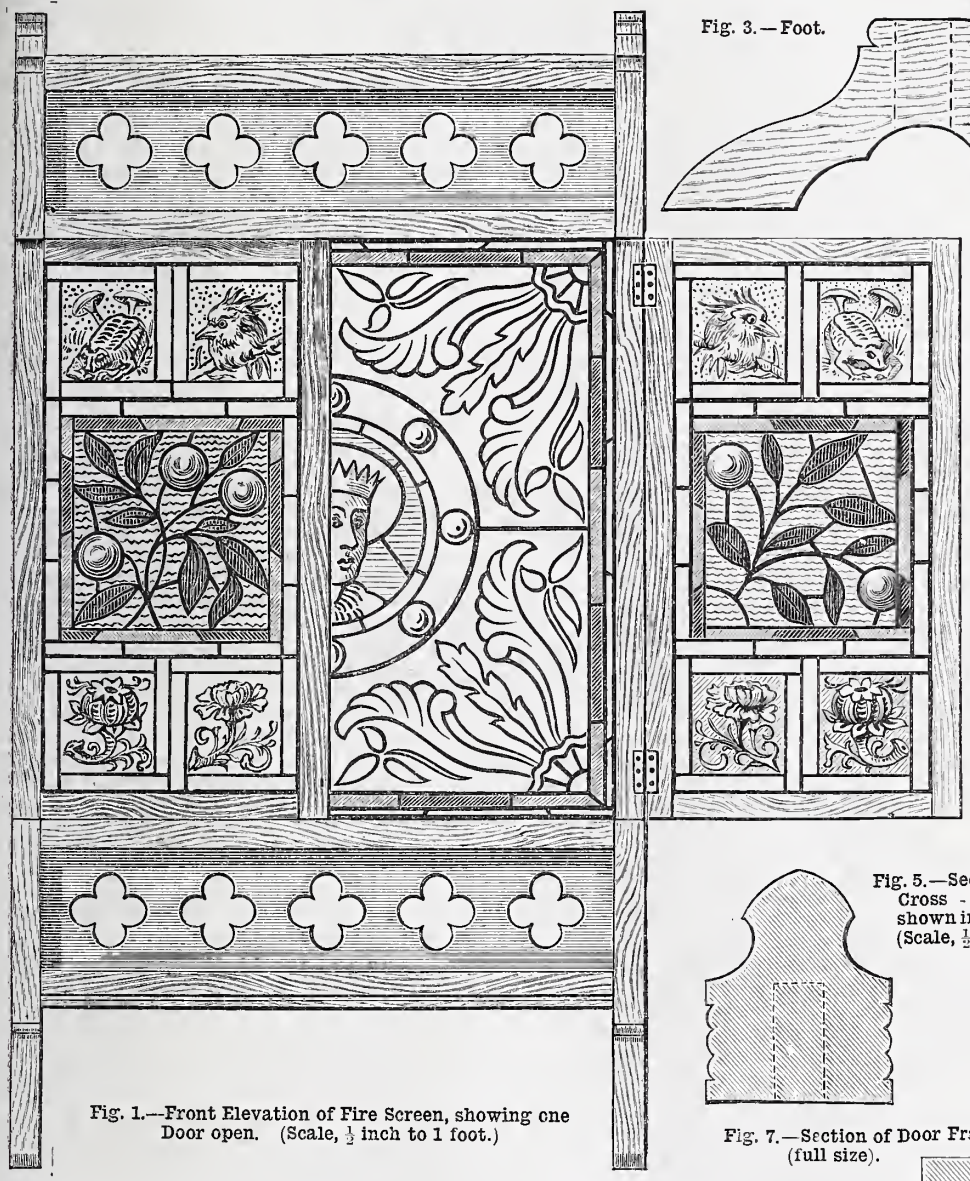


Fig. 1.—Front Elevation of Fire Screen, showing one Door open. (Scale, ½ inch to 1 foot.)

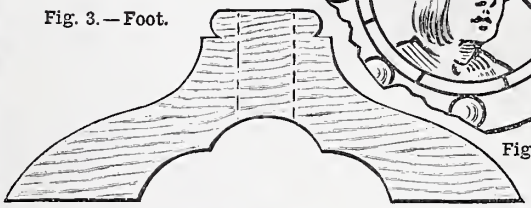


Fig. 3.—Foot.

Fig. 8.—Centre of Large Panel, complete.

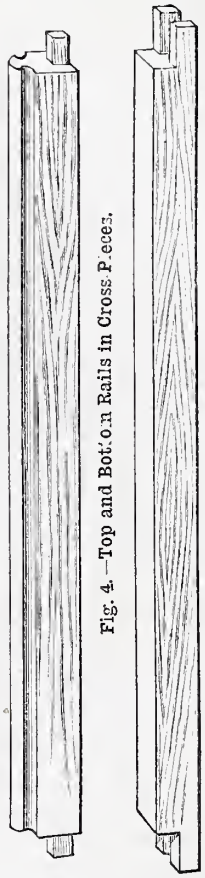


Fig. 4.—Top and Bottom Rails in Cross Pieces.

Fig. 6.—Intermediate Rails in Cross-Pieces.

*** Figs. 2, 3, and 6 are on a scale of 2 inches to 1 foot.

Fig. 5.—Section of Cross-Pieces shown in Fig. 4. (Scale, ½ size).

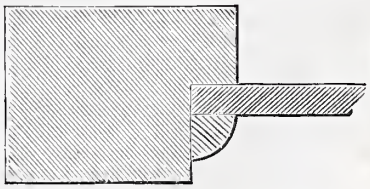


Fig. 7.—Section of Door Frame (full size).

Fig. 2.—Left hand Side of Framework of Screen.

For my part, I regret that I cannot count myself amongst their number—at least, as far as the subject in hand is concerned—as I live far from any city or town where the requisite materials and facilities for glass painting are to be had. I have, however, so far appreciated the articles alluded to,

that I am ready to "have a try" at the work whenever opportunity offers, and in the meantime have been considering the uses to which I shall put my glass when it is painted. There is a hall fanlight to be beautified, an unpleasant aspect of back premises to be shut out; there is a staircase lantern in wrought iron so far advanced that its "prospectus" adorns the workshop wall; and, lastly, there is the long-felt want, a fire screen for the study—which forms the subject of this paper, and of which Fig. 1 is a sketch, or rather, front elevation.

I recommend this screen as most effective for the particular object for which it is intended, and also as a most presentable article of furniture; and I may point out to any reader who may not feel inclined to attempt glass painting that plain, embossed, or ground glass may be employed; or panels of double glass decorated with dried ferns, grasses, etc. etc., would suit admirably; or, again, even the patent "glacier" window decoration might be used. Besides, leaded lights may nowadays be easily obtained of any shape, size, and almost at any price, from about 1s. 3d. per square foot upwards.

Pending the arrival of the opportunity before mentioned, I have contented myself with plain glass, but as I hope some day to have that "Toad" and "Laughing Jackass" (*see* page 568, Vol. I.), I have introduced them in my sketch—apologising to Mr. Miller for the caricatures of his highly artistic quarries.

The woodwork of the screen is of the very simplest construction, and in the drawings I have abstained from either mouldings or chamfers; but I need hardly point out to the reader that these will greatly improve the general appearance of the screen.

Good well-seasoned oak will, of course, be the best wood to employ; but it should not only be well-seasoned and sound, but also perfectly dried before working. If the various pieces required are first cut out in the rough, and then placed in a very warm place for a few days, there will be no danger of after shrinkage; but having regard to the purpose for which this article of furniture is intended, it goes without saying that this precaution is absolutely necessary.

Fig. 2 represents one of the two sides which, with the four cross-pieces, form the framework of the screen. These may be about 4 ft. long and 2 in. wide by $1\frac{1}{4}$ in. thick. The upper ends should be carved or otherwise ornamented, according to fancy, and should project about 2 in. above the upper cross-piece.

In Fig. 1 the small pierced panels are represented as being 5 in. wide, while the cross-pieces are 1 in. wide; but if these panels are made, say only $2\frac{1}{2}$ in. wide, the doors might be made 5 in. longer, and therefore the portion, A B, Fig. 2, where the uprights are halved to take the doors, may be cut accordingly. This is altogether a matter for the maker's decision, and does not interfere with the directions, or rather suggestions, given in this paper.

The foot, Fig. 3, is cut out of a solid piece 16 in. by 6 in. by $1\frac{1}{2}$ in., and if the grain runs in a slight curve, as indicated in the cut, the feet will be all the stronger; but even a perfectly straight-grained piece of oak will bear to be thus shaped and morticed without danger of splitting. The tenon and mortice should be very carefully made, and should be the full depth of the foot—*i.e.*, about 3 in.

Fig. 4 represents the top and bottom cross-pieces, or Nos. 1 and 4, counting from the top. These are morticed with a single tenon at each end, which for strength should be of the full depth of the cross-piece.

Fig. 5 shows a section of these cross-pieces (Nos. 1 and 4), the moulded sides being meant to be reversed in each case, the moulding on No. 1 being uppermost, while in No. 4 it is underneath.

Fig. 6 shows shape of cross-pieces Nos. 2 and 3, which for rigidity is secured by a double tenon and mortice at each end. These are of square or rectangular section, and all four cross-pieces are to be ornamented on both sides, with a centre reeding as suggested in the section, Fig. 5.

The door frames are of stuff $1\frac{1}{4}$ in. by 1 in., and although of such simple construction, call for accurate work to ensure the necessary strength and rigidity. They should be rebated to a depth of about $\frac{3}{16}$ in., and so that the glass, or lead lights, may be placed in the centre of the thickness of the frames, in which they are to be secured by a small bead or moulding (*see* Fig. 7, which is a full-sized section, showing door frame, lead light, and the moulding just mentioned). The doors are hung with brass "butt" hinges, as shown in Fig. 1.

The narrow perforated panels should be of $\frac{1}{2}$ in. oak, and are secured in position by means of a small bead moulding on both sides; or glass, etc., as used for the other parts of the screen, might be substituted for these panels.

Fig. 8 is a sketch of the completed head that is half hidden by the closed door in Fig. 1.

With regard to finishing, polishing, etc., it is unnecessary for me to offer any remarks, as this subject has been so often and so well brought before the readers of WORK by abler pens than mine.

THE TRIUNIAL OPTICAL LANTERN: HOW TO MAKE IT.

BY CHARLES A. PARKER.

ATTACHING STAGE-PLATES TO LANTERN — REGULATING SCREW FOR STAGE-PLATES — THE ROLLING CURTAIN EFFECT — PREPARATION OF CURTAIN SHUTTER — MODE OF MAKING WOODEN FRAMES TO HOLD SLIDING CURTAIN —POLISHING THE WOODWORK — STAINING— FILLING—POLISHING—FINISHING THE BRASSWORK—REGISTERING STOP FOR SLIDE CARRIERS.

As a postscript to my last paper I may say that when the stage-plates have been provided with hinges as described, they should be placed in position on the body of the lantern over the condenser apertures, in order that the position of the screw holes of the hinges may be marked on the woodwork underneath, by means of a bradawl, after which each plate is hinged to the lantern with suitable brass screws. As soon as the stage-plates have been hinged, it will be advisable to mark on the woodwork the position of the two holes at the opposite corners to the hinges. A bed of sufficient size to take the foot-plate of an ordinary lantern regulating screw is then sunk in the wood where marked, by means of a brace and centre-bit, into which the regulating screw is afterwards fitted. These regulating screws consist of a small circular brass plate, to the centre of which a $1\frac{1}{2}$ in. length of threaded screw is riveted, the latter being provided with a couple of milled nuts, which travel along the threaded portion carrying the stage-plate between them. One of the cheapest houses from which to obtain these regulating screws would doubtless be Messrs. Noakes and Sons, of Greenwich, who are willing to supply amateurs with castings of brass-work at 2s. per pound; they will likewise furnish other parts of lanterns at equally low rates.

The rolling curtain effect about to be described, which may be said to be an ingenious form of dissolving arrangement, usually forms part and parcel of all the better class of lime-light lanterns, and as it is very simple in construction, the reader will do well to fit it to the instrument under description. The working part of the shutter, which takes the form of a longitudinal strip of moderately thin sheet brass, cut to the shape of Fig. 29, is made to pass between a couple of light grooved wooden frames attached to the stage-plates, the action of pushing the shutter downwards serving to shut off the light from the lower lantern, whilst at the same time it uncovers a corresponding amount of the disc projected by the top lantern, this movement presenting the appearance of a curtain being rolled up.

For the curtain diaphragm, or shutter, procure a sheet of tolerably thin brass, measuring 16 in. by $4\frac{3}{4}$ in., and, by the aid of a pair of shears, carefully cut it to the form indicated in Fig. 29, with a rectangular opening 5 in. by 4 in., commencing at two inches from the upper shaped end of the metal. After having been roughly cut to the required shape, it will be necessary to carefully file up the edges by means of a half-round and flat file, after which the surface of the brass should be brought up to an even state of semi-polish by rubbing it with pumice-stone and blue-stone moistened with water. When the shutter has been prepared in the manner above directed, a small light wooden frame will require to be fitted on to each of the stages, close against the condensers. Although the curtain shutter will simply require to pass from the top lantern to the second or middle one, it is usual to fit one of these frames to each stage of a triple lantern, as it thus permits the use of the curtain with the biunial or twin instrument at any time that the top lantern is removed. These frames, which should be 6 in. square and $\frac{3}{4}$ in. thick, may be made in any manner desired, provided they are furnished with a groove through the middle which is in connection with a slot at either end, of sufficient width to take the curtain shutter. Two modes of making these frames will now be described, either of which are equally successful, although the first is by far the simplest. This method, which is illustrated in Fig. 30, is almost self-explanatory, and consists of a couple of pieces of well-seasoned board 6 in. square, and about $\frac{3}{16}$ in. thick (machine-planed fretwood or cigar-box lids will be found to answer admirably), glued together with a thin slip of wood barely $\frac{1}{8}$ in. thick and $\frac{5}{8}$ in. wide, placed along opposite sides between them, a 4 in. circular aperture being afterwards cut clean through the two boards, as shown in the illustration. The boards should be so adjusted that the shutter will just slide through the frames when finished, and a small hole must be bored through the wood at each corner of just sufficient size to take the supporting rods of the slide-stage, on to which it should be made to fit. The curtain will be made to slide smoother if a narrow slip of velvet is glued along the inside of each board at the top and bottom, previous to being put together.

The second plan is to make three light

wooden frames similar in appearance to Fig. 31, each of which are slit at the top and bottom, and furnished with a groove on the inner edge of either side, along which the shutter may slide. For each frame, carefully dress up a strip of mahogany, to measure 24 in. by $\frac{3}{4}$ in. by $\frac{1}{2}$ in., and then run a narrow groove to the depth of about $\frac{3}{16}$ in. along the entire length of one of the half-inch sides.

Thus prepared, the wood should be sawn into four equal lengths, and then fitted together by mortice and tenon joints to form a frame 6 in. square, enlarged details of the mortice and tenon being shown in Fig. 32. If a couple of saw cuts $\frac{3}{4}$ in. deep are made longitudinally down either end of all four pieces, then a couple more saw cuts at $\frac{3}{4}$ in. from the end of the wood, and at right angles to the first, this will remove the two outer cheeks of the wood, and thus form the tenon. Having treated each end of a couple of the pieces of wood in this manner, the mortices to fit the tenons can be made by removing with a sharp chisel the central portion between the saw cuts at either end of the remaining strips of wood, after which the four pieces are glued and fitted together to form a frame 6 in. square. The top and bottom of each frame will require to be slit through by means of a circular saw, in order to admit the sliding shutter, and a small hole must be bored through each corner of the frame by means of a suitable-sized centre-bit, of sufficient size to take the pillars of the slide-stage, on to which it should be fitted as soon as finished. When properly adjusted, the curtain should slide freely through the slot in the top of the frame and along the grooved sides, and then out by means of the opening at the bottom. In order to put the curtain in action, the two upper lanterns are fully lighted, and the shutter is drawn up sufficient to expose a slide painted to represent an arrangement of curtains, which should be placed in the second or middle lantern, the view to be exhibited on the rising of the curtain being put into the stage of the top lantern. As the shutter is pushed downwards it enters the frame attached to the central lantern, and gradually obscures a portion of the curtain slide, at the same time exposing a corresponding portion of the view in the upper lantern, which makes it appear as though the curtain were being slowly rolled up in order to disclose the view behind.

A great many of the better class of lanterns are provided with a rackwork arrangement, in order to ensure a slow and regular movement of the curtain, but as this can generally be supplied by a steady hand, it would seem to scarcely warrant the expenditure of the extra time and trouble involved in the preparation of this rack movement.

The constructive details being by this time complete, the woodwork will be ready to be polished, this work being carried out in a warm dry atmosphere, free from draughts. The first proceeding will be to remove all the brasswork, and place this aside, ready to be lacquered as soon as the polishing is completed; after which the entire surface is carefully gone over with Oakey's No. 1 glass-paper, until every speck of roughness has entirely disappeared. The grain of the wood will now be ready for "filling in," unless it is desired to darken it, in which case this would require to be done previous to filling. The simplest plan of staining mahogany darker is to procure a pennyworth of chromate of potassium (sold by druggists in the form of amber crystals), and dissolve this in about a quart of hot water, applying the solution, when cold, to the surface of the wood by means of a soft woollen rag, care being taken to avoid splashing the wood with the chromate, as this would result in an unsightly stain, which will show through the polish when finished. For this reason the rag must not be made too wet, and it should be rapidly drawn across the surface of the wood from edge to edge, and then back again, until the stain has been laid evenly from end to end, without any of it running over the edges on to the next side. Some workmen use a large-size flat brush, in preference to a rag, for applying the stain, but this is merely a matter of taste. As soon as the stain has become dry, the grain of the wood must be filled with plaster of Paris, mixed into a rather thin paste with water, and rubbed well into the pores by means of a piece of rag until they appear to be sufficiently stopped, when the superfluous plaster is wiped off with another piece of rag before it has had time to harden. It is usual to tint the plaster to match the colour of the wood by the addition of a small quantity of rose-pink.

We shall now require a gill of the best orange polish, also some methylated spirit, linseed-oil, and finely powdered pumice-stone. For the rubbers a few woollen rags or some white wadding (sold by drapers at about 3d. per yard) will be wanted, and last, but not least, a good supply of washed-out linen rags. As the latter form the chief part of the rubbers, it is important that they shall be entirely free from all traces of grease or starch. The woodwork having been filled, or stained and filled, according to requirements, will now be ready for polishing, care being taken to see that the work-room is not in the least draughty, as this would chill the polish, and cause it to become white and creamy. Everything being ready, take a piece of wadding or flannel, of a convenient size to be held in the hand, and moisten it with polish by holding it over the mouth of the bottle containing the polish, and shaking the latter against it once or twice: this will cause it to imbibe sufficient polish to cover a considerable extent of surface. The rubber is now enclosed in a piece of soft linen rag (the finer the better), and made up into an oblong ball about the size of an hen's egg, the ends of the rag being gathered together in the palm of the right hand in order to form a kind of handle whereby to operate it, the two first fingers being placed on the fore part of it in such a position as to afford a good purchase, and at the same time assist in keeping the covering drawn tight. Thus prepared, the rubber is passed over the surface of the work in free, continuous, and uniform strokes with a circular motion, gradually traversing the entire surface from end to end, the rubber being occasionally moistened with fresh polish whenever it exhibits signs of dragging. As it passes over the work the rubber will be seen to make a cloudy mark, which may be lapped over by the next stroke, pains being taken to keep the strokes a uniform size as much as possible. It should be borne in mind that the first application of polish is intended to fill up the grain of the wood, and not merely lay on the surface; it must, therefore, be well rubbed into the pores of the wood, care being taken that every portion shall receive an equal amount of it. This can be ensured partly by regulating the degree of pressure given to the rubber, and partly by squeezing the latter between the fingers. When the grain appears to have been entirely filled up, and the wood presents a uniform coat of polish, it may be placed aside for an hour or two in order to allow time for the polish to sink and harden.

On returning to the work, the first proceeding will be to rub down the polish with very fine glass-paper until the smooth level surface of the wood is exposed upon which to resume operations. The outer covering of the rubber should be removed, and a little more polish having been added, a clean part of the linen is drawn over it and gathered together in the palm of the hand, the same as before. After having smeared a drop or two of linseed-oil on the face of the rubber by means of the finger, the polishing process is again resumed in the manner before described by passing the rubber lightly and rapidly over the surface in one uniform direction, occasionally easing it with a touch of oil whenever it appears to drag, and persevering with this rubber until the surface of the work is covered with an even coat of polish, when it is placed aside for a few hours in order to harden, and again papered down the same as before. On resuming operations, a fresh rubber is made up, and the same polishing process repeated until the surface appears quite smooth, and covered with a thin and even coat of polish, entirely free from spots; should any spots appear, it is a sure indication of sunken grain, caused by the evaporation of the spirit and the sinking of the shellac of the polish into the plaster or pores of the wood. In such a case the surface will require papering down again, the same as before.

At this stage of the proceedings it will be found an advantage to let the work stand for a couple of days, in order to allow the polish plenty of time to sink. If there is no indication of sunken grain at the end of this time we may safely say that the pores are properly filled, and the surface will be ready for the final operations of levelling and spiriting off. The levelling rubber is a long strip of felt rolled into the form of a coil, and tied together with string. Thus prepared, one end of the coil of felt is placed face downwards in a saucer containing some boiled linseed-oil, in which it is allowed to remain for about three days, at the end of which time it is removed, and placed aside to dry for a week.

Now dust some finely powdered pumice-stone over the surface of the work, and having smeared the face of the levelling rubber with a small quantity of oil, go over the work carefully with this, in order to remove any little irregularities of surface and leave the polish quite smooth and even. The finishing rubber, which is prepared in a similar manner to the polishing rubber, is now charged with polish and a small quantity of methylated spirit (each being applied separately without any oil), and is rapidly and lightly passed over the surface of the work until the spirit has evaporated, when the pressure may be slightly increased in order to effect the adhesion of the shellac to the former coat, the quantity of polish added to the rubber being lessened each time, so as to bring the work up to perfection. Towards the finish, the rubber, which should be charged with spirit only, must be passed across the surface of the work like a breath, and as the cloudiness gradually clears off the strokes of the rubber may be elongated, and finally traversed off either end of the work.

It must be understood that the object of spiriting off is for the sole purpose of working out the oil, and thus obtaining a glass-like surface, entirely free from all traces of

grease. In order to ascertain whether the oil has been properly worked out or not, a simple plan is to breathe on the freshly polished surface, from which the moisture should instantly evaporate as from a polished steel surface if it is free from oil, but if there is the slightest trace of greasiness the evaporation will be retarded. In polishing an instrument of this description, which will be subjected to a considerable degree of heat, it is important to work with as little oil as possible, otherwise the polish will be certain to sink afterwards. If the oil is being used in excess, a finger drawn across the surface of the wood will show a greasy or clouded line; and then, again, the rubber will slip over the surface and leave the polish about in patches. The writer always uses the first rubber without oil, as the polish is thereby rendered more tenacious. It is always advisable to allow plenty of time to elapse between each succeeding coat of polish, as a good hard surface upon which to recommence operations is thus ensured. When the work has been placed aside for a few hours in order to harden, the shellac will be found to have sunk into the plaster more than the wood, thus proving the necessity for papering down between each additional coat. A fresh rubber should always be skimmed over the surface as lightly as possible, otherwise the polish will be squeezed out unequally, and left on the surface in a number of unsightly ridges or patches, an occasional stoppage during the progress of the work producing a like result. The glass-paper employed for papering down should be the finest o o, and if desired, it may be glued on to flat pieces of cork of various sizes.

The woodwork of the lantern having been polished, the next proceeding will be to polish and lacquer all the brasswork. As full directions for finishing this class of work have already appeared in Nos. 55 and 58 (pages 35 and 82), it will be unnecessary to do more than outline the mode of procedure. The stage-plates and similar flat surfaces are prepared for lacquering by first filing or scraping up the straight or curved edges until perfectly bright and true. The flat surfaces are then brought up to an even grain by the use of emery-papers of different degrees of fineness, which should be wrapped round a flat piece of wood and rubbed in one uniform direction. When the finest or flour emery-paper is reached, the surface will doubtless be sufficiently good for the application of the lacquer; but if a further finish is desired, the emery dust must be wiped away, and the metal still further polished by the use of water of ayr-stone or blue-stone and water, which is rubbed in the direction of the grain left by the paper, the polish being afterwards brought up by means of whiting or crocus-powder, pains being taken throughout to preserve the sharp edges of the work. The work will now be ready to be lacquered with pale gold lacquer, which should be applied to the surface of the metal (previously heated to the temperature of boiling water) by means of a broad flat brush, and when every portion has received a coat, the various fittings can be returned to their respective positions on the instrument.

The back of the stage-plates and the inside and outside of the collar belonging to the spring-plate, together with the interior of the draw-tubes, should each receive a coating of dead black varnish, in order to prevent the reflection of light. The varnish may also be applied to any other portion of the interior of the lantern which would seem to require it. When the newly lacquered brasswork is being attached to the lantern, it will be found a considerable improvement in the appearance of the instrument if a small brass eye-piece is screwed over the sight hole of each door. These eye-pieces can be obtained from any manufacturing optician for about 1s. each.

A capital registering stop for the slides can readily be made by means of a milled screw and bush and a glass plate. One of these stops screwed on the woodwork at the side of each stage will act as a stop to the end of the wooden carrier containing the slide, registering it in position without any annoying jerking about of the picture upon the screen. The glass plates are made of brass, shaped similar to Fig. 33, and doubtless owe their name to the fact that they are generally used for the purpose of affixing chimney-glasses and mirrors to walls. These plates can be procured from any furnishing ironmonger.

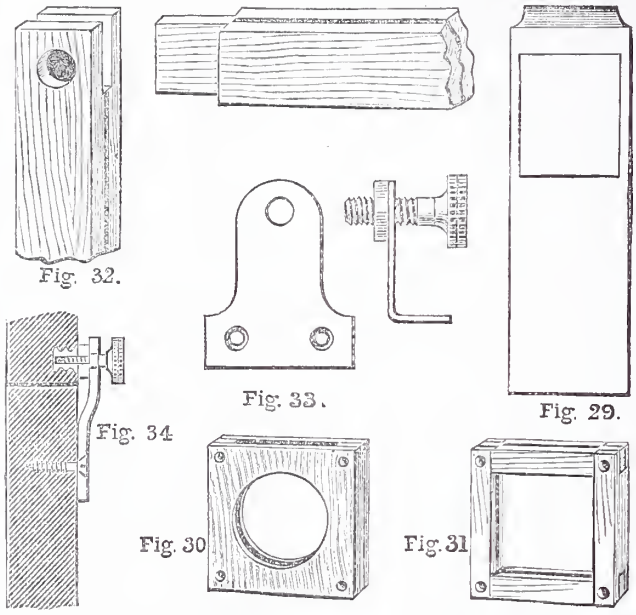


Fig. 29.—Rolling Curtain Shutter. Figs. 30, 31.—Frames for Sliding Curtain. Fig. 32.—Enlarged Detail of Mortice of Frame. Fig. 33.—Plan and Section of Registering Stop. Fig. 34.—Section of Woodwork of Lantern, showing Portion of Clamping Plate.

For each of these registering stops we shall require one of the above glass plates, and a milled screw and bush; the latter can be obtained from Mr. Platt, of Kingsland—No. 61 in his list, price 5d. each. The bush belonging to each milled screw must be hard soldered over the top hole in the glass plate (on the under side), in the position shown by the section of Fig. 33; the process of soldering having had the effect of softening the plate, it will be a simple matter to bend the lower portion up to right angles in the manner shown in the cut. The stops are then lacquered and affixed to the woodwork by means of small brass screws. Although the use of these stops is not absolutely necessary, they will nevertheless be found a very useful addition, as a few turns of the screw will serve to register all slide carriers which are of a uniform size.

MODERN FORGING.

BY J. H.

Miscellaneous Examples.

Cranks and crank axles appear in so many and various forms, that, though it is necessary to make some allusion to them, it is not possible to give a very fully detailed account of the methods employed in their construction.

We take a common bent or dip crank of round section (Fig. 95) in the first place, and suppose it has to be made without any assistance from a die-block. It would not do to simply bend a round bar to the cranked form, because at the corners where the bending takes place the area would be reduced by the stretching process. And it is of no use to have bad iron for a bent crank, for the process of upsetting and bending will open out the fibres.

Fagoted iron—of which more directly—is often used for cranks.

A crank of this kind may have one, two, or three throws, and the axles extending at each end may be long or short. The cranks may be forged separately, and the axles separately and welded together, or they may be all forged from one bar: in each case the question is one of practical convenience.

To simplify matters, we will suppose first that the crank has only one dip, and to a certain extent the same description will be applicable to cranks with two or three dips, the twisting of the dips to relative angles with each other excepted; of which matter I will speak presently.

Before bending the dips, there will be three upsettings of the iron: one along the length that is to form the future crank pin, A, and the bendings where the pin merges into the webs or levers, reaching from B to C in Fig. 95, and two others where the webs are to merge into the axle, or from B to D, and C to E (Fig. 95). These upsettings are done before the bar is bent.

The bendings at B and C will be done either at one or at two heats. If the pin is short, one heat will suffice, but if long, two will be necessary. Here the swage block, or, better still, the large shop levelling block pierced with numerous holes, comes in serviceable; for by inserting a couple of pins into holes in either block, suitable fulcra are obtained for the pulling round of the axles and the preservation of their true plane in the plane of the dip. If no swage block nor levelling block is available, a pin placed in the anvil hole must answer the purpose of a fulcrum, but it will not be suitable for heavy work.

It is necessary to check the length of the pin on the distance A before bending the other corners. If the distance A is too great, upsetting must be resorted to; if too short, drawing down must be done.

The bending of the corners D, E, will be effected around suitable pins, the axles F, F, affording good leverage. After this the crank webs from B to D, and from C to E, must be adjusted for parallelism, and the axles F, F, also for longitudinal alignment in relation to each other, and be brought into the same plane with the webs and the pin.

It is a matter of so much importance that the iron should be well upset before bending

for the corners, that I must emphasise this fact. In cranks of this type, it is desirable and usual to have rather an excess of metal at the corners, especially when they are to be filed up bright. It is not easy to round these corners very neatly: another reason why plenty of stuff should be allowed.

diameter of the crank, and ample depth is given. The length is not necessarily so great as that of the crank axle, but is sufficient to permit of true alignment of the axle being made.

The distances from the centre line A B to each end are made unequal to permit of the

such a block, those sections where the bendings are to be made are upset as before described, and the webs are turned round upon the levelling or upon the swage block, and the axles turned round at right angles with the webs with some moderate approximation to truth, though not neces-

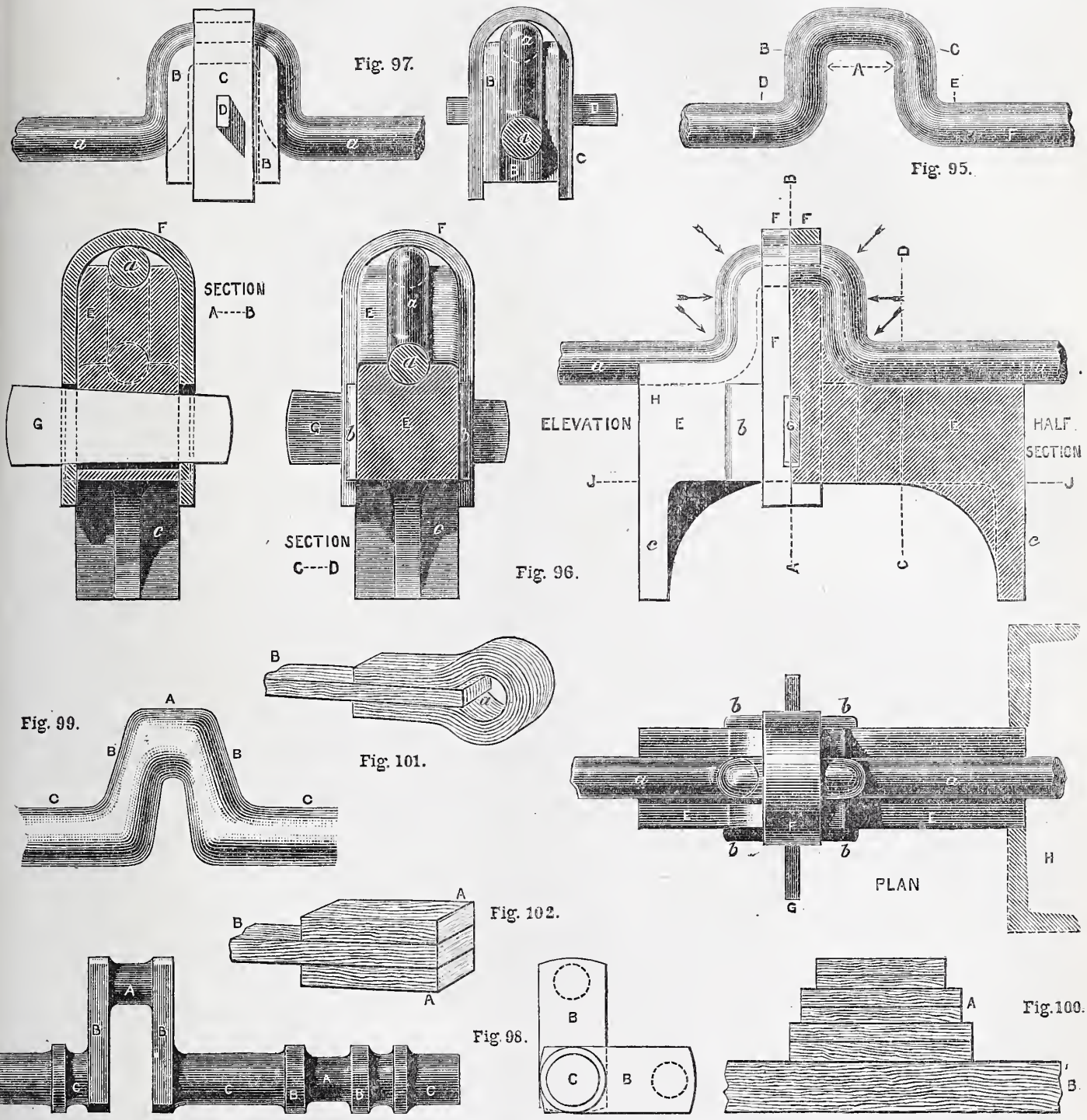


Fig. 95.—Common Bent Crank. Fig. 96.—Bending Block. Fig. 97.—Filling-in Block. Fig. 98.—Locomotive Type of Crank. Fig. 99.—Crank roughly pillered into Form. Fig. 100.—Piled Crank Lump. Fig. 101.—Crank Boss. Fig. 102.—Lump for Crank Boss.

Such cranks are, when made in quantity, usually bent over a block, or even stamped; and I think the cost of making a block is saved if only three or four cranks are required.

A bending block is shown in Fig. 96. It is a casting, E, made sufficiently massive to resist the hammer blows necessary for setting in the bends of the crank. Its width is therefore considerably greater than the

forging of two-throw or three-throw cranks. In single dip cranks the lengths would be equal. In Fig. 96 the right-hand end is made sufficiently long to afford a good bedding for the axle *a*, but the left-hand end is made so short that after one crank is forged it may lie beyond the left-hand end to permit of the bending of the second or the third crank upon the block.

In the formation of a crank by the aid of

sarily so carefully as though the crank were intended to be finished by this method. The advantage of the block now comes in. Getting the crank *a* nearly to a welding heat, it is dropped over the block E, embraced by the strap F, tightened by the cottar G, which being driven in rapidly holds it in place, and the webs and the axles are quickly bedded down into the curved recess of the block; hammer, fuller, and hollow

tools being quickly brought into requisition wherever wanted. The crank is practically finished thus, only a little smoothing over being done after removal from the block, chiefly at the sides which could not be got at while the crank lies on the block. The crank should be quickly removed from the block, or it will become bound hard, owing to the shrinkage of the metal by cooling. For this reason the sides of the block should be tapered slightly, and in large crank blocks allowance for shrinkage in cooling should be given when making the block at the rate of about ¼ in. per foot.

In Fig. 96, *b*, *b*, are guide strips cast upon the sides of the block E for the strap F. If the strap is not sufficiently stout, a clamp or a rough gib may hold the bottom ends of the strap together. The two horns *c*, *c*, are cast on as a matter of convenience. As the blows for the most part are delivered in the direction of the arrows, the block needs to be steadied endwise. In the example from which this is taken, therefore, there is a heavy cast-iron block sunk into the ground a little below the floor of the shop. One end is grooved out to take the ends *c*, *c*, so preserving the bending block steady under the hammer blows. The grooved end of this casting is shown dotted at H, Fig. 96, plan: *c*, *c*, are below the ground—J J, in Fig. 96, elevation, being the level of the floor.

If a second or third dip has to be forged, the truth of the first one is preserved by inserting a packing block B, Fig. 97, in the dip. This is a cast-iron piece hollowed semi-circularly to fit the webs, and secured in place with a strap, C, and cottar, D. This is retained in place until the remaining dip or dips are bent.

This is a form of crank axle that is well adapted for forging into the strongest form possible, the fibre running round the bent portions. In some other forms the same advantageous disposition of metal is not secured. A few years ago it was quite common to see the largest crank axles of the general form shown in Fig. 99 built up by a round-about process of welding, the pin A, the webs B, and the axles C being prepared separately and welded together. The webs were opened out at the one end to embrace the pin, at the other end to embrace the axle, and all welded up together. But it is usual now, in very large cranks, to make and machine each of these parts separately and weld them together, shrinking the webs on to the pin. This is practised in marine engine work. In small cranks of this type, however, no such plan is adopted, but the forging is made solid and machined out. Briefly, the methods employed are as follows:—

The simplest and the worst way is to take a slab and cut the entire crank out of the solid—a poor plan, seldom adopted. Better than this is the drawing down of the axles from a lump whose width is equal to the total width of the crank from the outer edge of the axle to the outer edge of the pin. Superior still is the fullering out of a lump in such a way that an approximately curved disposition of the fibres is obtained (Fig. 99), leaving, however, a good deal of finishing and machining to be done afterwards.

Another way—not so good as the last, but more common—is to weld on one or several pieces, A, to one side of the bar, B, that is to form the axle (Fig. 100), leaving the gap to be slotted out or drilled out.

In two- and three-throw cranks the gaps have to stand at angles of 90° and 120° respectively. Cranks like Fig. 95 are usually forged with the dips at proper angles, but those like Fig. 98 are more often forged with the dips in one plane, and twisted afterwards. They are sometimes forged approximately at these angles when built up, as in the last example. Sometimes each crank is prepared separately and welded to suitable lengths of axle; but generally they are forged in one plane and the portion of the axle lying intermediate with the cranks twisted until the cranks stand at the angles required with each other. When twisting is practised, it must be performed over as great a length of shaft as possible, in order to be gradual. Two or three heats may have to be taken if the length is considerable, and a portion of the necessary angle imparted at each heat. One crank will have to be secured by some means, such as clamping down to the swage or levelling block or anvil, or pinching under the steam hammer, or even in the vice, if of small size, while leverage is exerted at the other end. The leverage may be applied direct to the other crank, or to the axle itself, by means of clips. A few well-directed blows of the hammer will assist and serve to regulate the dead pull exerted upon the lever.

If the cranks are welded to the axle, a long and somewhat bulky scarf should be made to give plenty of metal for subsequent consolidation and swaging down.

The bosses for some large stationary engine-cranks when they are not upset, or the webs not swaged from the solid, are built up or turned round in various fashions. In one method the boss is formed by bending round a piece of bar *a*, and welding it to a straight portion B (Fig. 101). The bending is usually done by placing the bar across two supports and fullering it down in the central portion. When the bar is thus partly bent, the curving is finished by hammering the ends and nearly closing them upon the anvil, or until they are sufficiently close to just embrace the flat bar B in readiness for welding. Obviously more than one lamina of metal may be employed in the formation of the boss, one or more being curved around and welded on the first to make bosses of any dimensions.

To finish such a boss, any excess of metal at the end, *a*, of the bar is cut off with a gouge, a suitable mandrel inserted in the hole, and the outer curves finished with suitable fullers.

Often, however, the boss is made simply by piling (Fig. 102). The pieces A, A, of any convenient thickness, are welded to the straight bar B, and afterwards are consolidated at a welding heat, and a rudely curved form imparted to them by means of fullering tools before final shaping with the set and finishing tools. This fullering gives an approximately curved disposition to the fibres.

When the two bosses are prepared, the ends B, which have fulfilled the function of porters, are cut off, and the bosses united by means of a scarfed joint, like that shown in a previous article. We have then a double-ended boss whose middle portion, or web, can be fullered and swaged down to the lesser section required.

I have not yet touched on the important subject of piling and fagoting for heavy forgings. It is well known that when extra strong and sound forgings are wanted the way to secure them is not to use a solid new bar, but to weld together a large number of selected pieces. These are of any conceivable size and shape, and of various qualities, though a selection of best material is made when specially desirable. They are laid together in bundles of suitable sizes, bound with iron round a porter or long bar of iron, and raised to welding heat and hammered and consolidated, and reduced more or less under the steam hammer. For specially good qualities of work this process is repeated two or three times, the pile being drawn down, and then cut off into lengths that are re-piled, and re-heated, and welded. The bars are not merely laid in parallel series, but are often made to cross one another at various angles, with a view to securing greater strength.

By this means, not only are forgings with the maximum of strength procurable, but all the odds and ends of metal cut off in the processes of forging are utilised in the best way possible. In large shops this is made a stock job which the men fall back on when the ordinary work is slackening. Accumulations of waste ends are used up, and the "uses" ready piled are stored away for future convenience.

Nothing of very large bulk can be treated thus in the forge fire. Where large masses have to be manipulated, the reverberatory furnace affords the means of thoroughly heating the pile.

STAINING FLOORS.

BY C. E. MAES.

Now that the healthy and economical fashion of having floors only partially carpeted has been so widely adopted, it is not surprising that many of our readers desire information on the subject of staining or otherwise giving a presentable appearance to the uncovered portions of flooring.

Perhaps before proceeding further, and describing the actual staining and other operations, it may not be amiss to offer a few suggestions to those who may be removing, re-carpeting a room, or contemplating alterations, and are not quite able to make up their minds whether they will have their carpets close fitted to the walls or only have a square, "art" or otherwise, in the centre, leaving a margin all round to be stained, or, as is often the case, covered with a floor-cloth surround of some kind.

The two great advantages of having a portion of the floor uncarpeted may, as stated above, be owing to sanitary and economical reasons. It certainly cannot be said that a close-fitted carpet is in itself dirty, and consequently unhealthy, but there cannot be any question that owing to the difficulty of taking it up it is frequently a cause of dirt being allowed to accumulate. A square of carpet loosely laid, and not necessitating the removal of any cumbersome piece of furniture, such as wardrobe, sideboard, or cabinet, can be taken up at any time without much trouble, and easily be re-laid by the ordinary domestic portion of the household.

On the score of economy even stronger arguments can be given in favour of squares. The initial cost is considerably less, for there is little or no cutting to waste, even when the "square" is made up of ordinary carpeting. Unless a particular width of uncarpeted margin is insisted on, it is seldom necessary to cut a breadth in half; whereas, when a room has the carpet fitted to it closely a considerable quantity may be, and often is, cut to waste. Thus we have not only to consider the saving effected by not covering so great a superficial area with carpet, but that from there being little waste—none, in

fact, except what may be caused by the necessity of matching the pattern. A carpet dealer might object to this; but no matter—his wishes cannot influence us at the present time. Of course, as is no doubt well known, art "squares" are manufactured in large numbers, and they are even cheaper than a made-up piece of ordinary carpeting. They are to be had in many patterns and colourings, and the objection cannot now be urged against them that in either respect they are objectionable. As a rule, both colour and design are good, most of the kinds being reversible, although there is always a "right side up"; when one side gets dirty or shabby the other may be made the top. One great economy of squares is owing to the fact that as they are rectangular they can be changed about as wear necessitates. If they are not only nominally but actually square, of course it does not matter in what position they are laid, but it may be presumed that it is known that these "squares," or, more correctly, centre carpets, are of varying portions in regard to length and width, as well as of different sizes. No one can have failed to notice that the carpet on some portions of the floor—as, for instance, near the door—gets more wear than at others. Well, with a close-fitted carpet it is seldom possible, without entirely undoing and re-making, to put the part which gets most worn in any other part of the room, but with a square at least two changes can always be effected.

It may be asked if there are no disadvantages to detract from the advantages of having a centre carpet merely, but the only objection that is ever seriously urged may be dismissed in a sentence, as it must be entirely a matter for personal consideration. It amounts to no more than the question about appearance, as some people appear to think that a room which is not carpeted all over the floor does not look so comfortable as it might.

With these considerations in his mind, the reader will now be able to approach the actual work of staining his floors with a decided opinion.

The colour to which floor margins are stained is generally a brown, the finishing being giving with varnish, wax-polish, or oil. It will be understood that ordinary floorings only are referred to—just such as will be found in the majority of houses, and not those covered with parquetry work, which are usually finished in such a superior way that they may be left out of consideration. For ordinary rooms the varnish finish is to be recommended generally. It looks well, and requires less attention to keep in order than wax. A coat of varnish every now and again will restore the margin to original gloss. Wax-polished floors look well, but they require rubbing up frequently, and they cannot be washed without destroying the gloss. Oiling has few, if any, advantages beyond the cheapness of the work, and can hardly be recommended as suitable for ordinary dwelling-houses. At its best, an oiled floor never looks as well as one that is varnished, but perhaps where there is much traffic, and expense is a prime consideration, oil is the most suitable finish. It is true, floors are sometimes French polished, but so seldom that nothing need be said about this finish, especially as it is carried out like any other work of the kind.

On deciding to stain and varnish a floor, the first thing to be done if it is an old flooring is to pull up any nails which have been used for fastening carpets to round by the skirting-boards. When the carpets have been laid with rings, nails are always sure to be found. The nail holes may be filled up with putty, but in recesses and dark corners it may not be necessary to take this trouble. It all depends on whether a first-class job is intended, so it need not be understood that all the preliminary preparations of the floor must be done. The worker will be able to judge best for himself to what extent they should be carried.

It often happens that the edges of flooring boards are above the general surface of the floor—*i.e.*, the boards have become somewhat concave on their upper surface, in which case, if necessary, they may be planed down. If the floor be a dirty or discoloured one, it is in this case advisable to plane all over the portion to be stained, otherwise the difference between the new and the old surface will probably be plainly discernible.

While preparing the floor it may be advisable to punch in any nail-heads and fill up the holes with putty. Wide joints between the boards may be either filled up in the same way or with thin slips of wood. With the almost unnecessary remarks that new floors do not generally want so much preparation as old, and that all dirt should be washed away, we may proceed with the staining operations.

The stain may be either purchased ready made, as wood stains are sold by most oil and colourmen, or it may be prepared at home with very little trouble. There are many recipes from which stains may be made, but there is none better than the following one. The proportions are of very little importance. The ingredients are vandyke brown, liquid ammonia, and water. The vandyke brown is mixed up with the ammonia to form a thin paste, to which water must afterwards be added to reduce the strength and liquefy the stain.

When a thin paste is mentioned, it must be understood that nothing thicker than this is satisfactory; but the same objection by no means applies to the converse, for the mixture may be liquefied to almost any extent with ammonia without detriment. Ammonia, of which only the strongest should be used, is, however, dearer than water. Care must be taken that the brown is thoroughly mixed. The mixed brown and ammonia may be either kept as a stock preparation to be used from with water as may be required, or it may at once have water added and be kept in a usable state. It is, however, advisable to mix at least as much as will suffice to do a room entirely, and to avoid any difficulty in matching to exact shade in any fresh mixture.

Instead of ammonia, caustic potash or soda may be used to mix the brown with. It is not, however, nearly so nice a preparation, and is open to objections from which ammonia is free. If potash or soda be used, it is better to mix them with a fair quantity of water, and to boil after the brown has been added.

Whatever the stain, it should be washed on evenly with a cloth or be applied with a brush. Care should be taken, especially if potash or soda has been used, not to let the stain get on the painted skirting-board. It will be found a convenience to mark a line showing the width to which the margin is to be stained, and this should be a few inches under the intended carpet. A straight line may easily be struck by means of a piece of chalked string. The stained portion should be allowed to dry before proceeding to the operation of sizing.

Size is used to economise varnish, being much cheaper and filling the grain of the wood, which thus absorbs less varnish, and allows it to remain where it is wanted—viz., on the surface. If the varnish sinks there is comparatively little gloss. The size may be bought at the same kind of shop as the vandyke brown, but can be got from almost any painter or decorator, as it is largely used in whitewashing, etc. It is applied to the floor like the stain, and must be allowed to become thoroughly dry before varnishing.

A good varnish for this purpose is "brown oak," but any hard-drying one will do very well. It should be bought ready made, as there is no use in amateurs supposing—as so many of them do—that they can prepare their own. Whatever varnish is used, it should be laid on with a brush, and it may be noted that two coats thinly laid on are better than one applied thickly. In many cases one coat is all that is needed.

For a wax-polished floor it is only necessary to stain, and then when dry finish with a mixture of beeswax and turpentine. As wax-polishing has been fully treated of in WORK, it is unnecessary to do more than refer to the article on it.

The same remarks apply to oil finishing, except that it may be understood that the same care is not necessary as with a piece of furniture. Indeed, on a floor it is useless to attempt to get any polish with oil. The oil is useful to enrich the colour of the stain, and that is all.

A very useful stain may be made by thinning ordinary paint with turpentine. Of course the turpentine causes the paint to dry flat or dead, but a coat of varnish will soon remedy this. Mentioning paint may induce some to suggest the inquiry whether a floor might not be painted instead of stained. If so, the answer is "Yes." But were all ways in which flooring might be finished enumerated, more space than can be devoted to the subject would be required; but in the "sweet by-and-by" I may have an opportunity of describing the finishing of a floor with wall-paper: a material not generally recognised as suitable.

MATCHBOARDING.

HINTS ON ITS APPLICATION TO WALLS AND CEILINGS.

BY ALEXANDER MARTIN.

WHERE the walls are covered with matchboarding all the way from floor to ceiling, the monotony is still more noticeable than when they are only partly covered. The long stretches of board may easily be shortened by introducing any of the previous designs as a dado, 3 ft. high, running the boards above the dividing bead on top of the dado right up to the ceiling. Perhaps our meaning may be made clearer by reference to Fig. 23, which shows the arrangement we speak of. The mitred squares in the dado are in marked contrast to the boarding above; and at about 15 in. from the cornice a flat frieze moulding is nailed on, to form a frieze round the room. A section of this frieze moulding is given, about half full-size, in Fig. 24, and an alternative section in Fig. 25, either of them being equally suitable for the position. A gas-bracket is shown in Fig. 23 in the centre of the vertical boards. It has a diamond-shaped panel prepared for it in the matchboarding, all the surface being in one face, and not raised, as might be supposed. Another arrangement for covering a wall from floor to ceiling is given in Fig. 26, where above a dado are placed boards set

to an angle of 45°, mitring into each other at regular intervals. There is no need for a frieze moulding in this; it is better without one. The grounds for these designs are so very much similar to others already given that it is unnecessary to show them again. The cornice may be either of plaster or of wood—the latter being, however, preferable, especially where the walls show no plaster at all. A section of a cornice suitable for a very large room, or small hall, is given in Fig. 27; but as the size of cornice necessary is regulated by circumstances, the dimensions must be decided accordingly.

Another method may be adopted for decorating matchboarding, without interfering in the least with the usual method of attaching it to the wall, board against board, irrespective of design; and one that, at the same time, will not add much to the cost of the work. It consists of covering the wall first of all with the matchboarding, and afterwards sprigging on its face mouldings suggestive of panelled work, as indicated in Fig. 28. Two arrangements are shown, which may either of them be worked separately or alternately. The moulding used should be of a kind which will not require to be mitred at every connection, as one of the form in Fig. 29 would. Half of the mitring may be saved by using a moulding as shown in section in Figs. 30 and 31; for the square edge will receive the full moulding in a butt-joint. In the left-hand arrangement in Fig. 28, therefore, the two squares—the inner one and the outer—are mitred together exactly as a picture-frame is, and sprigged on the boarding: the four little connecting pieces are then butted between these two frames, and the design is complete. The diamond panel on the right-hand side of Fig. 28 is a little more difficult to manage, but it is made up in the same fashion. The outer square is easy enough, as is also the centre diamond, mitred and sprigged on. The four connecting pieces in this case require fitting at the corners of the diamond panel, but no mitring is necessary. In Fig. 32 is shown an enlarged sketch of this corner, by which our meaning will be made quite plain. This figure shows the short connecting piece; but the long one, of course, is fitted in exactly the same manner.

If a long stretch of wall is being treated in this way, the panelling should be broken up in some fashion to make more variety than the two kinds of panels alone afford. If there are any buttresses in the wall, they will naturally divide it into compartments, which may each have one or more panels;

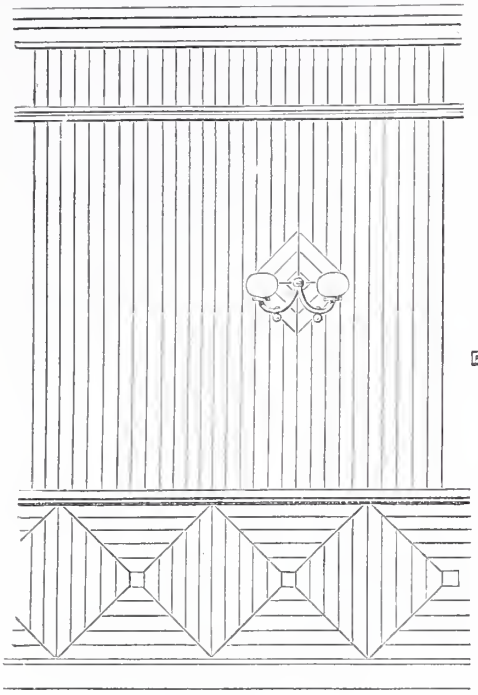


Fig. 23.

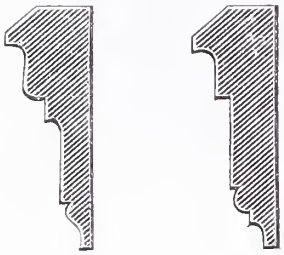


Fig. 24. Fig. 25.

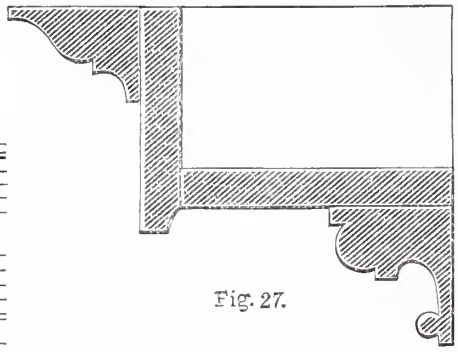


Fig. 27.

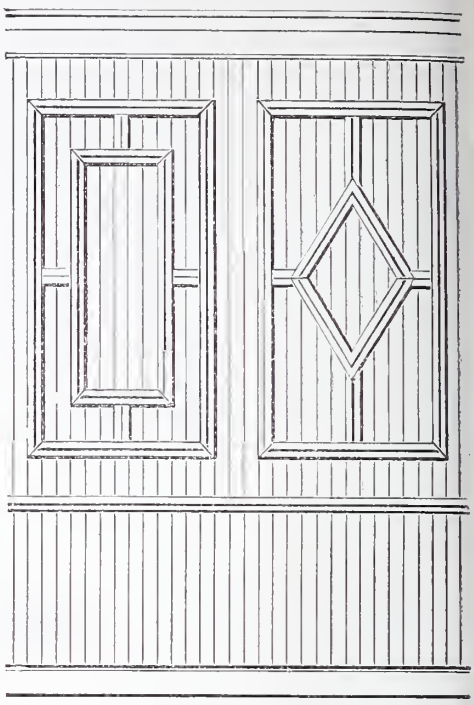
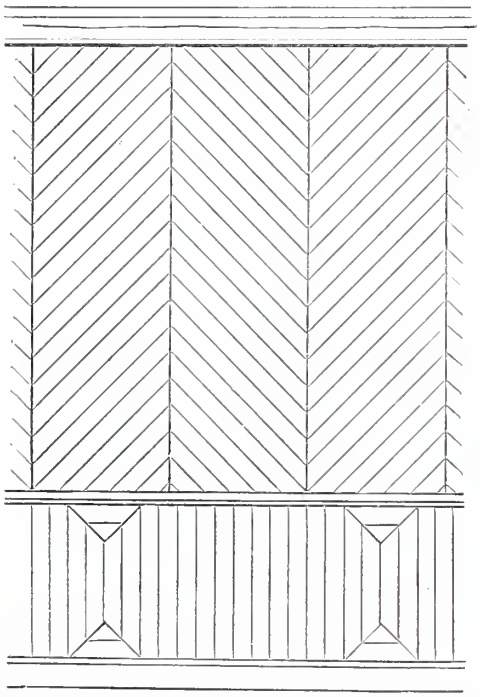


Fig. 28.



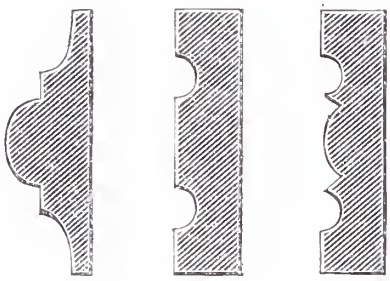


Fig. 29. Fig. 30. Fig. 31.

Fig. 26.

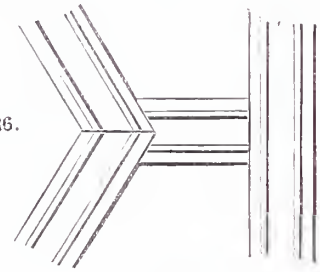


Fig. 32.

Fig. 33.

Matchboarding: its Application to Walls.—Figs. 23-33. *For Explanation of Diagrams, see accompanying Text.*

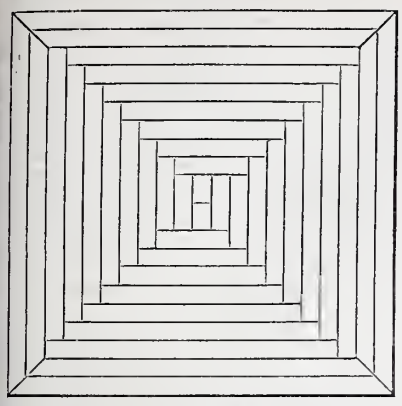


Fig. 34.

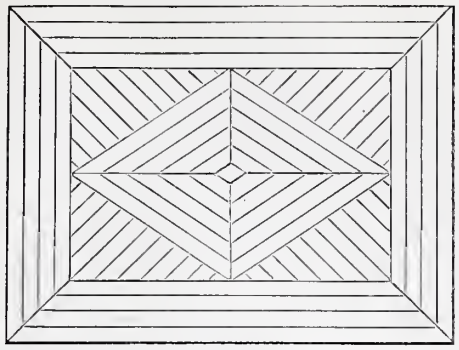


Fig. 36.

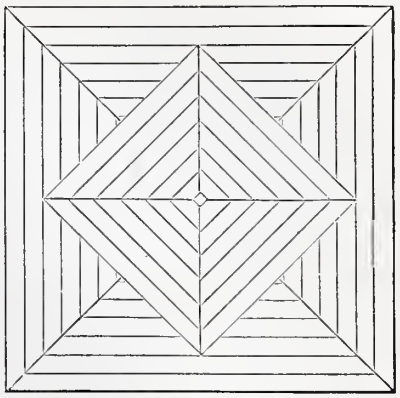


Fig. 35.

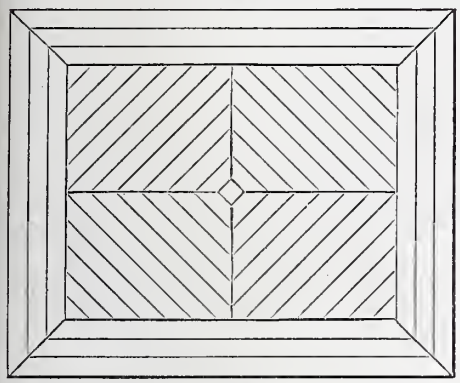


Fig. 37.

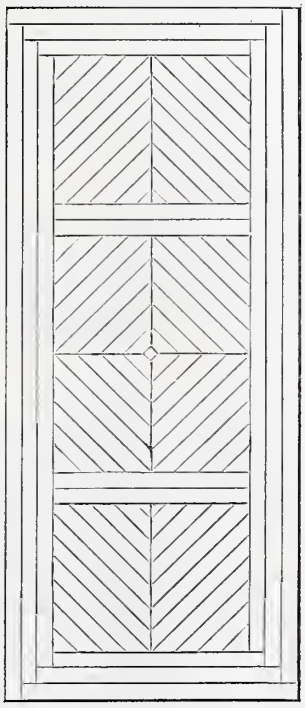


Fig. 39.

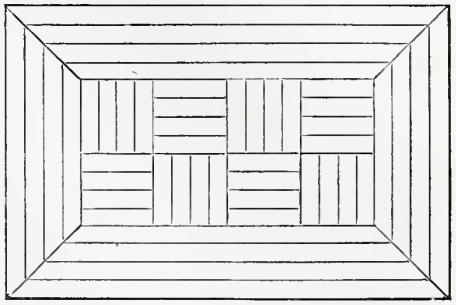


Fig. 38.

Fig. 46.

Fig. 44.

Fig. 47.

Fig. 45.

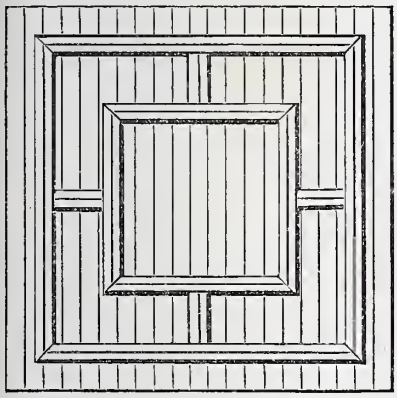


Fig. 40.

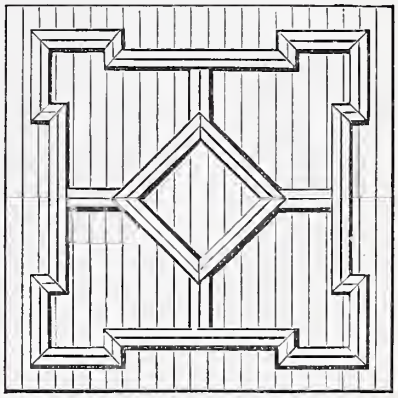


Fig 41.

Fig. 48.

Fig. 49.

Fig. 42.

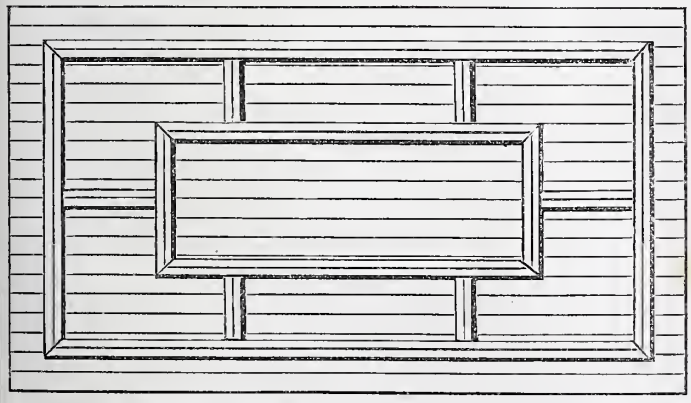
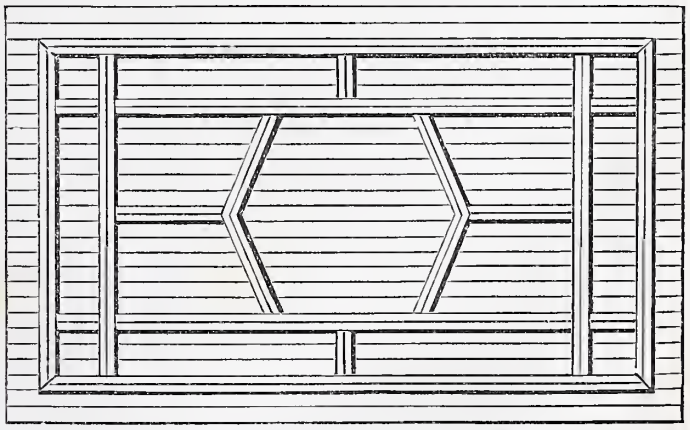


Fig. 43.



MATCHBOARDING: ITS APPLICATION TO CEILINGS.—Figs. 34-49. *For Explanation of Diagrams, see accompanying Text.*

and the face of the buttress, if it be broad enough, may be panelled also. In Fig. 33 a buttress is indicated with panelling on its face; and alongside of it is shown another arrangement of panel, carried out in the same manner as already described. A narrow panel, it may be observed, is placed between the two larger ones to relieve them from appearing side by side; a little management of this sort is invaluable in setting out the wall.

Ceilings require as much attention as walls when they are covered with matchboarding, and usually they get more. Perhaps it is because that in shops the walls are usually covered up with merchandise, while the ceiling is always seen throughout its whole extent. In Fig. 34 is shown a square ceiling, with mostly square joints; the two outer boards on each side are the only ones mitred, and they are so finished to give an effect of "completedness" to the whole. Another design for a square ceiling, and one which entails a good amount of mitring, is given in Fig. 35; this makes a very effective design. Almost the same idea is used in Fig. 36, but this being an oblong ceiling, a lot of the angles of mitring are different from the usual 45°. In the next (Fig. 37), all the angles are of the usual 45°, and will therefore be more readily put together on that account. A plainer design, yet neat enough, is given in Fig. 38; in Fig. 39 is shown an arrangement for filling up an exceptionally long and narrow ceiling.

In putting up such designs as these in any place, it will be found best to cover all the ceiling with rough boards—⅝ in. sarking will do nicely—so that there will be one flat surface to nail the matchboarding to. It may then all be made in the workshop; every different piece of wood being cut and mitred to its proper size and shape, there will be no difficulty in putting them all in their exact position just at once.

Where the walls have been treated with the sprigged mouldings formed into panels, the ceiling should be in keeping. In our next four Figs.—40, 41, 42, and 43—are shown various designs for different shaped and sized ceilings, Fig. 41 being suitable for a larger ceiling than Fig. 40, and Fig. 43 larger than Fig. 42. The mouldings used in the ceiling should be of the same section as those on the walls; and although the design on the walls and ceiling need not be exactly alike—it is better, in fact, that they should *not* be—yet some features of resemblance ought to be found in both. Any of these four designs for ceilings would go with either of the designs for wall-panels already given in Figs. 28 to 33.

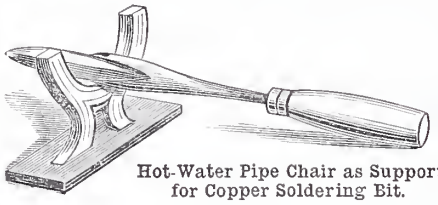
Before finishing, a word ought to be said of the matchboarding itself. It usually consists of V-jointed, grooved, and tongued boards, 3 in. wide, as indicated in Fig. 44. Sometimes it is made of boards 6 in. wide, which have a V run up the centre, as shown in Fig. 45. This enables the matchboarding to be more expeditiously laid than when it is of 3 in. boards; but it has a great drawback in one way—viz., when the boards begin to shrink, as most of them do to a certain extent after they are put up, the alternate V's are much opener than the others, and therefore much more observable. This is bad; and the narrower boards are therefore the better kind to use. When they shrink, besides shrinking less than the wider boards, they also allow each V to get its own share of the extra opening.

These are the ordinary kinds of matchboarding, and it is of such that the preceding lines and sketches have been penned. But all that has been said is equally applicable to the other varieties indicated in Figs. 46 to 49. The difference consists, in Fig. 46, of the bead in place of the V at the joint, while the other three varieties have more moulding about them. These different finishings of boards may be had at some of the larger sawmills, and the extra amount of finish they give to the appearance of the work when completed is remarkable. It may be well to add, however, that where the panelled mouldings are planted on the face of the boarding, the ordinary V-jointed boards are most suitable in that case, the mouldings being seen to better advantage; and with these words, I must, in the meantime, bid farewell to the patient reader who has followed me thus far in my considerations.

MEANS, MODES, AND METHODS.

Hot-Water Pipe Chair for Soldering Iron.

As this column is meant for the communication of items of a practical kind, however simple, I pass no apology for pointing out what, to me, has proved a very useful article, in the shape of a rest for a hot soldering iron. It consists of what is known as a "chair" for the support of hot-



Hot-Water Pipe Chair as Support for Copper Soldering Bit.

water pipes, and while it answers this, its legitimate, purpose admirably, it seems also "cut out" for the use to which I have applied it. These chairs are made in different sizes, to suit pipes of various diameters, but one suited for a 3 in. pipe makes the best stand for a copper bit, etc. It is easily obtained, and costs only a few pence.

OPIFEX.

Tinning Mixture.

Amateurs who dabble in solder often find great difficulty in getting that rather capricious substance to "take" to iron, steel, etc.—at least, I have often experienced this difficulty; and as I found that the ordinary method prescribed in books—viz., treatment with sal-ammoniac—did not always answer satisfactorily, I tried the following simple recipe with good results. Make a saturated solution of corrosive sublimate in water—about 1 oz.—and in this solution dissolve some shavings or grains of block tin, when a whitish grey precipitate will result. Clean the surface of the iron, etc., with file or emery-cloth, and apply a little of the precipitate with a piece of rag; rub well, and then remove surplus mixture with a perfectly clean rag, when the metal will be found coated with the amalgam; and upon applying solder in the usual way, it will "take" delightfully.

The mixture should be kept in a wide-mouthed stoppered bottle, and when required for use the clear water should be carefully poured off into a clean vessel, to be returned when the job is done.

I have found this preparation of considerable use to me, and I trust that many readers of WORK will find it equally useful.

OPIFEX.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

113.—Electro-Motors: How Made and How Used.

This is one of the volumes of "Whittaker's Library of Arts, Sciences, Manufactures, and Industries," published by Messrs. Whittaker and Co., Paternoster Square, at 3s. It is written by Mr. S. R. Bottone, the author of many useful works on subjects directly connected with electricity, and is, as he rightly describes it, "a handbook for amateurs and practical men." Its pages, which are freely illustrated, were, as Mr. Bottone explains in his preface, "originally penned, chiefly as letters, in reply to queries addressed to the author on the construction of electro-motors, on their many modifications, and on their mode of working." Mr. Bottone has done well to put his letters into book form, as thereby many will benefit by the information contained in them instead of the few to whom they were originally addressed. Readers unacquainted with the elements of electricity should read Mr. Bottone's "The Dynamo: How Made and How Used," before proceeding to study this.

114.—Metal Turning.

This is another volume of the same series as that to which the volume just described belongs. It is written by "A Foreman Pattern-Maker," one of the most practical and valued of the many contributors to WORK. The book, which is illustrated copiously with diagrams and cuts of lathes and lathe appliances, "is written to explain and illustrate the practice of plain hand turning and slide-rest turning as performed in engineers' workshops." It does not touch in any way on the ornamental section of the craft. The author gives us an insight in his preface into his past life, and shows his fitness for his task by explaining that his "constant employment as apprentice, workman, and foreman in an engineer's factory" for twenty-nine years past has made him "familiar with each of the departments into which engineers' work is divided, of which section metal turning is one of the most important."

115.—Electricity in Every-Day Life.

This is the title of a small pamphlet by Mr. Frank B. Lea, B.A., Assoc. Inst. El.E., and published by Mr. E. W. Allen, 4, Ave Maria Lane, London, E.C., for the inconsiderable sum of 2d. It is intended to show, within reasonable compass, the various uses to which electricity is put in every-day life, as its title implies. We are shown that the electric light in houses is pleasant, healthy, steady, reasonably cheap, perfectly safe, and truly æsthetic, and the means by which the electric current is generated, maintained, and utilised as a source of light is duly explained. We are then told how it is used on torpedo-boats as a means of search on the waters, and how pressed into the service of man as a motor for turbines, launches, cranes, tramcars, etc., for which I must refer my readers to the pamphlet itself, which is well and abundantly illustrated.

116.—Exposure Notes for Use with the Watkin's Exposure Meter.

In page 274 of this Volume a notice was given of the Watkin's Exposure Meter. This is a desirable handbook for use with the meter, dealing as it does in its text with the elements of photographic exposure, and instructions for manipulating the meter, with other desirable information, and many blank pages ruled for registry of exposure notes, etc. Its price is 1s. 6d.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

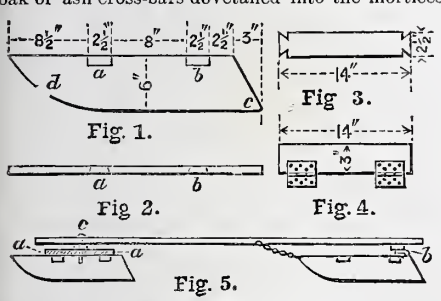
In consequence of the great pressure upon the "Shop" columns of Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Erratum.—G. W. (*Brockley*) writes:—"I notice that in answer to A. S. (*Ayrshire*) (see page 505, Vol. II.), R. A. makes a slight mistake in saying there are sixteen sheets to the cwt., as there are only six sheets to 1 cwt. and 9 lbs."—[I find, on referring, you are quite correct as regards the error in number of sheets to the cwt. It is decidedly a printer's error, and should be six instead of sixteen. I should scarcely make such a gross blunder, using and weighing it as I do every day.—R. A.]

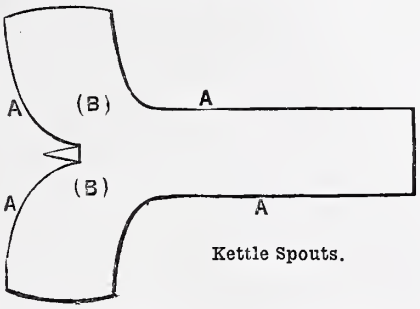
Canadian Toboggan.—L. B. (*Kirkcaldy*) writes:—"The following is a modification of instructions for making a 'Bob-sleigh,' which I saw in a magazine a good many years ago, and which, as it may be useful to the readers of Work, I know from experience that if the directions are carefully followed, and a little care taken, the result will be a sleigh which will not disappoint you. The advantage of this over the ordinary toboggan is that it can be very easily steered in any direction, and that it is flexible, and therefore well suited for use over frozen roads or rough ground. The accompanying sketches are to a large extent self-explanatory; but should anyone have difficulty in making practical use of them, I shall be glad to answer any questions in a future number. The runners (Fig. 1), four in number, are made from a clean ash board 6 in. wide and ¾ in thick. Each runner must be cut to the shape shown in Fig. 1, and planed smooth on all sides. Now mark off on the upper edge of each the distances, 2½ in. by 2½ in. by 8 in. by 2½ in., measuring from the rear top corner, as shown in Fig. 1. Now set your bevel, and draw the lines for the mortices *a*, *b* (Figs. 1 and 2), and note that Fig. 2 shows a left-hand runner; the two right-hand ones will have the bevel the opposite way. Round off the front end of the runners to a nice curve, as at *d*, and round off the rear corners as at c (Fig. 1). Each pair of runners must now be joined by two oak or ash cross-bars dovetailed into the mortices



Canadian Toboggan.

just described. These cross-bars (Fig. 3) will be 14 in. long, 2½ in. wide, and 1 in. thick. The iron shoes, each 34 in. long, for the runners may be made from ⅜ in. half-round iron bent to shape, and screwed on with 2 in. screws. Now take a piece of pinewood 15 in. long, 12 in. wide, and 1 in. thick, and draw diagonals from corner to corner. At the point where the lines intersect bore a ½ in. hole, and then on one side of this board draw semicircles with a 6 in. radius, touching each end of the board at the centre. Cut off the corners by these lines, so that the board will now be of a shape something like an ellipse. Place this lengthwise upon the cross-bars of the bob which you have decided shall be the leading one, and screw it firmly down upon them. The edge of this board is shown at *a a* in Fig. 5, and I have shaded it so that you may easily distinguish it. The bobs are now complete, and you must proceed with the platform, or reach-board. This is a good pine board 7 ft. long, 14 in. wide, and 1½ in. thick, all squared and planed smooth. Now cut two pieces of ash wood each 14 in. long, 3 in. wide, and ⅞ in. thick for cross-pieces. Fix one of these across the under side of the reach-board, 8 in. clear from one end. In the centre of this cross-piece bore a ½ in. hole right through it and the reach-board. Now take the other cross-piece and attach to it two strong door hinges, as shown in Fig. 4. Place this on the rear cross-bar of the rear bob, and secure the free flaps of the hinges to it, as at *b* in Fig. 5. Now place the reach-board on the bobs so that its rear end projects 5 in. beyond the outer edge of the hinged cross-piece, and fasten the reach-board to that cross-piece with screws. The king-bolt (c, Fig. 5), which is a ½ in. iron bolt, 5 in. long, is now passed through the hole in the reach-board and through the hole in the front bob, a washer or two put on, and the nut screwed up. Light side chains are fixed with eye-bolts as shown in Fig. 5, and a suitable cord for steering is attached to the front bob. Your sleigh is now complete; and my experience is that this form of coaster is superior to any other I know of. I trust yours will be the same."

Kettle Spouts.—Tom writes:—"In Work, No. 88, page 583, there is a matter that I wish to draw your attention to, and that is 'Kettle Spouts.' One writer—I forget his name, not having the paper by me—rightly points out the faulty way in which he has been told to make them. And then you, in my opinion, make matters worse by telling him your idea of making them, which is quite wrong. The proper way of making spouts such as we see in copper and brass kettles is thus:—



Kettle Spouts.

I mean that they have to be cut out to this shape. Of course, the sizes are made as circumstances require. They are bossed out at B, until the edges A, A, A, A, come together, and are then brazed, and after being frilled in the lead, bent and planished with a bright-faced hammer."

II.—Questions Answered by Editor and Staff.

Line Wires for Bells.—A. W. (*Wakefield*).—Your plan is quite right in theory, but a practical bell-fitter would seek to economise wire and labour by taking the lines along a more direct route to the bell and indicator. If the corridor has a wood flooring, you should try to get the wires along under the floor instead of round the doorways. This you can do easily if the joists run lengthwise with the party wall. If they run transversely, you must take up a flooring board and make saw cuts in the upper part of the joists to lay the wires in, and secure them in the cuts with staples. It would be even better to run the wires along the cornice than to waste them round the doorway. Perhaps you can pierce the ceiling with a long gimlet and take the wires up through it into a room above, then down through the ceiling at the other end of the corridor where the bell and indicator are situated.—G. E. B.

Defective Coil.—R. J. W. (*Fulham*).—The probable cause of failure to get a shock from your coil is either defective insulation or a broken wire. If the insulation of the secondary wire has broken down, or if one of the wires are broken, you will not get a shock from the coil. Examine first the connections of the wire ends with the studs. If you find the wire frayed or broken at these points, it is possible you may only have to repair the faults discovered there. If the insulation has broken down, you will have to unwind the coil, repair the insulation, and wind it afresh. It is possible that the condenser or its connections are out of order; sometimes the insulation of the foil is pierced with sparks. If, on examination, this is found to be the case, the condenser will have to be taken to pieces and rebuilt with new insulating sheets. One can only conjecture the fault without seeing and examining the coil.—G. E. B.

Telephone.—Tee Jay.—These instruments, speaking generally, are divided into two classes—*i.e.*, electrical and mechanical. By electrical, I mean all those which depend upon a current of electricity, generated by some means or other, to enable them to do the required work. The best known of this class is the Bell, because it is the property of the National Telephone Company, whose system is in use in most of our large towns. Mechanical telephones are quite distinct from "Bell's" and all other electrical instruments. There is no battery nor microphone used with mechanical telephones. But if you want to use a microphone with Bell's instruments, the battery you name is what is generally used. There is no limit to the distance which the sound will run. The distance depends upon the resistance of the conducting wire and the strength of the current. But it is not the sound that travels. What actually does take place is as follows:—You make a noise in the neighbourhood of a telephone, which may be speech. This noise causes a little iron plate to bend to and fro in front of a magnet around the pole of which there is a little coil. The vibrations of the iron plate cause undulations in this little coil which are transmitted to the line wire, and after having traversed it, they set up vibrations in the reverse order at the other end which will reproduce the noise faithfully, and if an ear is held to the instrument an imitation of the distant speaker will be heard.—W. D.

Relief Stamping.—A Stationer's Assistant.—It would require an article to answer you fully. You want to know how to do gold and silver relief stamping. In the first place, you want a stamping press, which you may get from Messrs. John Greig & Sons, Fountainville Works, Edinboro', or from any bookbinder's engineer. Wherever you get it, it must be a good one. You want also steel dies, but these the customer generally supplies, although you must be able to take an order for a die and suggest designs, as customers generally look for this from stationers. You require sole leather and gutta-percha for making matrices, and you want colours and varnish for mixing. And you want most of all experience, especially to stamp in gold or silver. Supposing now that you have provided yourself with all the necessaries, and you have a job to do. For the sake of illustration, we will imagine that it is a monogram to be stamped upon note-paper and envelopes. Your die is a round one, the monogram is cut into it on the face which is polished. In the bed of your press you will find a movable piece of metal with a hole in it; withdraw this and turn it up, and on the under side you will likely find three or four pins which fit into holes in the bed of the press. To this you must fasten your die rigidly; in some presses screws are provided for this purpose; if these are wanting, a piece of gutta-percha melted will fix it, or even glue may be used (I have tried all of these, and used the most ready). The die must, of course, be fixed straight, or you will have no end of trouble with your paper. Having fixed the die, return the whole thing to the bed of the press. Now cut a small piece of shoe-leather larger than the die and damp it thoroughly; place it upon the top of the die, and bring down the movable part of the press upon it gently and firmly. At the bottom of this movable part will be found a little plate called the head, having a roughened surface with one or two little spikes projecting. These spikes press into the leather, and cause it to stick to the head. The screw of the press is now worked up and down, causing the head with the piece of leather to strike the die again and again; by this means a clear impression in relief is taken upon the leather. A small piece of gutta-percha is softened and spread upon a scrap of paper or linen rag, and while soft and sticky it is placed upon the die with the sticky side up; the head is again brought down, and the gutta-percha adheres to the leather; the pressure is kept upon it until the gutta-percha is perfectly set, when a few more ups and downs of the screw will complete the making of the matrix. It is now taken off the head and pared neatly all round the impression with a sharp knife to prevent undue marking of the paper. When pared it is replaced. The next thing is to get the colour ready. The colours are dry vegetable colours, to be procured at any respectable colourman's, and the varnish to mix is white crystal varnish, to be had at the same place. A pick of colour is put upon a slab and mixed with the varnish, using a stone or muller to grind it down smoothly. The die is taken from its bed in the press and the colour worked into the monogram with a hard brush by daubing. The die is then wiped upon a piece of paper to clean the face and replaced in the press. A sheet of paper is now laid down upon the die (there are gauges to be set so that the design will appear in the proper place) and the head brought down sharply upon it. The result will be a coloured impression of the die in relief—any colour can be used, and for gold or silver, bronze of the required shade is dusted over the colour while wet, and after having dried, it is again placed in the press and the head brought down to burnish it.—G. C.

Venetian Blinds.—L. T. (*Middlesboro'*).—If L. T. will size his Venetian blinds with two coats of patent size, the first coat diluted with nearly half water, the second coat rather less water, he will do right. The varnish used in the trade is best "church oak." This is a hard-drying varnish, generally rather too dark for light colours, but will do to varnish pine either in its natural state or stained. To impart rather more colour than the varnish gives, I have used some oak or walnut stain mixed with the first coat of size. If wanted dark, of course the stain must be applied alone, before sizing. Should oak or walnut stain be too brown for the effect desired, I have found a little gamboge dissolved in water added to the size beneficial; and mixed with some stain, various tones of yellow or brown can be produced. Any yellow dye wood would serve just as well, but should either be applied before sizing or mixed with the first coat of size. As to hiding any knots, I fear it is almost hopeless; at any rate, I should not attempt it. If the querist wishes to try, he must make some opaque colour—probably yellow ochre and whiting—and touch up artistically the knots objected to, but the success of the operation is doubtful. In staining, remember that the varnish, as well as light and lapse of time, will darken the laths.—B. A. B.

Brickwork.—C. J. S. (*Trimsaran*).—There are several compositions now manufactured for preventing damp from striking through walls. The following are the names of the manufacturers of some of these:—A. T. Morse & Co., Ward Road, High Street, Stratford; Colourless Solution Silicate Paint Co., 46, Cannon Street; Bulmer's Impenetrable Paint, London; Hay's Waterproof Marine Glue, Chandos Street, Landport, Portsmouth; A.

Sanderson & Co., Humber Bank, Ropery Street, Hull; Ransome Patent Stone Co., 2, Queen Street Place, London. The solutions are applied generally with a brush in the same manner as paint, but instructions for laying on are generally sent. The walls should be thoroughly dry before laying the solution on; the summer is the best season. There is a good deal of difference in the qualities of the bricks, some being cured with one application, while others require renewing at intervals of one or two years. If the walls have no damp course at the ground level, a trench should be formed at the outside, the wall cleared to the foundation, the bricks pointed with cement, and the solution laid on when dry. The trench should be lined with brick, and a concrete bottom with an inclination to a trap connected to a drain. The trench should be covered with stone flags, with two or three openings to admit the air. Two or three openings should also be cut through the wall at the foundation to admit a current of air. These should have a grating fixed in front. If the inside of the wall is filled solid, an air course or trench should be made along it under the floor.—M.

Fairy Bells.—MIST.—If you will refer to the reply to KILDONAN (see page 814, Vol. I.), you will find all the information you seek.

Lock Picking.—S. D. C. (*Trowbridge*).—I am afraid you will not be able to obtain the instrument referred to in WORK, Vol. I., No. 26, as I do not think they are made by any wholesale firm. However, as you are a practical locksmith, you would have no difficulty in making it if you follow the description given. If there is anything you do not understand in it, I shall be pleased to help you, if you will write again.—T. W.

Holes in Steel Plates.—A. H. (*Birmingham*).—It would be exceedingly difficult to make such small holes in plates of such a thickness. You might try to drill and slot them, but unless the metal is very soft, neither drill nor slotting tool will stand. You might build the plates up of strips half an inch wide, notched out to templates, and screwed or brazed together.—F. C.

Horizontal Coupled Engine.—J. D. (*Glasgow*).—The indicator diagram shows a very bad condition of valve arrangements. The exhaust opens too soon, the steam ports are not large enough, and the steam is consequently so badly wire-drawn that the figure does not show where the cut-off actually occurs. You give the back steam pressure 40 lbs., and the front 43 lbs., but on the diagram those pressures scale only 28 lbs. and 30 lbs. respectively, and the mean pressure is 15 lbs. per square inch. Referring to my former reply (page 537, Vol. II.), this would give a horse-power of

$$1{\cdot}353 \times 15 \text{ lbs.} = 20{\cdot}29 \text{ (nearly } 20\tfrac{1}{4}\text{) h.-p.}$$

The wire drawing may be due to the steam pipes being too small. A very curious mistake in the valve is that both ends of the cylinder are open to the exhaust at once, the distance between the steam ports being given as $4\frac{7}{8}$ in., and the inside length of valve $5\frac{1}{16}$ in. This accounts for the angle at the heel of the diagram being so long. You should certainly have a new valve or put "inside lap" on the present one—that is, if the engine is worth the trouble.—F. C.

Carved Bowls.—J. B. (*Glasgow*).—As the stains in your plane-tree bowls are natural to the wood, they cannot be eradicated. The only thing that might do good is a solution of oxalic acid, but the effect of this would only be partial. The application of chemicals to woodwork for bleaching purposes is never very successful, especially in white woods. Why not carve your bowls, and afterwards stain them all dark? the defect would thus be hidden.—M. E. R.

Magic Lantern.—H. E. (*West Bromwich*).—TRIUNIAL OPTICAL LANTERN.—Part II. appeared in No. 87, Part III. in No. 91, and Part IV. appears in this number. The remaining paper will appear in the course of the current volume.

Violin.—W. C. P. (*Warwick*).—Papers on this subject are ready, and only await opportunity for publication.

Combining Chucks.—A YOUNG BEGINNER.—You want to know whether it would pay you to make a chuck to combine in one, the dog chuck, the die chuck, driving, flange, and taper screw; and whether it would pay to patent it. No, it would not. First, it would be difficult to combine these chucks; and second, only A YOUNG BEGINNER would wish to have them so combined. Fancy if you had a piece of work in the dog chuck and then want a screw for it; you would have to take it out and fix up the dies, perhaps, to turn the screw, and then rechuck your work again in the dog chuck. Combination tools have a strange attraction for beginners, but workmen will have nothing to do with them. It is not reasonable to suppose that A YOUNG BEGINNER can produce anything worth patenting; no one should expect to do such a thing without first making himself master of all that has been invented by others in that line. A successful invention is not the result of a chance hit by an unpractised shot; it means long practice and patient study. Trust to work, not luck.—F. A. M.

Varnish.—DANSEMBARAS.—French polish is far superior to varnish for a finish. The latter is not suitable for any but the commonest and roughest furniture. The flutes and mouldings to which you allude ought not to prevent you polishing your hall stand. Perhaps you may be mistaken also about the supposed possibility of polishing the carving, but as I have no idea what this is, I cannot speak with certainty about it. If the carving cannot be polished, and you want it bright, there is no alternative but to varnish it. For this purpose, you should use spirit varnish and apply it with a soft brush. It is, however, by no means an uncommon thing not to polish or varnish the carving, but to leave it untouched or "in the white." Sometimes it is merely oiled or wax-polished. The contrast between the carved parts dull, and the brightly polished surrounding, is often very pleasing. If you prefer to do so, you might wax-polish your hall stand, but the objection to this method is that wet umbrellas, overcoats, etc., might injure the appearance, as wax polish is damaged by excessive moisture.—D. D.

Machine Saw and Drill.—J. M. (*Midhurst*).—The top bar of machine (on front page of WORK, No. 87) does not cause the saw to recede from the wood when it drops—at least, not perceptibly. The matter is of no moment in actual work, and it does not matter whether you have the saw end higher than shown or not; it is a matter of convenience. Place it sufficiently high, or it will give you a knock on the head occasionally. You are all wrong about the treadle, and in proposing to omit the beam D and weight. This beam and the connecting rods are important parts; without them there is nothing to resist the strain or pressure of the wood against the saw, and it will not act. Again, to pivot the treadle in the centre and put a weight at the further end would be worse than useless. You can put a weight at the saw end if you like, but not at the other. Mattress springs might do if there is sufficient elasticity in them. Remember the saw has a 9 in. stroke.—F. H. R.

Re-enamelled Pails.—W. T. (*Alford*).—You will most likely get what you require in the way of enamelled pails from A. H. Kreuser, Wolverhampton, maker of all kinds of stamped iron enamelled hollow ware.—R. A.

Graining Trade.—ESPERANZA.—The study of graining and marbling at any school by a man totally unused to and ignorant of the trade of house painting and decorating would be utterly futile, so far as ultimately getting a living is concerned. There are thousands of good workmen who can grain and stencil well, besides being thoroughly practical house painters, and yet are out of work many weeks in a year. Graining and marbling were once "almost a fine art," but nowadays a grainer to the trade must be a clever and experienced worker, and possess a good trade connection in order to get a decent income throughout the year. The ideal house painter and decorator is one who can prepare and plain paint, grain, write signs, gild, stencil, and hang wall-papers; and this is really what things are coming to if the worker would get a good living at his trade. Hence you see the graining notion for your son does not savour of success. Two callings that we have some reliable experience of may be suggested to you. The first is that of sign-writing. Your son's faculties of copying may develop success in this line, and it can readily be studied at home, and without much expense. If this is suitable, purchase Vol. I. of WORK, and let him follow its directions for one or two hours each week-day for a year, and then purchase "The Art and Craft of Sign-Writing," 21s., 15, St. Ann Street, Manchester, a year's study of which will "finish him off" if he has anything in him. In the meantime, let him remember a spot of paint or whitewash on his clothes is no spot upon his honour or integrity, and that he must work or "go under." He will then, probably after a few months' practice, earn many shillings and get his practice at the same time. The other suggestion is photography, which is supposed to be a more "gentlemanly" occupation. This would ultimately suggest a little capital, but for some time he could study first simple manuals, and then purchase a plain but reliable amateur's outfit, costing from £5 to £10. He could then go in for practice, and meanwhile go to the lectures at the Polytechnic, take in a photographic paper—say *Photography*, 1d. weekly—and then, if he has any suitability for it, he would soon—say in two or three years—be able to get into the profession as an assistant. All his future will depend upon himself.—LONDON DECORATOR.

Clock.—VENATOR says that he has a thirty-hour American striking clock with weights which he wishes to convert into an eight-day clock. My advice is not to proceed with the change at all. It would be the height of folly to do so, even were it possible. It would first be necessary to insert an extra wheel—that is to say, an intermediate wheel—between the barrel and the next wheel of the train. This intermediate wheel would have to be calculated to fit the train of existing wheels; and probably other new wheels would be required. Then, with the addition of another wheel, the clock would have to be wound up in a reverse direction. I do not think it possible, under ordinary circumstances, to accomplish this conversion. But if it be actually possible, the trouble and expense would exceed the value of a new clock. No practical man would think for a moment of undertaking such a job.—HERR SPRING.

Dulcimer Making.—F. V. (*No Address*).—The best wood to use for wrest and hitch-pin blocks is good sound beech or straight-grained oak, which you can obtain ready cut from Messrs. Chilvers and Co., St. Stephen's, Norwich. The method of boring the blocks is described in the articles on "The Dulcimer" in Nos. 31, 38, and 41, Vol. I. of WORK.—R. F.

Mechanical Ship.—W. S. (*No Address*).—To obtain a result, fix an arm to the arbor which would carry the seconds hand. This arbor revolves once in a minute. If you fit a sliding piece so that it can rest within reach of the above arm, it will stop it and hold the mechanism at rest. If the sliding piece is withdrawn and immediately replaced, it will release the arm, but only for one revolution, when the arm will again be arrested. The sliding piece should be kept under the arm by a light spring except when momentarily withdrawn by one end of a bell-crank, on the other end of which the penny passed through the slot falls on its way to a receptacle. The connection between the coin lever and starting and stopping slide may be made by a light wire. The attachment to the clock will depend upon the arrangement of the frame. Inquire at some large picture shop for the picture you require.—F. C.

Leather Work.—UNCLE leaves doubt as to the kind of stamped leather required. If he needs ornaments for ordinary leather work, the keeper of any "fancy" shop will get them for him. For the producers of other kinds of stamped leather he should consult a London or Paris Directory.—S. W.

Graining.—E. D. (*Liverpool*).—The whole matter of graining and inlaying have been treated in the series of articles in WORK.—DECORATOR.

Picture Frame Compo.—ORNAMENTAL.—The subjoined, which appeared in Vol. I., will answer your purpose, and will make a large quantity, as desired. Take of best glue 7 lbs.; melt it in three pints of water. Dissolve also 3 lbs. of resin in three pints of raw linseed-oil. Now mix the two whilst hot, and boil in an old iron saucepan for about thirty minutes. Then procure best gilder's whiting, break it up to powder, and stir this into the hot mixture until it gets like dough. You can now "put in a few hours," well kneading it together while it is warm, and then it is ready for pressing into the moulds. These should be of carved boxwood. When the compo. which is not used gets cold and hard, it can be softened up again by heat and kneading.—F. P.

Distempering.—J. W. (*Lewisham*).—The difficulty you met with when using green-tinted distemper was due to the action of lime upon the green pigment which you used for staining the whiting. The green called "Brunswick" is a mineral preparation, and, therefore, of a nature easily affected by lime. I do not think the lime can be in the old plaster, but it may be owing to the walls having been coated with "calcarium," or some such preparation of lime. Purchase Vol. I. of WORK, and thoroughly master all the elementary papers on "House Painting," after which you will not again try "chrome and Prussian blue." The papers alone will probably be worth to you not the 5s., but £5. Buy and judge for yourself; they were specially written for such as you. In making green distempers in future, use only lime greens, or colours specially made for distemper by such firms as Mander Brothers, Wilkinson, Heywood & Clark, or Leach, Neal & Co., Derby.—DECORATOR.

Round Edge on Wood.—AMATEUR (*Glasgow*).—For rounding edges of wood you do not need any special kind of plane, though you may use moulding planes, as you must if you want other mouldings on the edges. No, you cannot get different mouldings with the same plane. For prices, inquire at any tool-shop in Glasgow or elsewhere.—D. D.

Phonograph.—DUMPER.—I can make nothing of your letter. State your wants a little more definitely, and I will try to help you.—W. D.

Phonograph Queries.—A. A. (*Duffield*).—(1) The keys mentioned on page 202 are not used for fastening the threads, but for keeping the cards in position while the book is being sewn. (2) There is no ready method of finding the centre of a section, and practice will overcome the difficulty experienced. (3) This question I cannot fully understand. I cannot make out your diagram, but you are right when you say the thread is not sewn through the band. (4) In cutting books in the flat, it is usual to pad them up with strips of waste paper. Do it in this manner: knock your book up straight and place it in the machine with the back towards your left hand; take a number of strips of paper longer than the breadth of your book and broader than the platen of your machine, lay them across the edge of your book that is about to be cut, taking care to keep them back from the back of the book, and bring down the platen and press it tightly, and cut in the usual manner. The object is to pad the rest of the book to the same thickness of the back. If you do this, you will find your book quite straight when cut. (5) Yes, if you are using head-band, but the leather is turned in upon itself, not upon the lining of the back. (6) No; reason given above. (7) They have double-ply lining, for the back of the book is lined, so is the back of the case. (8) In the rotary millboard machine the boards are cut by a series of knives which work against each other in pairs, one above the board and the other below. The edges of the knives are on the same principle as a pair of scissors: the board is taken through with rollers, and the knives revolving cut the board into any size. The knives can be set as desired. It is an extremely useful machine in a large shop. (9) Yes. (10) Plain enough in the article; please read it again. I cannot repeat the operation here. (11) Apply to Messrs. John Greig and Sons, Edinboro', or Kampe & Co., London. I do not wonder at Messrs. Royle charging you for their list.—G. C.

Battlesden Cart.—W. S. (*Preston*).—I cannot ive you the addresses. I do not know any firms in Manchester or Liverpool who supply such fittings or carts. The principal portions of the ironwork may be procured ready made, but my experience is that it is very difficult for an amateur to get the minor parts, and unless one is able to make them himself, as I do, the expense does away to a great extent with the advantages of home-building. There are surely some ironmongers in your own town who could supply you, or if not, would he able to give you the information you require. The springs and iron for a cart like this cost me £4 10s., and the wheels £3, while the other materials should be obtained for about £3 or £4.—OPIFEX.

Slide Valve.—F. C. (*Cardiff*).—I append a rough sketch of model. Make a box or frame of convenient size in which fit a block of wood (see sketch marked A); make it to slide backward and forward. Next screw your frame to a piece of wood, say, 1 in. thick, and as broad as the box or frame is, and about four times the length. On top of frame paint the section of a steam cylinder. Also on the moving block paint a piston and rod as in sketch. Now construct a crank shaft of light tube, and place it on two bearings running at right angles to the centre line of cylinder, and distant from the centre of cylinder exactly the length of the connecting rod and the length of the piston rod.

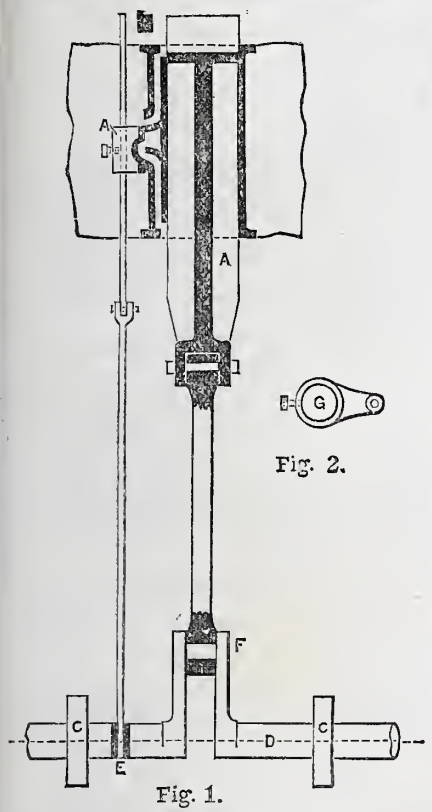


Fig. 2.

Fig. 1.

Slide Valve.

Now get a second block to slide parallel with the piston and along the steam port fence; on it paint our slide valve. Have to this a couple of rods attached as in sketch. The eccentric need not be in the usual form, but in the form of a crank (Fig. 2), so as we can give or take off less stroke of valve as we give or take off lap of valve. Having completed our model we can see the effect of lead, cusion, etc. A few months in an erecting shop of any good engine works will be worth a great deal more than experimenting with any such model. I have given it, however, so as any who have not that chance can master the mysteries of the slide valve if they will only persevere.—T. R. B.

Book on Colour.—W. F. (*Lyndhurst*).—You should get "Colour," by Professor Church, published by Cassell & Company, price 3s. 6d., or by post 3s. 9d.

Books.—W. S. (*Bow*).—The titles and prices of the books you inquire for are "The Practical Rabbit Keeper," by Cuniculus, Cassell & Co., 3s. 6d.; and "The Practical Pigeon Keeper," by Lewis Wright, Cassell & Co., 3s. 6d. Any bookseller will obtain them for you. If not, write to the publishers, Cassell & Co., London.

"Seal" Engine and Electricity.—BOSWORTH.—The address of the maker of the "Seal" Gas Engine, as noticed in WORK (see No. 87), is 67, Carthew Road, Hammersmith. A good book (not too expensive) to get a fair insight and grounding in electricity is "Practical Electricity," by Professor Ayrton, 7s. 6d., Cassell & Co.

Hand Cart.—W. N. (*Wood Green*).—As there is such a variety of shapes and sizes of hand carts, I send you a sketch of a plain one (Fig. 3), which I think will suit your purpose. The hind-board (Fig. 4) is not a fixture, but slides in and out of a groove made of wood or angle iron, bolted to the inside of the cart. The framework (Fig. 1) of the body is of ash, 1¾ in. thick by 3 in. wide. The chests, or shafts, 6 ft. 8 in. long; the chockrells or cross-pieces, 3 ft. 5 in. long. If common arms are used, a bed 4 in. square is fixed either under springs of 5 laps 2 in. wide, each ¼ in. thick, or the bed can be fixed on blocks, as Fig. 2. These blocks are 3 in. thick, 12 in. long at the top and 8 in. at the bottom. The wheels are 3 ft. 8 in. high. The nave turned cart or coach fashion 7 in. × 8 in; twelve spokes 2 in. wide, 1½ in. thick; felloes, 2½ in. × 2 in.; tyre, ⅜ in. thick. Either two or four ash standards,

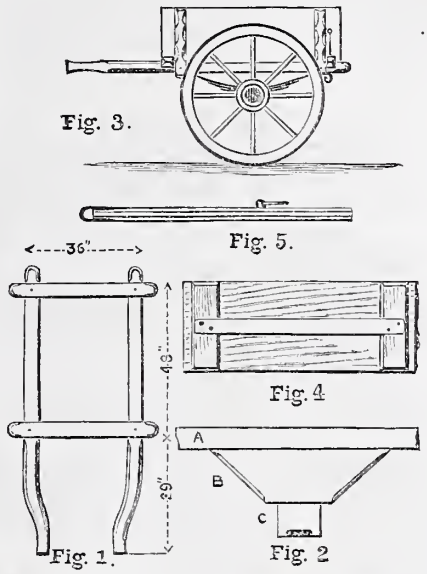


Fig. 3.

Fig. 5.

Fig. 4

Fig. 1.

Fig. 2

Hand Cart—A, Chest or Shaft; B, Block; C, Bed.

1¼ in. long, 1¾ in. × 1¼ in., should be placed each side of the cart, the bottom part of the standard being bolted to the chest. The sides are of deal, 12 in. deep, 1 in. thick. The hind-board has two pieces fastened across the board. On these pieces is fastened an ash rail. A couple of legs, made of ash (Fig. 5), are made of 1½ in. square stuff, planed octagonal. When finished, they are fastened in the centre of the cross-pieces underneath the body, and when not in actual use are suspended from an hasp in the bed or else slung over the axle. The link and staple shown on the leg is to be hung on the hasp. In fixing the wheels, have the axle in the centre of the body. The hand cart is now ready for painting. If the above sketch does not quite suit your requirements, just send me a rough sketch of what you want, and I will soon set you right. You can buy your timber of any English timber merchant, and the ironwork of any coach ironmonger.

Varnish.—R. B. (*Bradford*).—Re "varnishing over greasy paint," don't! If it is greasiness that prevents the varnish from drying, then you must clean it all off with turpentine, a brush and rag free from "fluff." A nice job that is. Varnish may sometimes be long in drying owing to damp air "catching it," and very occasionally the varnish itself is at fault. Old woodwork that has been previously varnished should not only be well cleaned with "dry-soap" solution, but should also, when dry, be given a weak coat of glue or patent size. This effectually kills any trace of grease.—F. P.

Polishing Bamboo Canes.—H. W. (*Peckham*).—Bamboos can hardly be said to require polishing, though they may be improved in appearance by brightening up with a little French polish or a thin varnish. Go over them lightly with ordinary French polish on a rubber of the ordinary kind. Bodying in, oiling, and spiriting are not necessary, though it is often of advantage to wash the canes to remove dirt. I am not acquainted with "paper mosaic work"—at least, under that name—so cannot tell you "what kind of beeswax is used to heighten the colours." Get two or three samples of wax, say ordinary yellow and pure white, and try for yourself. If, as I am inclined to surmise from your next question about a stamp-covered table, paper mosaic work is merely bits of paper—stamps or other—stuck on to a piece of wood, I do not think you will find any kind of wax suitable. Why not use a varnish at once, as you suggest for the stamps? There is no special kind of size used for "stamp-covered tables," as they are so seldom seen, that nothing specially adapted to them has, so far as I am aware, been prepared. Any good hard varnish ought to be suitable, the one you name as well as any other.—D. D.

Boot Making.—SNOBBY.—Had you mentioned the part of lasting in which you felt most deficient, I could have set you right better than I can perhaps by having to embrace the whole principles of lasting in the columns of "Shop," as I may deal least with the points you need most. I conclude that it is for machine-sewn work for which you ask the questions. This class differs much from hand-sewn, but its principles, which have to be understood to produce a well-lasted boot, are the same. In the sketch below I have used lasting tacks to give a better illustration, but in practice these would only be used for hand work, and drown as you come to them in sewing in the welt, whereas for machine work, tingles would have to be used, and driven in to clench on the iron bottom of the last, and they must be put in as near to the centre of the insole as the upper will admit, so as not to come in contact with the point of the machine needle. Fig. 1 shows the upper on the last, hoisted at the back about an inch, the toe having been pulled over the toe of the last, and the first tack (A) put in the centre (first being very careful to get the back seam and the centre of the vamp quite straight); then each side of A should be pulled with the pincers, working reasonable and equal stuff towards the centre of the toe (as all the pipes or wrinkles have to be got out at this point), and two tacks (B and B) put in; and if the boot is nice and straight, catch hold of the side of the toe at C, and pull as much as possible in the direction from H, and put in a tack (C), and the same on the other side at C. These two tacks are called the "draft tacks," as they hold the draft in the boot (if lasted tight) until the last tack has been driven in. It is also to get this draft that the upper is raised at the back, for when all the fore part, as far as E E, Fig. 2, and the heel of the last, has to be knocked down, it necessarily forms a line of tightness from H to C, Fig. 1. This line is called the draft of the boot. When the heel has been knocked down, the waist and heel can be lasted, only it need not be pulled so hard, more especially the waist. The greatest principles of lasting are: the draft lasting tight, lasting out all the wrinkles out of toe, and pulling equal at all parts, and at one side equal to the other. It is the evenness of the

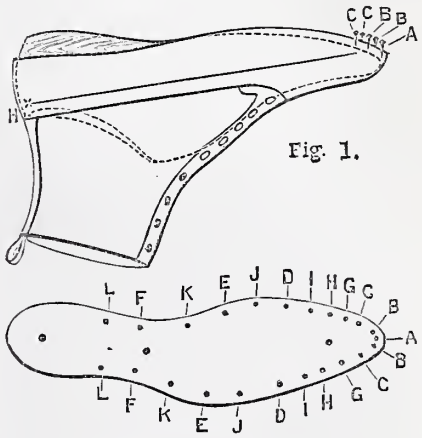


Fig. 1.

Fig. 2.

Lasting in Boot Making.

lasting that makes the boot set clear when the last is out. Fig. 2 gives the bottom of the last, and the dots thereon indicate about the position of the tacks, which are numbered alphabetically, to show that the one marked should be put in first—the two B's, then the two C's, and so on till finished. Of course, more tacks are needed than I have shown at the toe, but only to last out the wrinkles, so these are put in according to the number the stuff forms itself into.—W. G.

Staining Oak.—SIDEBOARD.—To properly stain oak in imitation of old oak, you may either darken it with a liquid stain or by fumigating it with ammonia. One of the best stains is made by mixing vandyke brown with liquid ammonia to the consistency of a thick syrup or thin paste, and then diluting as may be required with water. This is then rubbed into the oak, which when dry may be either French polished or varnished. The fumigation is managed by simply leaving the article you want darkened in an air-tight (or as nearly so as it can be made) box or room with some strong liquid ammonia placed in a shallow dish till such time as the wood is dark enough. If enough ammonia is used, a day or two ought to be sufficient time. The same effect may be obtained by putting the oak in a stable where the ammoniacal vapours will darken it, but not so quickly as the former plan. Fumigated oak is generally finished by wax polishing, but there is no reason beyond custom why it may not be French polished or varnished. In order that you may see which method of staining and finishing suits your taste best, try the effect on waste pieces of oak. You will then be able to tell exactly the depth of colour, etc., which you think will look best on your work.—D. D.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Blackboards.—A. J. L. (*Paddington*) writes:—"Will any kind reader of WORK inform me as to the best material to use to blacken blackboards?"

Model Sailor.—SLIEV DONARD writes:—"I wish to make a model sailor with swords to be moved with the wind. Will someone please give me information as to how to proceed—proportion of parts, etc.? Sailor to be about 18 in. from head to foot."

Lathes.—A. T. B. writes:—"I can recommend the Britannia Company's lathes as being, in my opinion, the best value of any."

Card Surface.—D. P. (*Sheffield*) writes:—"Can any reader of WORK tell me how to make the composition with which cardboard or paper is covered so as to give it a surface which can be written on with common slate pencil, and also how to apply it?"

Stick and Umbrella Mountings.—NEW READER writes:—Will any kind reader of WORK be good enough to let me know where I can purchase umbrellas and walking-stick mountings?"

H.P. Formula.—PUZZLED writes:—"In a description of an electric light installation, the engine is described as a 'Westinghume of simple type, having two single-acting cylinders 10 in. diameter by 9 in. stroke. A test of the brake H.P. developed at 80 lbs. steam pressure gave 50·11 H.P., the engine running 350 revolutions per minute.' As I understand the formula for calculating indicated H.P. to be $\frac{2\ A.S.P.R.}{33000}$ which in this case is equal to 200 H.P., how is the disparity between brake test and indicated H.P. accounted for?"

A.=area of piston=78·54 in.
S.=stroke, 9 in.
P.=pressure, 80 lbs.
R.=revolution, 350.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Hanging Paper.—MIEUX QUE ÇA writes, in reply to JACK OF ALL TRADES, (see page 602):—"There are two ways of doing this job. I shall give you one way, when you have sent for a pattern-book to any of the following firms:—Charles Knowles & Co., 164, King's Road, Chelsea; Tine & Son, High Street, Reading; none better than the former. They bear expense of book to and fro. Having chosen and received your stuff, rig yourself up a pasteboard or table, get a long strip of zinc equal length of pasteboard, tack one end of it to under end edge of *p*, and flush with the edge of board next you. Draw it, and stretch over top of board to other end, and tack it under as same. Now get a straight-edge of very hard wood, or, if possible, with steel edge to it: a shoemaker's knife and huff are indispensable articles in this part of the business as well as your own. Roll out a roll at right-hand end of table, face up. Sometimes this, as well as other stuffs, are rolled face or pattern side out. If yours come so, place a sheet beneath it, drag one end of it over top of table, and tie a piece of rag round your *lapstone*, and place that on the end to keep it from curling back on you. The edge of your stuff is supposed to be lying along middle of zinc; place your straight-edge on the edge to come off and carve away. But mind, do not cut straight down, but in, as it were, so that the edge of the knife inclines from you. This causes the edges when pressed against each other, or, as we term it, a close butt. When all your walls are rubbed down and sized, measure off each length (look out for drop pottery, if any) on wall, and run a brush full of flat same colour as ground of paper, for fear of shrinkage, which if not attended to, and it happens to shrink as it dries, looks something dreadful. You know how to make paste, but add some glue to it. As this stuff, as a rule, is heavily embossed, do not use a roller, but use a patt; rub on plenty of paste, and if heavy let it soak. Another tip: do not forget to keep a small hammer and a few copper tacks handy."

Luminous Paint.—MIEUX QUE ÇA writes to INQUISITOR (see page 602):—"At any oil and colour store. I cannot remember as to price, but it cannot be much, as you can get it in small bottles, not larger than penny gum-bottles. They will place another small bottle beside it, most likely telling you a lot of stuff, etc. Leave it, and bring along the night-light. Use a little clean white paint and rub up a pinch of sulphur in it and give one coat; stir up your night-light in bottle, and use it. You will find it work like fine sand and turps. It will not shine at night unless light gets at it in the day-time.

Luminous Paint.—J. C. K. (*London, N.W.*) writes, in reply to INQUISITOR (see page 602):—"It is sold by W. C. Horne, Dowgate Hill, E.C. (See WORK, Vol. I., No. 42, page 662)."

Gilding.—MIEUX QUE ÇA answers JACK (see page 602):—"There are many ways or kinds of gilding, but I shall give you two of the commonest methods used in my trade. Go to a colour-store and buy a gilder's kit-cushion; knife, tip, and map, cost about 3s. 6d. Get a bit of chalk, grind it up fine with a knife, put it in a piece of close rag, tie it up in the shape of a doll's head, and pounce or beat the article you wish to gild all over, which I suppose to have been painted and is properly dry. Now with a writer's pencil and a little Japan gold-size you mark—not much at a time. Get a book of gold, different prices, open first leaf, and blow it out on your cushion. Repeat this until you have blown as many as you think you require, then take a little oil—any kind—on your finger, and rub it on your hair at the right side of the head and in front of the ear. Now pass your thumb through that leather loop that sticks down beneath the cushion; the other one is for the gold knife to stick in. Breathe through your nose instead of your mouth, and it will not blow about so. Lift up one of the leaves; do not be afraid of it. Now try to spread it gently on the spare part of cushion next you, passing the knife beneath it, and turning it over as if it were a pancake, and did not wish to break it; and when you get it pretty near the mark, give it a little blow from the mouth straight down on top of it, and you will see it will spread out beautiful. Now cut it with your knife in strips the size you require—that is, a little larger than the lines of gold-size, which ought to be getting tacky now. Feel it with the back of your finger, and see if it be almost dry. If so, seize the tip, and give it a flick along your ear, so that the tips of the hairs will rub along the oil you rubbed on. Now lift up a strip of gold with this, place it up against your gold-size, and whistle at it, and you will find it there. Two or three hours after this squeeze it off with your mop. The particulars of the other way later on."

Camera Fittings.—W. E. D., JUN., writes, in answer to J. C. (*Glasgow*) (see No. 89 of WORK):—"You can obtain bellows for camera of J. Thompson, Lintmill, Portgordon, and brass fittings of Watkinson & Lonsdale, New Briggate, Leeds (who advertise in WORK). I can strongly recommend them, as they are both good and cheap, and I have tried several places for camera fittings; another point in their favour being that they will make to your own design or drawing. As for cost, I suppose you are making an ordinary square camera; if so, rack and pinion will be about 5s. I am making one that is only 6½ in. by 8 in., instead of 8 in. by 8 in., and yet allows of the camera being reversed instantly, my rack and pinion of course not costing quite so much as yours would."

Netting Machine.—W. K. (*Castletown*) writes, in reply to A. G. (*Dublin*) (see No. 89, page 599):—"If A. G. will write to R. Knox, engineer, Douglas, Isle of Man, he will obtain all particulars."

Rabbit Skins.—C. W. B. (*London, W.C.*) writes, in reply to IDEM SONANTIA (see page 634):—"Lay the skin fur downwards on a board and tack it, stretching it as tightly as possible. Then scrape off all the fatty matter with a blunt knife. Dress it daily with the following solution till the skin appears dry:—Four ounces of bay salt, two ounces of alum, four ounces of corrosive sublimate, and two quarts of boiling water. Let the mixture stand till cold."

Cardboard Models.—A READER writes, in reply to J. F. (see No. 91, page 634):—"He can get cardboard models, with instructions, for a penny each, from Mr. Folliance, toy dealer, Cable Street, St. George's, London, E.; he must send a stamp for postage. I think if he is a beginner at model making, these are good practice, as they are so cheap, and when he learns a little about making them, he should send to Steven's Model Dock Yard, Aldgate, E.C., and then he will get a model ready mounted on cardboard for a shilling, carriage paid, to any part of England, which, if made up well, is worth putting under a glass case; when sending, he must state what sort he would like, as they keep a good many patterns. If he has penny ones, I should advise him to have the Poulterer's Shop or the Village School. If J. F. cannot get them, and he writes again, I will get them for him."

Fretwork Stencils.—T. S. (*Willington-on-Tyne*) writes:—"I saw in 'Shop' that S. H. H. (see page 520, Vol. II.) has been inquiring about fretwork stencils. I have never heard of any for sale. I think most people cut them themselves; but there are not many who go to so much trouble. This is how I treat my fretwork patterns when I buy any: I first gum them on good stout foolscap paper, and then cut them out with my penknife. But it requires a lot of patience, and when I want to cut one from the pattern I get some white tissue paper and lay on the pattern; get two books, lay one on one-half of the pattern, and then rub the other part over gently with shoemakers' heel-ball. When this is done I place the other book on the part that has been done. Raise the other book quietly up, and serve the other half the same way; this makes a true copy of the pattern, and it will last for years. Some of my patterns I have had for over twenty-two years, and I have cut dozens of things from some of the patterns. I have two large books full of fret patterns that I have cut out, and they make a nice scrap-book, but they have cost me no end of labour and patience."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. H. (*Sheffield*); J. M. P. & Co. (*Nottingham*); J. W. (*Homerton*); W. H. G. (*Hornsey*); W. E. (*Liverpool*); S. P. (*Oldham*); A. K. B. (*Hull*); J. B. C. (*Coatbridge*): J. L. (*Nelson*); A. G. (*Sunderland*); W. C. W. (*Chiswick*); CRUDE ELECTRIC; MAGTELO; N. W. (*Leicester*); PLUMBER (*Hackney*); CANE; C. N. & Co. (*London, S.E.*); C. W. S. (*near Liverpool*); W. W. W. (*Nottingham*); G. K. (*London, N.W.*); L. S. L. (*Kirkcaldy, N. B.*); J. H. H. (*Manchester*); C. P. (*Wanstead*); C. R. K. (*Paris*); RULER; O. B. M. (*New York City, U.S.A.*); J. L. (*Exmouth*); T. E. (*Rothesham*); KILOMÉTRIQUES; AMBIGITUR; W. M. (*Plaistow*); LOCO; A. H. C. (*London, W.*); T. J. (*Plaistow*); H. W. R. (*New Cross*); M. E. E. (*London, W.*); TOM; JACK; S. O. R. (*Notting Hill, W.*); J. L. (*Hornsey*); M. O. (*Battersea, S.W.*); W. C. (*Kensington*); F. O. J. (*Bayswater, W.*); F. B. C. (*Liverpool*); J. (*Witherusea*); RICHARD; MOP.

A Special Exhibition Number of "WORK"

(*Separate from the Weekly or Monthly Issue*)

Has been published, and is now on sale, price **3d.** (post free, **4d.**). This Number consists of 32 pages in a wrapper, and contains an **Illustrated Descriptive Account** of the most remarkable Exhibits.

Amongst the contents of the Special Exhibition Number are:—

Working Model of Steam Fire Engine.
The Story of the "Work" Exhibition.
Protected Exhibits under Certificate of Board of Trade.
The Value of Art Training to the Professional Workman. By C. R. ASHBEE.
Sir John Lubbock, Bart., M.P.: His Services to Science and Labour.
Fifty Years of Recreation Work. By the Rev. C. C. ELLISON.
Our Exhibits and Exhibitors.
Work and the "Work" Exhibition. By the SECRETARY.
My Ideas about Hobbies. By OPIFEX.
Special Gift Books to Exhibitors.
The Story of the Prize Certificate and Medal Competition.
Certificate Granted to Prize Winners.
"Work": Its Utility and Importance to all Workmen, Professional and Amateur—
I. From the Professional's Point of View.
II. From the Amateur's Point of View.
Statistics of the "Work" Exhibition.
"In Memoriam."
The Polytechnic Institute: Its Work and Its Workers.
The Jurors: How Appointed.
The Jurors' Awards, "Work" Exhibition, 1890-91.

The **Special Exhibition Number of "WORK"** may be considered as the Official organ of the Exhibition. It also forms a striking Illustrated Record of the First Exhibition ever held where the work of Masters or Journeymen, Apprentices and Amateurs, are judged, not by the actual result, but with allowances for concomitant circumstances, and therefore from different standpoints.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [6 R

Fretwood. — The cheapest in England. Bilson's Cabinet Works, 21, Horsemarket, Northampton. [7 R

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [5 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

Six Cabinet Copies, from Carte or Cabinet Photo, for 3s. 6d. Originals returned uninjured.—ETHELBERT HENRY, Alvaston, Derby. [3 R

New Rodgers' Treadle Fretsaw, complete, for sale, or exchange anything useful.—J. S., 60, H. B. side, Galashiels, N.B. [1 S

Lettering and Sign-Writing made Easy.—Illustrated instructions, and diagrams for marking out eight alphabets, 1s.—F. COULTHARD, Terrace Road, Bournemouth.

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [2 S

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [3 S

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

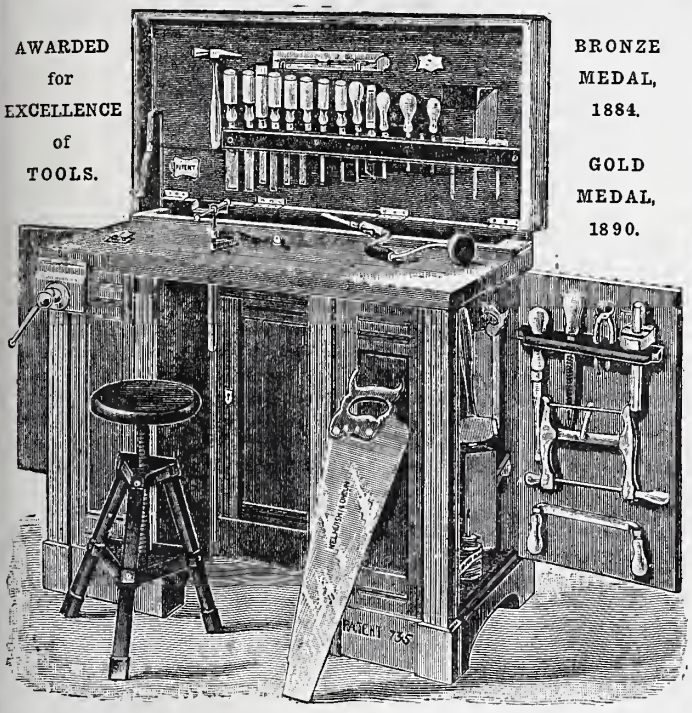
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RD. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

JUST COMMENCED, a NEW WEEKLY ISSUE of

CASSELL'S NATIONAL LIBRARY.

With Additional Volumes not hitherto published in this Series.

Price *3d.*; or cloth, *6d.*

Now ready—	**The Haunted Man**	.. DICKENS.
Now ready—	**Utopia**	.. SIR T. MORE.
Ready Jan. 21—	**Lays of Ancient Rome** ..	.. MACAULAY.
Ready Jan. 28—	**Essays on Burns and Scott**	.. CARLYLE.

*** *Intending Subscribers are requested to order the Volumes* **by Name** (*not by Number*), *and to ask for the New Issue.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

IRISH DISTRESSED LADIES' FUND.

PATRON—Her Majesty the QUEEN.

EXECUTIVE COMMITTEE.

PRESIDENT — H R.H. the Princess LOUISE, Marchioness of LORNE.

VICE-PRESIDENT—Her Grace the Dowager Duchess of MARLBOROUGH.

CHAIRMAN—The Marquis of WATERFORD, K.P.

The Marchioness of Waterford.	Mrs. Edgar W. Brodie.
The Lady Mary Howard.	Mrs. Hastings R. Lees.
The Countess Waldegrave.	Mrs. Charles Pontifex.
The Countess of B ctive.	Miss Emily Leshe.
The Lady Emma Talbot.	Miss Craigie.
The Lady Agnes Daniell,	Miss Phillips.
The Dowager Lady Westbury.	Gen. Sir Henry de Bathe, Bart.
The Hon. Mrs. Swinton.	Lieut.-Col. Davidson.
Lady M Clintock.	Lieut.-Col. Hatton.
Mrs. Goschen.	E. Parker Young, Esq.
Mrs. Hatton.	Augustus Hill, Esq.
Mrs. Lecky.	Robert Martin, Esq.
Mrs. Montgomerie.	

HON. TREASURER—H. H. Pleydell-Bouverie, Esq.

BANKERS.

Messrs. Barclay, Ransom, and Co., 1, Pall Mall East, S.W.

MANAGERESS—WORK DEPÔT.

Miss Leahy, 17, North Audley Street, W.

SECRETARY.

Major-General W. M. Lees, 17, North Audley Street, W.

The COMMITTEE APPEAL for FUNDS to enable them to assist while the need lasts, a large number of ladies in Ireland who have, through the non-payment of their rents and other causes beyond their control, been rendered absolutely destitute.

Money is most urgently needed to carry on the work of relief, and the Committee trust that the patiently-borne sufferings of these ladies will cause a generous response to be made to this appeal.

Their Work, Fancy and Plain, is on Sale at the Depôt, 17, North Audley Street, where orders are solicited for trousseaux, layettes, and work of every description.

Relief is administered without reference to creed or politics.

A register is kept of governesses, companions, nurses, etc.

The Committee will be grateful for gifts of clothing, boots, and blankets.

The Charity does not employ collectors.

Contributions will be gratefully received by the Right Hon. the Lord Mayor, at the Mansion House; by the Bank of England, either in London or at the country branches; by Messrs. Barclay, Ransom, and Co., 1, Pall Mall East, S.W., or 54, Lombard Street, E.C.; by the National Provincial Bank of England, Bishopsgate Street, E.C., and all its branches; by Messrs. Coutts and Co., Strand, W.C.; by Messrs. Hoare and Co., Fleet Street, E.C.; by Messrs. Henry S. King and Co., 45, Pall Mall, S.W., and 65, Cornhill, E.C.; by the London and County Banking Company, South Kensington Branch; or by the Secretary, payable to "The Irish Distressed Ladies' Fund."

W. M. LEES, Major-General, Secretary.

Offices and Work Depôt, 17, North Audley Street, W.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.

The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet	4s. free.
12 Finely Lithographed full-sized Patterns ...	1s. ,,
Sets of 12 Carving Tools	10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

WATKINSON & LONSDALE.

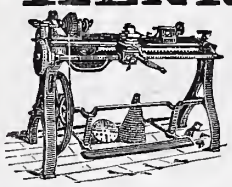
WRITE FOR PRICE LISTS

MANUFACTURERS OF

Photographic Apparatus,

NEW BRIGGATE, LEEDS.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

EVENING LECTURES

ON BUILDING, CONSTRUCTION, AND ARCHITECTURE,

Will be delivered by Professor BANISTER FLETCHER, F.R.I.B.A., at King's College, on Mondays, from 7.15 to 8.15 p.m. Fee, £1 1s. each term.

DRAWING CLASSES and CLASSES OF DESIGN will be held on the same evening, from 8.15 to 9.15 p.m. by PROFESSOR FLETCHER, assisted by a Demonstrator. Fee, 10s. 6d. each term.

Each term will last about Twelve Weeks.

The above are under the management of the Carpenters' Company and the Council of King's College. There will be an Examination at the end of each term, and Prizes will be awarded at the end of the academical year.

The next term commences January 19th, 1891.

All further particulars may be obtained from

J. W. CUNNINGHAM,
Secretary of King's College, London; or
S. W. PRESTON,
Clerk of the Carpenters' Company, London Wall.

Monthly, ***4d.***

CASSELL'S TIME TABLES.

A. T. TALLACK

Engineer & Patent Agent

28 HATTON GARDEN, E.C.

English, Colonial, and Foreign Patents at Reasonable Charges.

SPÉCIALITÉ.

The Patenting, Working out of Inventions, and making Practical Models, Special Tools, Drawings, Engravings, &c.

If you have a novel idea which has merit, provisionally protect it at small cost, and you can make money out of it.

PARTICULARS FREE.

Post Free on Application.

CASSELL'S

Classified Catalogue.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

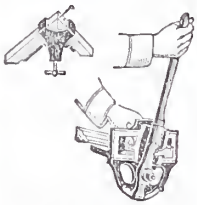
2s. 9d., of all Chemists and Stores, or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6d OR FOR 7 STAMPS
BIRMINGHAM.

London Warehouse: 124, NEWGATE STREET.

[33



PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine,** any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,
TOOL MAKERS, DUBLIN.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership,* are offering their *Enormous Stock,* including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill,** with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 6d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design **SENT GRATIS** with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 97.] SATURDAY, JANUARY 24, 1891. [PRICE ONE PENNY.

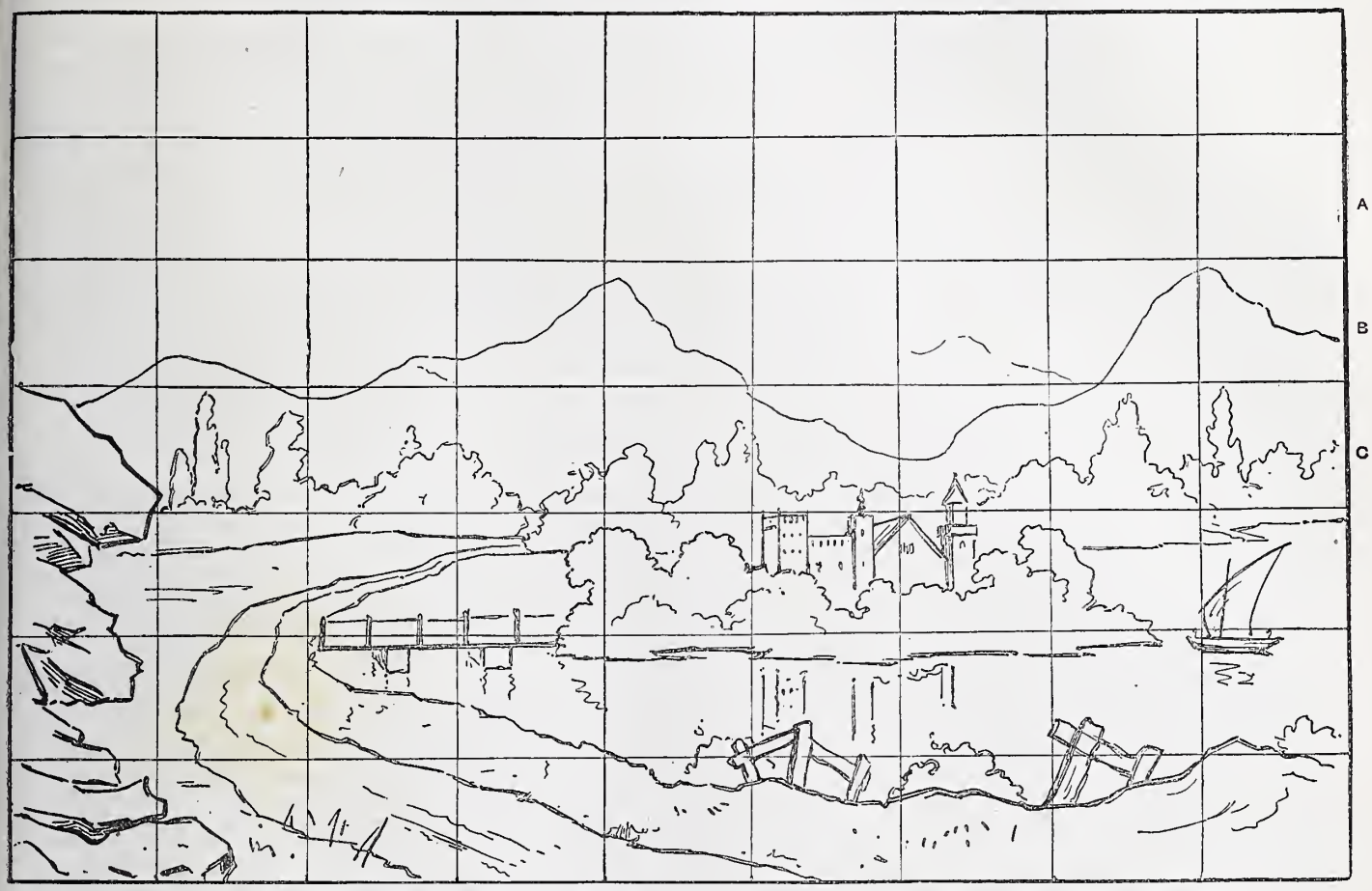


Fig. 1.—Diagram exhibiting Cloth divided into Squares with Charcoal Lines and Outline of Subject sketched on Cloth.

THE ART AND PRACTICE OF SCENE PAINTING.

BY WILLIAM CORBOULD.

SUBJECT FOR FIRST ATTEMPT—TRACING SUBJECT ON CLOTH—PAINTING THE SKY—CLOUDS.

Subject for First Attempt. — On selecting a subject as a preliminary essay, let us choose one as simple as possible, for the greater the simplicity and breadth the more charming will the picture appear when finished. To this I may add that too much complexity is always to be avoided if the stage is small; the subject should be painted as broadly as possible, for too much detail and overcrowding would ruin the best subject.

Let us take, for our first attempt, a rural landscape, as shown in outline in Fig. 1, disregarding the horizontal and vertical lines, which appear in the diagram, and on which I will touch presently. Assuming that the would-be scenic artist has a little knowledge of perspective, he has to carry it out in colouring—that is, by keeping the distance low in tone, and gradually strengthening the tone of all the colouring as he advances to the foreground of his subject. All distant and middle tints must be worked up with greys, such as the sky colours, blues, and greys that have been used in the sky, judiciously working them with the colours that are being used in your distance. I do not mean that the colours are to be mixed one with the other before putting them on, because that would make them like so much mud, but by lightly touching and laying on the colours one against the other, without mixing them. By proceeding thus the artist does not lose his tint, but the greys, such as the sky colour, when used in juxtaposition with the other colours, will give the scene that aërial perspective without which it would be hard and unnatural. It must be remembered that the further the distance is the more grey it must become. The use of a little lake with the greys in the far distance will help the perspective wonderfully, which in some cases, when seen from the front, should appear miles away over the country.

Our subject, as outlined in Fig. 1, has in it all that is required to make it attractive and picturesque, containing, as it does, distant mountains, foliage, water, rocks, the winding road, etc. I have chosen it as a good lesson for painting in perspective, which I shall explain further on. I think that now we may commence our work, taking it in a systematical manner, and dividing it into four parts or stages, of which the first will be the drawing in with charcoal, and covering all the charcoal lines with vandyke brown; the second, painting the sky, clouds, etc.; the third, laying in all the local and flat colours; and the fourth and last, the finishing of the whole.

Tracing Subject on Cloth.—Should the artist have a drawing or engraving from which he is taking his subject, it will be as well to divide it into squares by horizontal and perpendicular lines. Supposing the

scene is about 15 feet long and 12 feet high: divide the drawing by dots all round the margin at equal distances from each other, and draw fine lines across from dot to dot, as in Fig. 1.

He must now divide the cloth on which he is going to paint into squares in the same way. The same number of dots or points he has on his drawing he must have on the cloth, dividing the spaces equally, as on the drawing. He may now, if he likes, take one of his cords or lines, and rub it with charcoal, and obtaining the assistance of another person to hold one end of the line, while he himself holds the other end, stretch the line tightly from dot to dot. This done, lift the line from the cloth, and let it go smartly back, and by repeating this for every opposite pair of dots, faint lines will be made on the cloth corresponding to those on the drawing, as shown in Fig. 1. If the artist has a rod or straight-edge of sufficient length at hand, he may dispense with the cord for making the horizontal and vertical lines.

It will now be seen how easy it is to enlarge a small drawing to any size by this method. Whatever part of the small picture the lines fall on, it will be the same in the larger scene, and the different parts of the subject in each square will be the same as in the corresponding square in the original drawing, only on a larger scale. The outlining of the whole scene should now be commenced with all the large details, leaving the smaller ones for the finishing. All this is done with charcoal. When the outlining in charcoal has been done to the artist's satisfaction, let him take a small pot, such as a gallipot, if he has not got any earthen paint-pots, and put into it some vandyke brown mixed with double size—that is to say, size which has only a very little water in it. Well mix this, and with a lining-brush or a small fitch go over all the outlines of the picture with the vandyke brown, with the exception of the lines forming the squares, which have been used to assist in the drawing in of the scene. When the vandyke brown is all dry—and care should be taken that it is so—the artist must take his flogger, and whip off all the charcoal he can. This will leave a clean surface to work on, and the outlines of the subject will remain visible through the future paintings till the finish. After some practice, the scenic artist will be able to dot out a scene of this class without the aid of the square lines.

Painting the Sky.—He now commences painting in the sky; and I may point out here that the mixing of this first colour is the most difficult of all—that is to say, the mixing of any and all other colours. I have known several scene painters who have been very good painters in regard to everything but the sky, in which they failed through using ultramarine "blue." I suppose they had not been under the tuition of an experienced scene painter. Ultramarine turns grey in any artificial light, and if used strong will look positively black. If the artist has not a nice blue, he cannot make a good scene. To get a good blue for the sky, we must make a compound of three colours—celestial or azure blue, emerald green, and whiting, in nearly equal parts, using one's own judgment as to depth of colour. Should there be some priming left, it will do without soaking more whiting. Supposing the artist has three pounds in weight of white, he would require about two pounds of emerald green, which colour must be rubbed up into a thick paste with water, and then put in with the white. Then take about a pound and a half of azure blue, if you use this colour; but if you use celestial blue a pound will be about enough. Mix this also into a paste in water before putting it into the whiting, and well beat all up together before adding the size. This beating up prevents the colours from working streaky. After this colour has been mixed, the artist must try it by taking a piece of white paper, and putting with a brush a dash of the colour on the paper. Dry it, and if it should be too blue when dry, add a little white; but be careful in doing this, as the whiting is powerful in subduing the tone of colours, so put in a little at a time, and try the colour again. If when the colour is tried it should be too light, add a little blue; but if you have to add much blue some emerald green must be put with it. Emerald green will look blue by gas-light, as I have said in my general remarks on colours under artificial light. Again, the colour must be tried on paper and dried, for the artist *must* satisfy himself that he has a nice tint to suit the subject before starting his work. Assuming he has arrived at that conclusion, he may now start at the top part of the sky with the blue, always bearing in mind that the top part of the sky is deeper in tint than nearer the horizon. Supposing that the artist is painting a light evening sky, let him commence at the top right-hand corner. After well filling his stock-brush with blue, let him lay it on, crossing and recrossing the work, so as not to miss any part. Lay off lightly from left to right, and work quickly, so that the work may be kept wet. He must not touch any part of the blue he has finished off, but keep working on the left edge, covering the sky about a third down with the blue. The division of the sky portion of the scene into thirds is shown roughly by the letters A, B, C, placed at the sides of Fig. 1. Now let him put some damp lake and yellow ochre on his palette board: this is when and where the artist begins to use the medium, which should be about half size and half water. It should be ready to hand in a small pail or large pot placed on the corner of the palette board with a spare brush in it, so that when any of the medium is required on the colours the brush may be lifted out, and the medium allowed to drain on the particular colour or colours that are to be used. If the brush that the artist is painting with be dipped into the medium, it is obvious that it would be soon unfit for use, but by keeping a clean brush in it the artist avoids making it dirty. These deviations are necessary in order to save the beginner a deal of trouble, and also to impart what has been learnt by experience.

The artist is now supposed to have some damp lake and yellow ochre on the board, and he must put on these sufficient medium to thin out the colours. Take a clean stock-brush, dip it in white, then dip one side of the brush in damp lake, the other in yellow ochre. Lay this on the cloth from the blue downwards, over the middle third part of the sky, well covering the canvas by crossing and recrossing it with the brush as lightly as possible, mixing the colours as he can. Laying off from left to right, he will find perhaps some streaks of rose colour and others of light and deeper yellow, but this, when dry, will be only natural.

The next colours will be either lemon or orange chrome, according to the depth of tint that it is wished to have at the horizon; if light, use lemon; if deep, use orange. Commence at the horizon line, working upwards, right across the scene. When about half way up towards the other yellow, dip the brush into lake and a little white, still working up until the other tint is met. The sky is now all covered, but there are two distinct lines where the artist left off, and he has now to soften this all in—that is to say, to blend the colours together, forming a soft, flat, harmonious whole, the blue blending into the lakes and yellows of the horizon. This the artist will be able to manage after a little practice and perseverance.

To effect the blending, first wash all colour out of the stock-brush. When clean, dip the brush into clean water, but do not get too much water into it. Let the brush drain after lifting it out of the water, or squeeze it a little with the hand, because if too wet it will make the colours run, and spoil the effect.

The blending should be commenced where the blue and lake colours meet. I may here mention that in using the lake and yellow ochre, the lake should preponderate next the blue, the yellow ochre coming next, both tints of course being used with white, as stated above. By using the brush up and down, crossing and recrossing lightly, taking care not to disturb the colouring too much, the colours will be gradually softened one into the other. If well done, it will have a soft and beautiful effect when dry. The artist must be very quick with his work. After he has done the top blending he must treat the yellows from the horizon upwards the same way. To do this will be found somewhat difficult at first, but it will soon be mastered.

The artist should not attempt to paint in the sky unless he has time to finish it right off, so that the whole may dry together. When working on the other part of the scene, he may leave it as often as he likes; but not so with the sky. I have now said enough about the broad flat colouring of the sky.

Clouds.—The rubbing in and painting of clouds, so varied and beautiful in shape, ever shifting and never alike, assuming every form imaginable, will try the artist's skill. There are technical terms for different forms of clouds, such as *cumulus*—when clouds are heaped up in grand and striking masses—and many others; but these I need not enter on here, nor need the amateur scene painter trouble about them. Few colours are required besides what have been used on the flat surface, but as many gradations of those colours as possible will be needed. It is a good plan to dip one's brush into two or three colours—say, yellow ochre, lake, and white—and then to work it about in a broad manner. Should the artist wish his clouds to be massive and assume round forms, let him work his brush in the form he wishes the clouds to appear, but the colours must not be mixed too much, or they will be muddy. Supposing he wishes the clouds to be warm in tint, he would use more lake; if of a yellow cast, more yellow. If he wishes to have them very light he would use more white. For the high lights and edges of the clouds he must add more white to whatever colour he is using. If he dips his brush into the white last, and then commences at the top part of the clouds, working them into form as he works downwards, he will find when the work is dry that it will not be far wrong. Should the scenic artist not succeed in this most difficult part the first time—and he would be clever indeed if he did—perseverance will eventually overcome all his

troubles. Sometimes sky and clouds may be rubbed in together, leaving a flat piece of blue here and there where it is wished to represent the flat sky. In this case the artist may work with two or more brushes, one being kept for the blue, the other for the white, yellow, lake, etc. He must work quickly, and lay on almost anyhow, and it will all dry up together, and present a result that is at once soft and harmonious. It will be soon seen why I recommend the painting in of the sky before leaving it to dry in one part before you go on with the other, for if the artist did otherwise he could not get the softness required by resorting to after-paintings—that is to say, by leaving the work, and finishing it at another time. When painting a glorious sunset, positive colours may sometimes be used with care; for instance, when the sun is low, streaks of vermilion, damp lake, the yellows, lemon, orange, etc., when swept across the sky with the brush, or stippled in, will have a charming effect. It must always be borne in mind that a good sky assists greatly in making a good picture.

CLOCK CLEANING AND REPAIRING.

BY A PRACTICAL HAND.

CUCKOO CLOCK — MYSTERIOUS CLOCK — SEE-SAW CLOCK—CLOCK WITH NO VISIBLE WORKS—ELECTRIC ALARUM.

I AM now going to attempt to describe the mechanical arrangements of a few clocks that may doubtless have been at one time or another a source of wonderment to some of the readers of WORK. Although a "Practical Hand" at clockwork, I am not a practised writer, and if, in consequence, what I write does not seem perfectly clear, all I can do is to offer to explain myself in "Shop."

Cuckoo Clock.—As the hours and half-hours are struck on a gong of sweet tone, at each stroke the bird calls cuckoo. On giving warning, the bird slightly opens its door as if peeping; then, as the hour is complete, the lever drops, and the cuckoo throws the door open wide, opens its mouth, lifts up its wing and tail, and calls distinctly each time the gong is struck. When the number is complete the bird pops in and closes the door after it. Of course, some will say we know all about that well; but I have met hundreds that never saw a cuckoo clock. Now, how is it done? Very simply; when the lever falls from the hour pin, the striking part is set in motion, and an upright wire lever, with a very light brass wire coil spring around it to turn the bird in when calls are ended. This wire is turned one-fourth around by a small arm, which is held out by the stop lever when it is raised. In Fig. 1, A is an upright lever on which cuckoo, I, is fixed; B, light wire spring; C, small arm lifted by D and E, stop lever and arm; F is wheel acted upon by stop, which is connected to count wheel; G, bellows lifted on one side to produce "Cuc"; K, the arm at the wheel which also lifts hammer to strike the gong; J, connecting rod. At the other side a rather larger pair of bellows is affixed, and lifted same way by a longer arm, L, a little later than the arm K, so that it calls out "Coo," or "Koo." Those bellows simply blow down a small wood organ pipe, and the pipes are fixed in the side of the case of the clock, with a hole for the sound to come out. At the same time, the wire H lifts the bird's tail, and by an arrangement the bird opens its mouth, lifts its wings, and *seems* to call "Cuckoo"; M is the door it opens and closes with wire N. In taking the cuckoo to pieces, unscrew the four screws attached to the works and the case inside front; then, while face downwards, unfasten the wire from the door, and the hands having previously been taken off, the whole comes out at once. I am speaking of a cuckoo clock going with springs, not weights; if it has weights, undo the chain, hooks, etc. Now notice the sketch, and trace it all through; try it by striking it round, and you will see how the levers work, and the door is closed and opened, and the bellows arrangement. All else is like an ordinary round dial eight-day foreign clock. Clean all and examine as already described (see pages 580 and 665), and with a narrow strip of thin card or stout writing paper, clean away any dust or dirt in the lip or mouth of the two organ pipes, so as to have a full note; now put the going part together and try it, then add the striking ditto, and now replace the levers for cuckoo as per sketch (Fig. 1), and screw the plates together—foreigners beat us, in that we pin, but they screw, a better and safer plan—and hang it up on the wall without case to see that all moves right—bellows, levers, etc. After a few hours screw into case, test the

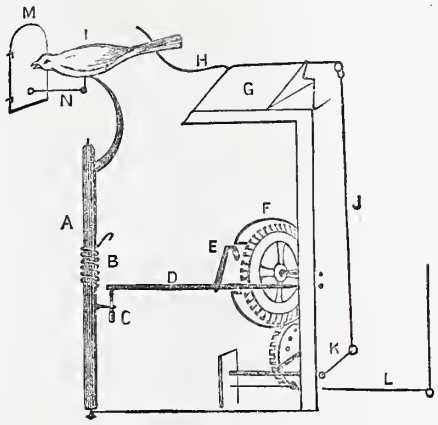


Fig. 1.—Mechanism of Bird in Cuckoo Clock.

cuckoo part, and replace the back with gong attached; turn over and fix the hands, and all is complete. It is not everyone who has served his time at the trade who can manage a cuckoo clock right. Any repairs treat as in other clocks, except such as the bellows. Leather may have holes in eaten by insect, etc.; if so, strip it off and lay it on an old white kid glove, cut to shape, and glue to original leather with thin glue. Any wires broken in cuckoo's body, wings, etc., you can easily imitate and fit. Use very *fine* wire.

Mysterious Clock.—This clock, with a lady holding the pendulum and swinging without any visible aid, used to greatly puzzle people. I think nearly everyone knows now how it is done. The figure stands on a plate very nearly balanced, and the slight impulse of each beat to the under side of the plate keeps the pendulum in motion. This you can easily see by fixing your eye on some article in the window behind the figure's head, and you will then perceive the oscillation. Clean and repair as for eight-day marble clock as described in page 666. There is the trumpeter clock, which works the same as the cuckoo, with pipe, etc. Also the sentry clock, where a small wooden soldier moves backwards and forwards. The figure is simply fixed on a lever, and the turning round is done by a notch which turns it. A man eating a dish of potatoes is manipulated by the figure having a striped waistcoat; one stripe is cut out, and inside the figure is a small wooden pulley, turned round by an endless thin leather band from a similar pulley fixed on a wheel in the movement. On the pulley inside his body is a wire, sufficiently long to revolve and just pass the fork held in the hand of the man. And notice this—the potato, on wire, *lifts* the fork and arm, which are fixed by a pin on the shoulder. The mouth opens just as the potato is leaving the fork

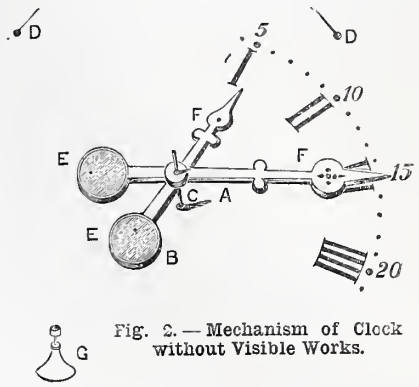


Fig. 2.—Mechanism of Clock without Visible Works.

and the arm, which drop to the dish again, waiting to be similarly lifted. The mouth closing upon the potato is done by a small piece of lead, which is fixed to the back of the chin to draw it up and close it.

See-Saw Clock.—This kind of clock, which never keeps time, is simply a small imitation branch of a tree. Two figures, one at each end, as John Bull and Uncle Sam, etc., are worked by the crutch of the pendulum placed upside down, and a small bullet, fixed on a wire in the centre of the branch out of sight, is moved to either side found out of balance; but the figures acting as pendulum through catching the air, etc., keep bad time. Next is the clock with the ball and string, which, in trying to revolve, has to pin a few turns around a wire at each side. This is useless, being a worse timekeeper than the above. Those with a sweet-looking child swinging backwards and forwards instead of a pendulum ball, and a small boy standing at one side, whose arm lifts to a small cord as if he kept her in motion, are very neat American made clocks.

Clock with no Visible Works.—The mysterious clock or timepiece, with no visible works, and a glass dial showing only the hands, is very clever. I once made one for a

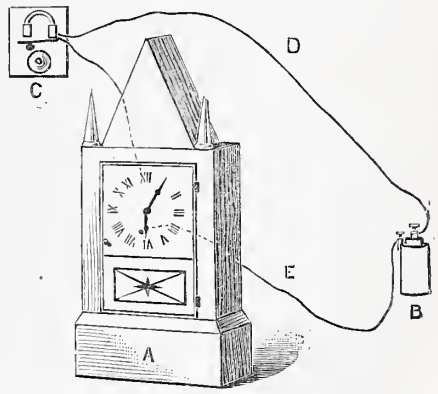


Fig. 3.—Electric Alarum Clock.

shop window as follows:—Take a square of stout glass, 16 in. by 14 in., and drill a hole in the centre using plenty of turpentine, and in a quarter of an hour you will be through. Now take a *stout* darning-needle, best quality, and fix it in the hole at the back with transparent cement, leaving about an inch and a half of the needle with the eye to the front. Paste

on the glass Roman numerals or figures, cut out of gilt or white paper. You can mark the places on whiting under side; put small dots for the minutes. Now make two thin metal hands as in Fig 2, in which A is the minute hand; B, hour hand; C, needle stud on which they turn; D D, cord to suspend dial plate. Now, after making them the right length for your circle of dial, solder a rim on behind each hand at E, E, to hold the movement of a Geneva watch, which you can procure where they melt up cases in large towns at 1s., 1s. 6d., and 2s. each. Pick those that will keep going whichever way you turn. Now fit one into each end at E, with hole to wind up, very small, not to be noticed; engrave about it to hide it. Now on to the barrel which held the hour hand, which you have fixed to B, place a small lead weight, shaped as at G, on to a watch hand, and fix it as if a hand, long enough to just turn easily within the rim of E. Do the same with the other, but place it upon the minute hand, for it has to go round the dial in one hour. Now, at F on the under side, solder a piece of lead just heavy enough to make either hand balance *true* at three o'clock or nine o'clock; then, when perfectly even, wind up, and the minute hand will commence to move. As the small weight is trying to rise, it adds its trifle of weight to the extended end, and consequently causes the other end to move on. And now the only thing is to regulate the movement as when it was a watch, and it will keep good time—mine does. Now do the same to the hour hand. Of course its weight moves slowly, so does the whole hand; regulate it to do in twelve hours in unison; it must be set to time with the other. To commence, simply turn centre square, as when a watch; that turns the small weight, and so balances it at the right time you desire. You then only need wind every day, and surely that small trouble is nothing for the pleasure of astonishing your friends. The movements have very little more to do than when carrying the hands, for at the least rise of the lead weight the large hand moves and eases it again. Mine will actually turn the weights round if I fix the whole hand. Make one: it will only cost you, say, 4s.

Electric Alarum.—Next I made an electric alarum, but I am no hand at battery filling, etc. This I got done by a telegraph manipulator for one shilling—filling, putting to work, etc.—and it acts twelve months without attention, being a Leclanché, one large cell. To an ordinary Gothic bedroom timepiece I fixed a short stud near the numeral VI. (see Fig. 3), to project out only so much that the hour hand *just* touches it and no more, then passes on. This you can easily manage, as the dial is only zinc, and can be put any distance and fixed; but you must have a glass bead to pass through, so as not to touch the zinc. The E wire must fix to the stud inside the clock, and the other wire must rest on the axle of the hour hand, so that at six o'clock, or at what hour you place the stud, when the hour arrives and the hand touches it the bell rings and does not cease until you rise and stop it, so as not to waste power. A is the clock, say 5s., 6s., or 7s. 6d.; B, the Leclanché battery, anywhere out of sight; C is the bell; D and E, the positive and negative wires. The alarum is easy, and its total cost, even with assistance, will not be more than, say, 5s.

With another paper I shall bring my remarks on the subject of clock cleaning and clock repairing to an end. They have been addressed to amateurs chiefly.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

Spindle or Shaft for Gramme Armature—Commutator—Winding Gramme Armature—Brush Holders and Brushes—Winding the Field Magnets.

The Spindle or Shaft for the Gramme Armature.—Before we set about preparing the spindle for the armature, it will be advisable to fit the bearings in their places in the standards. These will be fitted in the lower part of the crosses in the standards; the cross-slit receives an iron plate, fixed in with wedges, to hold the bearings down, and the upper part of the cross forms a space for the lubricator. The stem of this lubricator is screwed to fit a hole in the wedge-plate, and the oil is conducted through a hole in the upper half of the bearings. When these are turned true, and fixed, we will turn our attention to the spindle.

The shaft, or spindle, for the armature should be made of mild steel, of a size and length suitable to the machine in hand. It may be forged or turned to the shape shown at Fig. 46, which shows the form generally suitable to this machine. Referring to the figure, the long spindle end from A to B will go into the left-hand bearing of the machine, shown at Fig. 39 (page 677), and form a spindle for the driving pulley. The two shoulders B and C are for the bearing and the boss of the armature spider respectively: at *d* and *e* two holes must be drilled through the shaft and fitted with clutch-pins, to coincide with the two key-ways left in the spiders, and thus prevent the armature from turning round on the spindle. The space between *e* and the screwed part at S will be occupied by the commutator, and the remainder of the spindle will be taken up by the right-hand bearing. Quite two inches of the spindle at S should have a thread chased upon it, and a hexagonal nut fitted on the thread to bring the commutator and the spiders of the armature in close contact with each other. The spindle being prepared, we may next mount the armature on it, and, having put the spindle into its place, turn it round to see that every part runs true, as now will be the time to make any alteration required. This done, go all over the armature, armed with a half-inch square file, and trim off any roughness which may appear on the cogs and in their spaces, so as to bring the whole into one smooth and solid-looking mass. If the cogs do not properly clear the pole pieces, the projecting parts may be trimmed off in a lathe. The spaces between the cogs should now be coated with varnish and set aside to dry, preparatory to being wound with wire.

The Commutator.—The commutator or collecting cylinder of the Gramme machine, differs from that of the Siemens machine in that it is furnished with several segments, corresponding in number with the coils on the armature. Fig. 47 gives a general idea of its appearance when finished, whilst Figs. 48 and 49 show how it is constructed. The first thing to get is a piece of well-seasoned boxwood, large enough to turn out a solid hub of not less than 2 in. in depth and 3 in. in diameter. This hub must then be bored with a hole in the centre to exactly fit the armature spindle. On this cylinder of boxwood is mounted the bars of the commutator, as shown in Fig. 47. It would be possible to cut out these bars one by one from a sheet of hard brass, and fit each to the outside of the cylinder; but the commutators of small dynamos may be built up by a more convenient and accurate method. Procure a piece of gun-metal tube, with sides quite $\frac{1}{4}$ in. in thickness, and a diameter large enough to go over the boxwood hub, when a slight cut has been taken from the inside to render it smooth. Cut off a piece long enough to cover the hub, and fit this gun-metal ring tightly on to it. Now divide the ring into as many equal size sections as there are cogs on the armature. If there are ten cogs we must have ten sections, if fourteen cogs we must have fourteen sections, but each section must be equal, so as to form a series of equal-sized bars all round the hub. The division lines should be deeply scribed with a sharp steel scriber, then nicked with a hack-saw, as shown at Fig. 48. Next drill a small hole through each end of each section and into the hub beneath; countersink the mouth of each hole, and drive a short brass screw into each, as shown in Fig. 48. This done all round, next cut each section free from its neighbour, and allow the saw to enter the boxwood hub below, to the depth of nearly $\frac{1}{4}$ in., to form a hold for the insulating substance to be placed between each section. The insulating substance may be vulcanised fibre, or asbestos millboard. Procure some sheet fibre, or millboard, a trifle thicker than the saw-cut divisions, and cut from it slips large enough to exactly fill the cuts, as shown by the thick black lines at Fig. 49. Slightly ease the screws of each section, wedge the prepared insulating strips firmly into each saw-cut, then tighten the screws again, and so pinch each strip tightly between the edges of the sections on each side. When this is done, mount the hub in a lathe, and true up all rough projecting parts with a sharp tool, or with a rough file at first, and then with a smoother file.

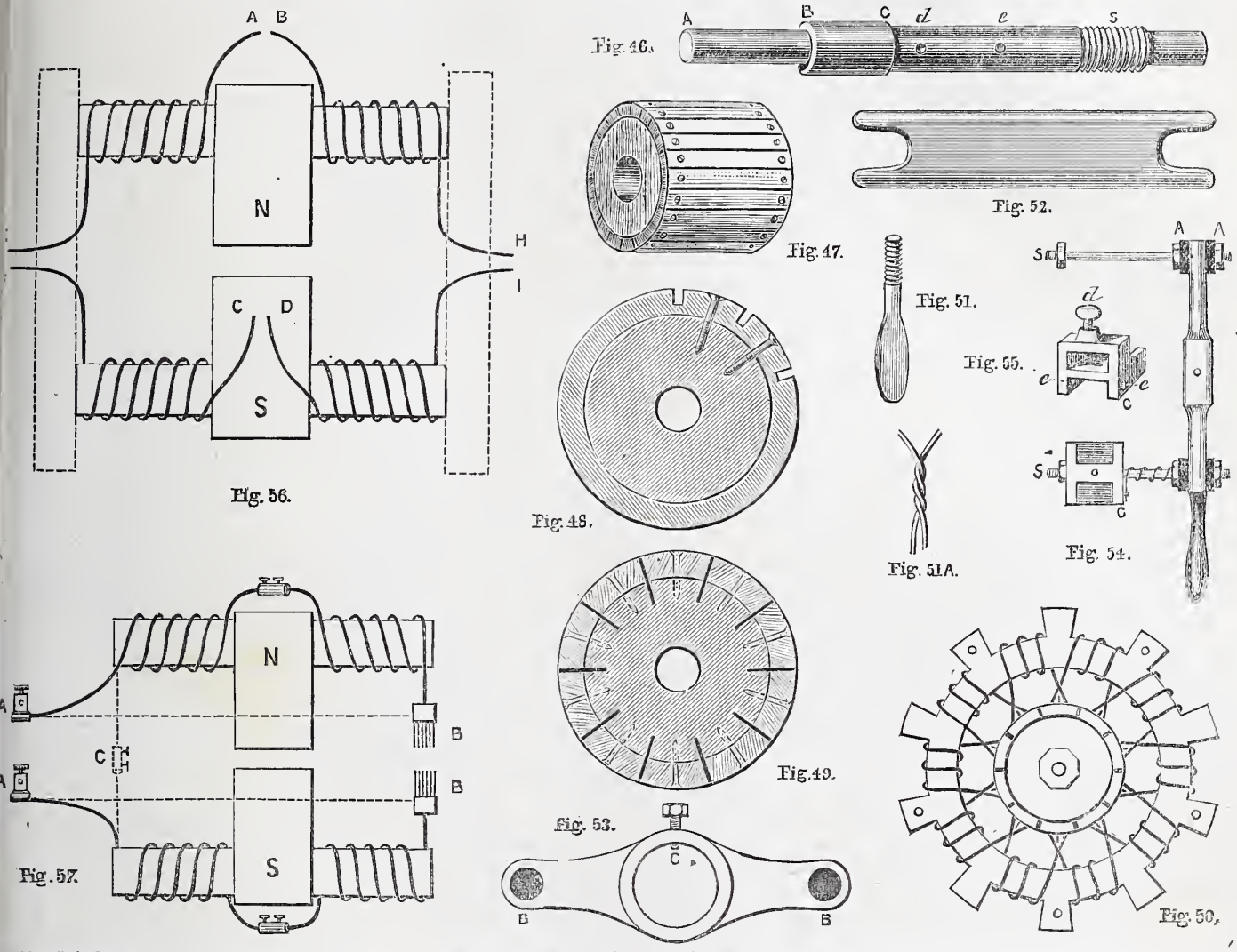
As each segment of the commutator will have to be connected to the ends of two coils of wire, we must now furnish each with a means of making the connection. This is best done in the following manner:—Select one end of the commutator to go next the armature (it matters little which end), then drill a $\frac{1}{16}$ in. hole in the extreme end of each section, and tap each hole to receive a screw. Next take a length of No. 12 B.W.G. hard copper wire, and cut up into two-inch lengths. Flatten one end of each length as shown at Fig. 51, and screw the other ends to go into the tapped holes made to receive them. Tin the screwed ends of each connector with a soldering-bit, and screw them as they are done into their places, giving each a touch with the soldering-bit to make the solder run, and fix the connector firmly in its place.

A disc of vulcanised fibre, slightly larger in diameter than that of the commutator, should now be turned out of a piece of $\frac{1}{4}$ in. sheet fibre, and this must be placed between the end of the commutator and the arms of the armature spider, to ensure the complete insulation of the one from the other when they are tightened up together on the spindle.

Winding the Gramme Armature.—Presuming now that we have the armature ready for winding, we will set about the job of winding on the wire for its coils. Before we do this, however, we must calculate how much wire will be needed for the whole number of coils, and divide this quantity equally among them all, so as to ensure each coil having the same resistance. In a table given with this paper (page 726), I give the proportions required for each size of armature. Looking down this table, we shall see that only three sizes are used: namely,

20, and 22. If we remember that No. 16 ton-covered copper wire runs to 24 yards the lb., No. 20 runs 80 yards in the lb., l No. 22 runs 120 yards in the lb., we can ily calculate the length of wire for each l by multiplying the number of yards per by the number of lbs. to be used, and iding this by the number of coils to be ced on the armature. For instance, sup-sing we have to use 4 lbs. of No. 20 on an nature having 10 divisions :—4 lbs. × 80 rds = 320 yards ; and this, divided by 10 e number of divisions), will give 32 yards each division. Measure off the length for 9 in. × 1 in. × $\frac{1}{8}$ in., with gaps $\frac{3}{4}$ in. deep by $\frac{5}{8}$ in. in width. All edges must be rounded and made quite smooth, to prevent chafing of the wire covering whilst the coil is being wound. This shuttle must now be neatly wound with one of the coils of wire, and then we are ready for winding the armature.

This is a two-handed job, and it is necessary to secure the services of a mate to help us whilst doing it. The armature ring may be held on a low trestle between the winder and his mate. Examine the edges of the spaces between the cogs and each coil closely side by side, until the space between the two cogs has been covered. Then wind back from right to left until the first layer of coils has been closely and regularly covered with another layer. If using a large wire, such as No. 20 or No. 16, the winder will perceive a tendency on the part of each coil to bulge in the centre of the space. This bulging must be kept down from the first by gently tapping the bulging part (whilst tightening the coil) with a small wooden mallet, or by placing a piece of wood on the wire, and striking it with a hammer. The wire must be kept down level and



ig. 46.—Spindle of Gramme Armature. Fig. 47.—Commutator complete. Fig. 48.—Diagram showing how to divide Commutator Ring. Fig. 49.—How to insulate Commutator Bore. Fig. 50.—How to connect Armature Coils to Commutator. Fig. 51.—Copper Connector for Ends of Coils. Fig. 51 A.—Ends of Coils twisted together. Fig. 52.—Winding Shuttle. Fig. 53.—Rocker for Brush Holder. Fig. 54.—Brush Holder and Parts complete. Fig. 55.—Section of Clamp or Brush Holder. Fig. 56.—Diagram showing how to wind Fields of Gramme Dynamo. Fig. 57.—Diagram showing how to connect Fields in Series and in Shunt.

ach coil on a yard measure, marked on the vork-bench, and roll the wire up into small anks, containing one coil in each hank. Place each hank in an old meat-tin, or imilar vessel, containing melted paraffin, kept hot the while, and let it soak therein or several minutes, then hang up to drain lry. Next make a wooden shuttle to the hape shown at Fig. 52 out of some tough ard wood. This shuttle may be from 9 in. in length, and of a width suitable to the ize of the spaces through which it has to pass ; the gaps in the ends must also be cut to a size large enough to take the whole coil of wire, and this will vary with the size of the armature to be wound. The shuttle for the smallest on the annexed list should be inside the ring, to detect any rough places likely to abrade the wire covering. If any of these appear, do not file them down, for in so doing the dried coat of shellac varnish would be injured, but cover them with short pieces of broad tape, well soaked in hot paraffin. Begin winding on the left-hand side of one of the spaces. next an arm of the spider. Wrap a few turns of the outside end of the wire around the arm of the spider, just to hold it in its place, pass the shuttle to the assistant over the armature, and get him to pass it back under the ring ; lay the coil up close to the left-hand cog, and draw it moderately tight; then pass the shuttle over again to the assistant, who will return it under as before. Thus proceed, laying compact in the outside space, but the inside may be disregarded. Whilst winding the coil, test it frequently for insulation by the method given in my last paper, and make good each faulty spot before going on further, for leakage here will destroy the efficiency of the machine. When the first coil has been wound, fasten down the last piece of wire (which should end on the opposite side of the winding space, and be long enough to reach the commutator), and coat the outside of the coil with some quick-drying varnish. Remove the guiding pieces of wood, which have been shown in Fig. 45, page 677, and paint the inside coils with varnish in a similar manner. This will help to set the wire in its proper position, and

also secure more perfect insulation of one coil from the other. Go on thus with each coil until all the spaces have been filled. It will then be well to examine each coil, and see that no part of it bulges above the level of the cogs; if this happens, the bulging part must be beaten down level with a wooden mallet. The whole wire should now receive one or two coats of varnish, the commencing end of each coil being also painted with a distinctive colour to facilitate its recognition when connecting the ends to the commutator bars.

When the varnish is dry and hard, the armature may be mounted on the spindle. The commutator must next be forced on tight in its place, and the two fixed closely together by screwing up tightly the nuts on the chased end of the spindle. It is well here to have two nuts, one to lock the other, and prevent those parts from shaking loose. The coils may now be connected to the commutator bars by soldering the commencing end of one coil and the finish end of its neighbour to its connector, as shown at Fig. 50. It will be found convenient to bare the ends of the wires, and clean them, then twist the end of one coil round the commencement of another, so as to form a clip on each side of the connector, as shown at Fig. 51 A, and tin this with the soldering-bit before soldering to the connector.

When a small armature is tightly wound with fine wire, and this is coated with some two or three coats of varnish, the coils should hold well together. But there is always a danger of disruption, owing to the immense strain from centrifugal force, when coils are whirled round at the rate of from 2,000 to 3,000 revolutions per minute. This has a tendency to throw a wire out here and there, with most disastrous consequences, when the coils are arranged to revolve close to cast iron. It will be well, therefore, to bind the middle of the armature coils with several coils of tarred tape, so as to form a hoop, and to wind tightly over this several strands of No. 24 phosphor-bronze wire, side by side, to form a hoop about ½ in. in width. The ends of the wire must be twisted together and soldered, using resin only as a flux; and it will also be advisable to solder the whole wires together here and there, where they pass over the cogs of the armature.

Brush Holders and Brushes.—The brush holders for this class of machine are not fixed to the bearings or to the pillars, as in the small Siemens machine, but they are made in the form of a "rocker," pivoted on a bridge attached to one of the standards, as shown at Fig. 41 (page 677), and therefore free to be moved round the commutator as desired. The "rocker" is a malleable iron casting, shaped as shown at Fig. 53. The large hole in the centre is turned to fit loosely on the hub of the bridge shown at Fig. 41. A hole is drilled and tapped in the crown of the arch C to receive a set-screw used in fixing the rocker in any required position. Two ½ in. holes are then drilled through the ends, and these holes are then plugged with ebonite, as shown at Fig. 53, B, B. In each of these a ¼ in. hole is drilled, to receive the screwed ends of the spindles (Fig. 54, S, S), on which the brush clamps C, C, are hung. The spindles may be made out of ⅜ in. brass rod, cut long enough to bring the outer ends within ¼ in. of the inner edge of commutator. The inner ends—to go in the ebonite plugs on the rocker—must be turned down, and screwed to take two hexagonal nuts, one each side of the rocker, as shown at A, A, Fig. 54. These must be insulated from the rocker by two washers of ebonite or of vulcanised fibre. On the opposite ends of the spindles must be fitted two other hexagonal nuts, to keep the brush clamps from coming off. These clamps are made of gun-metal, shaped as shown in Fig. 55. The upper part of this clamp is made to receive the strips of hard brass, copper gauze, phosphor bronze, or whatever material may be chosen for the brushes. In this part the strips are held by a brass plate placed on top of them, and secured by the thumb-screw *d*. Holes are bored for the spindle to pass through the lower part, as shown at *e*, *e*. The clamp is thus free to move around the spindle, and this freedom of movement, together with that of the rocker, allows the brushes to be adjusted to any required angle. A small brass staple soldered to the inside of each clamp receives the end of a spiral spring threaded on the spindle, and this ensures due pressure of the brushes on the commutator, whilst it also keeps the clamp in its proper position at the end of the spindle. In adjusting the brushes, it is found advisable to move the rocker by means of an insulated handle, made of ebonite or vulcanite. This is shown in Fig. 54. It may be fixed to the rocker by means of a ¼ in. bolt screwed into the end of the rocker. A similar handle may be fixed at the other end if so desired.

Winding the Field Magnets.—As the wire for the field magnets of a Gramme machine will be wound in four separate coils, it will be advisable to divide the total quantity of wire to be used in these coils into four equal parts, and to treat each part as recommended in the treatment of the wire for the armature. After each coil of wire has been soaked in paraffin-wax, it should be wound on a stout wooden bobbin, as it will be easier run off from a bobbin on to the magnet core than from a hank. The method of winding, so as to secure a north pole piece above the armature and a south pole piece below the armature, is shown at Fig. 56. Mount the core to be wound in a lathe, and put on the back gear slow speed. Suppose we wish to wind the first cores to give a north polarity to the pole piece. Commence by twisting one end of the wire A round the neighbouring core, cross it over the pole piece, take one turn round its own core, and tie this turn with a short piece of twine. Then proceed to wind on the wire evenly and regularly, with the coils close side by side, from the pole piece on the right to the end of the core at the left, to and fro, until all the wire has been wound on; then tie the last coils together tightly with a piece of narrow tape, to prevent them from springing back loose when the end E is free. Next unfasten A from the right-hand core, and commence winding on the next coil, beginning at B and winding from left to right, observing the same precautions as in the first coil, finishing off the opposite end at H. Next, wind the cores for the lower pole piece, commencing each at C and D respectively, and finishing off at F and I. If the machine is to be connected in series, the two ends, E and F, will now be led to the two terminal binding screws, and the two ends, H and I, to the two brushes: whilst A and B will be coupled together, and also C and D connected to each other by screw connectors. If the machine is to be connected in shunt, the two ends, E and F, will also be connected together to form a continuous coil from H to I. These two only will be connected to the brushes, and from the brushes will go two short pieces of wire to the terminal binding screws of the machine. The distinction is shown more clearly in Fig. 57. When the two finish ends of the left-hand coils are connected to the two terminals A, A, and the two finish ends of the right-hand coils are connected to the brushes B, B, the circuit can only be completed by placing some kind of work in series with the coils between the terminals. But when the two ends of the left-hand coils are coupled up together, as shown at C, and the brushes are connected with the terminals, as shown by the dotted lines, the current is shunted through the coils, and the cores are always magnetised ready for action. This last condition always assumes that the cores are magnetised at the first, and thus are furnished with an initial amount of magnetism. This initial charge must be given to them by a battery sending a current through the coils, as explained in my last chapter on this subject.

The various parts of the machine may now be put together or fitted to each other. The field magnet coils should have two or three coats of varnish to set the coils of wire together, and to give the whole machine a finished appearance. In adjusting the brushes, move the rocker until the best position is found by actual trial. The indication of this is—a full current at the terminals, very little noise at the brushes, and little or no sparking where the brushes touch the bars of the commutator.

It will be noted that I have not given the sizes of the various parts. This I could not do in dealing with the subject as I have done: namely, in a general manner, applicable to several sizes of machines. All parts are, however, made proportionate to the size of the castings, and the vendor of these will also supply the various parts in the rough at a less cost to the amateur than that incurred by him if he made his own patterns and had the parts cast to order. I give below a list of Gramme machines made and sold by Mr. S. R. Bottone, Carshalton, Surrey. From this list the amateur can choose his machine, and can also see at a glance the dimensions of its various parts.

TABLE OF GRAMME DYNAMO-ELECTRIC MACHINES.

No.	Cores. 4.	Cogged Armature.	Wire on F.M.'s.
	Inches.	Diam. Deep.	
1	1½ × 2	3½ in. × 2 in.	6 lbs. 22 d.c.c.
2	2 × 3¼	4¾ in. × 2½ in.	10 lbs. 22 d.c.c.
3	3 × 6	6 in. × 6 in.	20 lbs. 20 d.c.c.
4	4 × 7	7 in. × 10 in.	90 lbs. 16 d.c.c.

No.	Wire on Armature.	Speed per min.	Power Developed.		
			C.P.	Amps.	Volts.
1	1½ lbs. 22	2,500	50	5	25
2	4 lbs. 20	2,000	100	5	50
3	4 lbs. 16	1,500	200	10	55
4	12 lbs. 16	1,200	600	30	55

Machine No. 1 has a solid-cogged armature, but all the others are built up of cogged laminated plates. In winding the armature of No. 4, two strands of No. 16 are used, side by side, to reduce resistance in the armature coils. All these machines are made to work incandescent lamps only.

In writing the foregoing description of the various parts of the Gramme dynamo, I have been much aided by a perusal of a little book on "How to Make a Dynamo," written and published by Mr. Alfred Crofts, of Dover. I can heartily recommend this book to all of my readers who may wish to make a small Gramme machine, and would like to make all the parts themselves. Mr. Crofts only describes one size of the Gramme

dynamo—one capable of giving a current of 3 ampères at a pressure of 45 volts—but he has done this in a most thorough manner, by using a style easily understood and a number of clearly drawn illustrations. The author has practically worked out the machine for himself, and is open to supply amateurs with all requisites necessary to make a Gramme machine.

A PEDESTAL FOR BUST OR LAMP.

BY C. E. MAES.

THE pedestal shown in the accompanying illustration is by no means difficult to construct, and when made, will form withal a pleasing addition to the somewhat limited number of articles which may be placed conveniently in the corner of a room. As a support for busts or vases, similar pedestals are well known; but the idea that they may be used as lamp-stands is possibly a novel one to some readers, and may require explanation. Few, however, can have failed to notice the tall metal lamps which have become so fashionable of late—that is to say, the lamps which have a high stand, rendering them independent of any table. These stands are usually of metal, and more or less costly articles of luxury. Why should the metal worker have it all his own way with these things, to the exclusion of the wood-worker? A wooden pedestal is surely as suitable as one of brass, and, what is equally to the purpose for home workers, it can be more readily made. However, the object of this short paper is not so much to suggest what the pedestal may be used for as to tell how to make it; and if any apology for giving instructions on such a simple matter is required, let me just say that a certain individual wanted to make a pedestal similar to that shown. It was to be at least 5 ft. high, and the lathe would only take 3 ft. long. This is a fair length between centres for an ordinary amateurs' lathe, and possibly others besides the individual referred to may be inclined to wonder if the job could be managed. It certainly can be by the very simple means of turning the pedestal in separate pieces, and fastening them together afterwards.

When this has been said, very likely all the description that is necessary to enable skilled workers to make the pedestal has been given, but others may require a few more hints to enable them to set about and complete it without tentative efforts. As will be surmised, the pedestal is turners' work, and as we proceed, it will be found that the whole of it can be turned up in a lathe which will take 3 ft. between centres, provided these are not less than 5 in. from the bed. If the centres are a little higher, it will be all the better, as the diameter of the largest member of the column is $9\frac{1}{2}$ in. Anyone who has such a lathe as, say, the Britannia Company's No. 10, should experience no great difficulty in turning even this size. It is not, however, my intention to describe the operations of turning, as it may fairly be presumed that the possessor of a lathe will have some idea how to use it before attempting such large work as that involved in the pedestal. It is not a suitable thing for the beginner, for though plain and simple—or, perhaps, rather because it is so—the turning should be accurate, not necessarily to sections and sizes given, but to whatever others may be preferred. Those given are from a model before me, and may be taken as fairly typical of the style of a plain pedestal, which, it may be said, is often more pleasing than a highly elaborated outline. That, however, is a matter on which opinions may differ, so nothing more need be said about it; but whatever the design, there can hardly be two opinions about the propriety of setting the work out full size. When this is done, calipers and rule will enable correct sizes to be turned in the lathe. For those who wish to work closely to the design shown, it may be said that Figs. 2 and 3 are given one-third full size. The former represents the members above the long centre column, the latter those at the bottom. On comparing them with Fig. 1, this will be clear, and show their relative positions without any chance of misapprehension. To economise space, only half of each part is shown. Between each member on Figs. 2 and 3, it will be seen a space is left, in order that the separate turned parts may be more readily distinguished. It may be thought that if the long centre column can be turned in one piece, the shorter ornamental ends might also each consist of one piece. Those who prefer this style of construction may certainly adopt it; but before they do so, they may as well consider the amount of turning required merely to cut away the waste wood. Thus, in the top part we find that the greatest diameter is 8 in., and the smallest only $4\frac{1}{2}$ in. Is it worth while to turn down a piece 8 in. thick? If the object were to make shavings, it would be; but as the object is to make a pedestal, there is no reason for wasting either time or material on superfluous labour. Let each piece be turned out of a piece of board of the required thickness, when, if the wood has been previously trued-up with the plane, only the rim will require turning. No special remark need be made about the preparation of the wood for these parts, but the main portion of the pedestal cannot be thus lightly passed over. At the top it is about 5 in. in diameter, and at the bottom an inch more. Now, to get a nice sound piece of wood free from knots or shakes may not be always an easy matter—at least, not so easy as getting several pieces of smaller dimensions without faults. These can easily be built up to make one solid block, which will be more satisfactory than a single piece—unless, indeed, the pedestal is to be polished in its natural colour, whatever that may be, when the joints might be unpleasantly conspicuous. I assume, however, that the pedestal will be made of some soft wood, and either ebonised or finished with an enamel paint, which will conceal the joints. Some, however, may prefer oak, walnut, or mahogany in their natural colours, and merely French polished; and in that case it will certainly be better—if a suitable piece can be got—not to build up the main portion of the pedestal, but to use one piece for it. Should there be any cracks, they may be filled up by "splintering" if of any extent, or with some stopping if small. The former consists of gluing slips of wood into the shakes, and afterwards trimming them off. It will be advisable not to "splinter up" till the turning is done. If, from any cause, it should be necessary to build up for the column in any wood to be unpainted, it will be as well to do so from four squares only, and not from planks, so that the joints may be as few as possible. It seems hardly necessary to say anything more about this part of the work, but in case the notion is not grasped, Fig. 4, showing the section of a column (when turned) formed from four pieces, and Fig. 5, the same, made up of boards, are given. Glue alone will hold the pieces together, but let the joints be as good as possible; and it is, perhaps, superfluous to say that the glue must be hard before the wood is put in the lathe. Each of the discs should have a hole bored exactly through its centre,

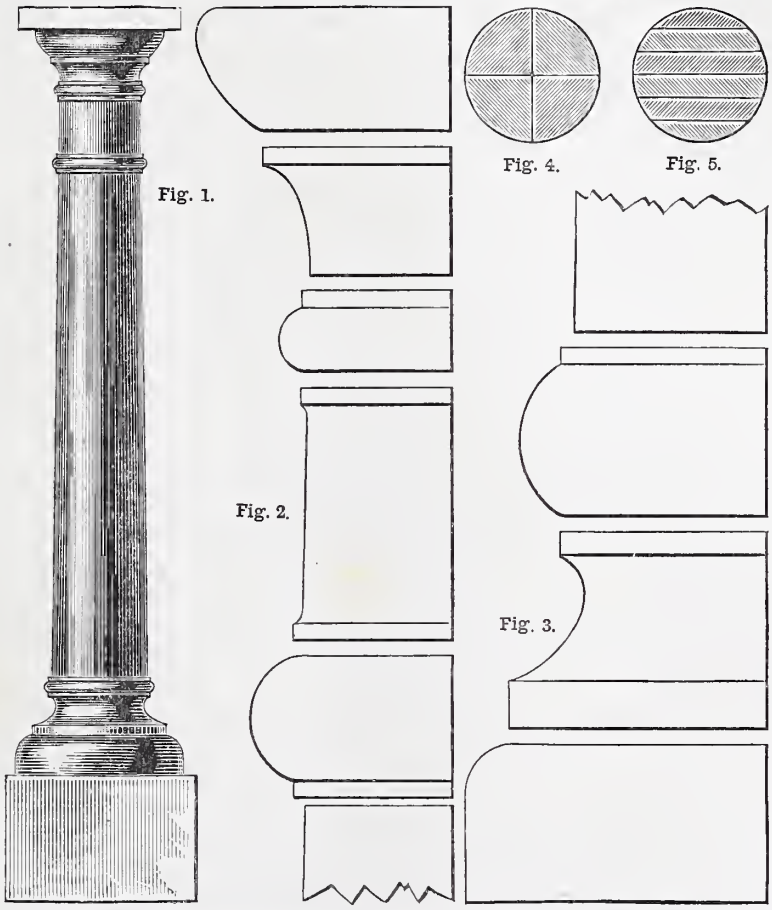


Fig. 1.—Pedestal. Fig. 2.—Upper Part (one-third full size). Fig. 3.—Lower Part: ditto. Fig. 4.—Column built up of Four Pieces. Fig. 5.—Column built up with Boards.

through which will run an iron rod fixed into the end of the long column. Probably many will find a wooden rod more workable, and if so, it may be used instead. It should scarcely be less than 1 in. thick, and of some good tough wood, such as ash, but so much will depend on the way in which the discs are fastened to each other that a good deal must be left to the discretion of the worker. The rod, or rods—for there must be one to each end of the column—may even be dispensed with altogether, but their use will be found of service in getting each disc evenly placed, as it will be only necessary to slip them on like so many rings. The centre sticks, or rods, should be rather longer than they will be afterwards, when the pedestal is completed. The end of the upper one can be cut off flush when the capping is put on, and any projection of that at the bottom will be concealed by the plinth. The rods must be well glued into the column. Before finally fastening all the parts together, it will be well just to see if they all fit. If the centre rod is sufficiently strong, further fastening of the parts together will be unnecessary; but if there is any doubt about it being so, it will be well to avoid all risk by either gluing or screwing each part to the one next it. A couple of stout screws to connect each disc will be sufficient, especially if they are only used as auxiliary to glue. Dowels are sometimes used instead of screws, but for amateur workers screws will probably be more convenient. It will be understood that these directions, if they can be so called, are given rather as hints and suggestions for the worker to act on according to the means at his command than as hard-and-fast rules from which there can be no departure without detriment to the pedestal. They are general directions, having special regard to the work in hand, but they may also be applicable to many other contrivances, and on that account are perhaps not unworthy of being regarded as educational. Though it might be easier for the pedestal maker to have definite directions about all parts of the work, the great end and aim of such a magazine as ours is not, I take it, merely to say how any given thing may be made, but to educate—the word being used in its literal sense—our mechanical and inventive faculties, and by so doing, advance technical education, if not so noisily, at any rate more effectually than by "talkee talkee." Parrots are good at this sometimes, and, no doubt, could talk quite as intelligently as some of the good people who, though enthusiastic, know very little about the needs or difficulties of the practical worker who is to be "technically" educated. But this is a slight digression, just while the glue is setting—one of those pleasant little interludes which relieve the monotony of constant work.

The top of the pedestal is simply a piece of thick board, say, 1½ in. to 2 in. stuff. It may have a hole in the centre for the rod to pass through, the rod, if wood, being split and wedged up, much in the same way that hammer-heads are often fastened to the handles, and it may be further secured by two or three screws. The other end of the pedestal may be similar to the top, but it will add dignity to the pedestal if it is more as shown in Fig. 1. To have it solid would be inconvenient in most instances, and a box-like construction will do very well. It is not always considered necessary to weight the bottom of such a pedestal, but it is safer to do so with a comparatively light one. Much, however, depends on the position the pedestal is to occupy. If it is exposed and likely to be knocked over, by all means put some "ballast" at the bottom; but if it is in an out-of-the-way corner, none may be required. What the weighting will consist of must be left entirely to the maker, and also the quantity. A few pounds of lead nailed to the bottom of the plinth inside may be named as appropriate, but any scraps may be made available by fastening them to a board, and nailing this on as a bottom beneath the plinth. Perhaps a few suggestions should be given about finishing and further adorning the pedestal. First, then, if it is to be French polished, let the polishing be done in the lathe, or, if that is not convenient, polish the various parts before they are fitted together. The polishing will be much cleaner than if it were done after the pedestal is together, when it should only require a little touching up with the rubber. The appearance may be enriched by having some of the parts bright polished and others dull, especially if the work is ebonised. If paint is the finish chosen, judicious colouring will prove very effective, but beyond saying that the colours should not clash with those of contiguous wall or curtains, directions can hardly be given. When painting it—or, rather, before doing so—let the position the pedestal is to occupy be well considered. The colour intended may look very well in itself, but might look anything but beautiful against a background out of harmony with it. Do not, therefore, so much regard the pedestal as a complete piece of decoration, but merely as an accessory. Plush may be named as a rich covering for the top, and all that has been said about paint colour applies with equal force to it. Enough, however, has now been said by way of suggestion, and the artistic worker may be left to his own devices for finishing the pedestal.

HOW TO MAKE AN OTTOMAN COUCH.

BY H. HINGE.

This very useful piece of bedroom furniture can be made by almost any amateur woodworker who is in possession of a few tools and a little skill and patience. To begin with, we shall require some ¾ in. boards, 11 in. wide, either white or red deal, moderately dry and clean; two pieces for the sides 4 ft. 7 in. long, and two pieces 2 ft. long for ends, and two pieces of 3 in. scantling 11 in. long. The wood, if it is clean, need not of a necessity be planed, except the edges; the ends should be cut off true and square, and the side pieces nailed out to one end in the form of a box; the other end the nails should only be pointed in. The pieces of scantling should now be prepared for the corners of this end by rounding one corner off till the end of piece is the shape of Fig. 1. These are fixed in the corners of the box and screwed firmly from the outside, keeping the screws as far away from the corners as it is possible, and still to get a firm hold in the block. The nails are now withdrawn and the corners rounded off (see Fig. 2, which is a plan of the bottom).

Of course, the couch can be made with a square end. If the round corners would be considered difficult, in that case blocks should be inserted in the corners of the bottom end, the shape of Fig. 3, and screwed from the outside of the box to keep it firmly together. The other end of box (we shall see later on) will be secured by the scrolls, etc. The bottom should now be screwed on. This is made of ¾ in. stuff running across the box (as indicated by dotted lines in the plan of bottom), and two screws at each end of each board, the last board being marked to shape of round corners, and rounded off and screwed on, the same as the others. The next job is to make the scrolls or arms, which can be made of 1½ in. deal, the shape of Fig. 4, and long enough to go down inside of box 6 in. at square end; the thickness of the box side is halved out of the scroll, so that when it is placed inside the box it comes flush (or level) outside. It is now firmly glued and screwed in position as in Fig. 4. The grooves in the scrolls (as seen in sketch) are to receive the cross rails. These grooves are ⅞ in. wide and about ⅜ in. deep. When both scrolls are fixed in their places, the rails, which are pieces of inch deal the required width and length (which can be got by measuring with a rule), are fitted in and nailed from the outside, care being taken not to split the scrolls. The top rail should have a block of 1 in. deal fitted in both corners and glued in, and when set, it should be levelled off to the shape of the scroll (this is to give strength). A piece of stuff should be fitted to the under side of the top rail, and glued and sprigged on to make out the shape of the scroll. Another rail should be fitted across the point marked A in sketch, 2 in. wide, being the height of scroll from top edge of box at this point. A piece of thin stuff should now be fitted in the inside of box under this rail the whole depth of box, to partition off the box from the scrolls. In cutting out the scrolls, it is best to make a pattern first, either out of very thin deal or cardboard, and in placing it on your stuff (which should be free from splits or shakes), so place it that the grain of the wood goes with it—that is, not to get the grain across it, or it will be liable to snap off. Cut them out with a bow saw, and with a spokeshave trim them up and take off all sharp edges to prevent them cutting the covering. We now want a lid. This is made of the required size out of 1 in. deal 2½ in. wide, keeping the end rail that comes on to the round corners 1½ in. wider; this can be halved together, and glued and screwed. A middle stretcher should be put in about 1½ in. wide, and hollowed out on the top side with a spokeshave to prevent it being felt when the ottoman is sat on. After it is made, it must be fitted to the top of the box, keeping it away from the rail A about ¼ of an inch to allow for the covering, etc., and the corners rounded on the wide rail to correspond with the box. It should now be hinged with a pair of butt hinges on either edge, just according to which way you want your ottoman to stand and open. Do not let your hinges in too much, or else when the box is covered it will be what is called "hinge bound"—that is, the covering will keep it from closing properly. Four "squares" should now be made of mahogany, or other hard wood, about 4 in. square, two of them rounded to correspond with the bottom of the box. These are screwed on to the bottom of the box about level with the outsides, to receive the casters. The "squares" are the only wood that is seen in our ottoman when complete, so they should be nicely made and polished or varnished; the casters should now be screwed on to the blocks. The casters called "pin casters," or "plate casters," will do very well. Our ottoman couch frame is now complete.

Our next proceeding will be to upholster

t, and make it fit for use. First take off the lid, afterwards the bottom, numbering the boards where they belong to, to prevent getting wrong when putting them back. It should be lined with a nice small pattern chintz, and for covering nothing looks better than a pretty cretonne. Lining the box is usually the first job, which is done as follows:—Cut off lengths for sides and ends, always taking care to have your stuff an inch or two longer and wider than the finished size; line the ends first, covering past the corners a little, and tacking it down carefully, not driving the tacks home till you are sure you are right and your chintz is evenly strained; do not pull it too much, or you will break the glaze, and never make a nice job of it. Now put your side pieces on (with a few tacks pointed in to keep it in position), and turning it under nicely at the corners, with some ⅜ in. fine brass gimp pins, fasten it neatly down; then placing the couch bottom upwards on your bench, or two stools, place the piece of chintz intended for the bottom (pattern side into the box) on it, and get it nicely in stretch, by first lightly tacking round, and not sending tacks down until it is evenly strained. Now replace the bottom, and pushing down a sprig-awl, or something of the kind, make a hole through the chintz; put no oil or grease of any kind on your screws in the bottom or it will mark the chintz. Now for the scroll, which we shall find the most difficult part to cover, but a little patience will master almost anything. We shall require some chair webbing, some flocks and canvas, and a little common calico for outer covering. Firmly tack three pieces of webbing across the scrolls, running the same way as the rails, one of the pieces right across the highest part of the scroll, the other two equidistant between the rails. (These must be pulled tight.) Upholsterers have a tool on purpose, but we can pull them as tight with a piece of wood about 12 in. long and 2 in. wide. After attaching one end of the webbing, wrap the other part round the long way of the wood, and using it as a lever against the other scroll, strain it tight, and before letting it go, secure it with tacks. It will be easily understood that the webbing must not be cut in pieces, but used off the piece, or else we should have nothing to pull by. Over the webbing tack a piece of strong canvas, getting this as tight as we can by pulling it with a pair of pincers. The canvas should go over the front or nose of the scroll and finish there, and then another piece of canvas, without webbing under, stretched across the front of the scroll (or under side as some would call it) where there is no pressure.

Now with some fine twine begin on the top of the scroll and form loops in the manner shown in Fig. 5 to put the flocks under. Keep tucking the flocks under the strings, making some loops across the canvas by stitching them in and tucking in the flocks until you have an even bed, say 2 in. thick, all over the scroll. Now cover this with calico, getting it nicely in stretch, and slitting a little here and there in the corners, to enable it to come down and tack on to the face of the scrolls. This should now be covered with cretonne, pointing in tacks all round till nicely and evenly stretched; then the under side covered in the same way over the canvas. It will, no doubt, greatly improve the amateur's work to pull in a few buttons in the arm (diamond-shape) with a long needle and thin twine, and "tie them off" on the under side before that part is covered. The box can now be covered with cretonne, turning under the top edge and fastening it down neatly on the top edge of box, and bringing it down and right under the bottom, and fastening off with tacks on the bottom of box. The lid should now be webbed by the same method as the arms were, crossing the webbing the same as the laths are in an iron bedstead. Cover with strong canvas, and form string loops right round the edge of the lid, and then fill the middle in with flocks, making it higher in the centre so as to form a nice round seat. Cover with calico, and finally with cretonne, tacking it on the under side. Now turn it upside down on something clean, and line the lid with chintz, turning in under all round, and fastening it off with brass gimp pins. Rehinge your lid, and fix a piece of tape at each end of box to the lid, to allow it to open just over square and keep it from going right back and breaking off the hinges.

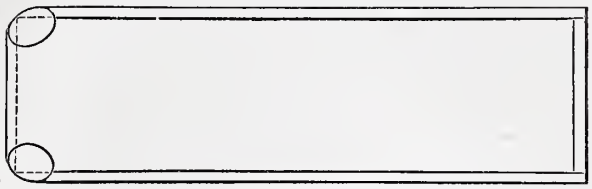


Fig. 2.

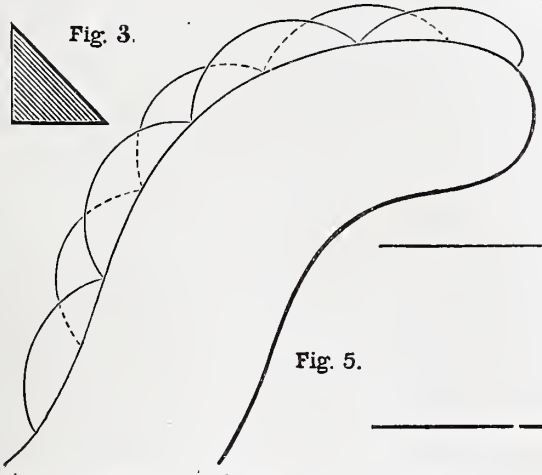


Fig. 3.

Fig. 1

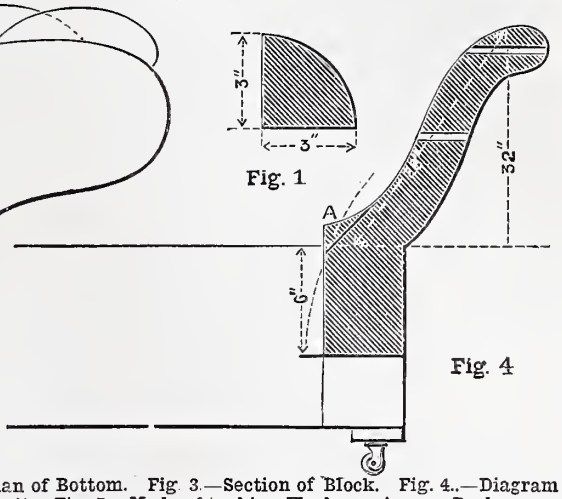


Fig. 4

Fig. 5.

Fig. 1.—Rounded Scantling. Fig. 2.—Plan of Bottom. Fig 3.—Section of Block. Fig. 4.—Diagram showing Arm and manner of fixing it. Fig. 5.—Mode of tacking Flocks on Arm or Back.

We now want a "loop," or handle, to open it with, which should be made of a piece of webbing about 12 in. long, and covered with the cretonne. This should be folded together to form a loop, and firmly tacked to the under side of lid, and allowed to project far enough to catch hold of, in order to raise the lid, which is a considerable weight when stuffed and covered. This had better be fixed before the lid is lined, and then the lining will cover all up. Often workmen leave it for the last job and carefully withdraw a few pins in the lining in the centre of lid, and insert the web, and pull it out just as much as they want, and then tack it down again; but the former is the right way. We now want two pieces of cretonne, cut out the same shape as the scrolls, about ½ in. larger all the way round. Lay the couch down on its side, and make a roll of cotton wadding (or even flocks) about 2 in. wide down the centre of the scroll,

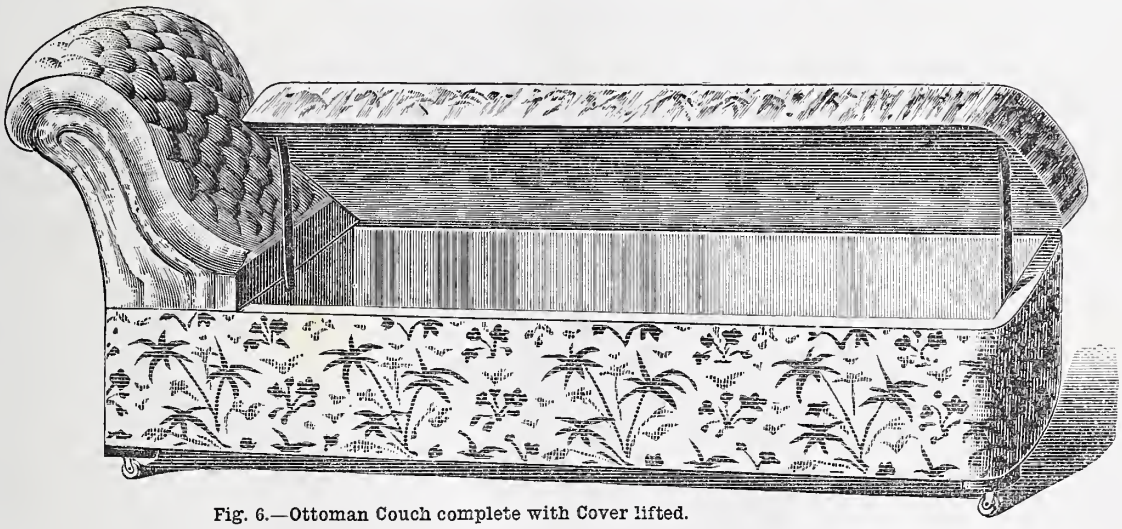


Fig. 6.—Ottoman Couch complete with Cover lifted.

leaving a margin all round, and covering it with one of the pieces of cretonne, pointing in a few tacks to keep it in position. Now begin by turning under the cretonne and fastening down with gimp pins (withdrawing the tacks as we go along), nicking it anywhere out of sight with a pair of scissors, to facilitate turning in. It will form a nice raised scroll, and make a good finish. When both scrolls are done, the ottoman couch is complete. The secret of success of covering with any material is not to fasten it down all at once, but just point in the tacks (so that they can come out again) till evenly strained all round, then drive the tacks home. The sizes given are the dimensions of an ordinary couch, but, of course, a few inches can be added or taken off length, etc., to suit the size of room where it is going to stand, which will at once suggest itself to the worker.

Couches thus contrived and fashioned are extremely useful in bedrooms, where there is room for them as receptacles for articles of dress, linen, hats, bonnets, etc. They will also be found desirable at times of removal from one house to another for packing similar things. If intended for this purpose, the box should be furnished with a strong lock and key, and straps of stout webbing with buckles passed round them.

MEANS, MODES, AND METHODS.

A Wrinkle for Fret-Workers.

Fret-Workers never weary of adding to their stock of useful hints, and I can give them one more. I have not been of much use to this section of our readers, for the simple reason that I do not interest myself to a great extent in this branch of woodwork; but in preparing a design the other day, an "idea" struck me. My object is—preserve the pattern entire when once sawn through.

If the design is upon a page of Work, or paper which is not very stout, gum it to a rather thick piece. The following will suit for this, and also for drawings which are already upon thick paper.

Most designs are shaded. Place the design over a piece of carbon paper, and trace accurately with a bone or steel point over the outline of it, when a skeleton of it will appear on the other side. Pass a gum-brush, having a sharp point, over all portions of the drawing *which are not shaded*, keeping well within the lines, until all are evenly gummed. Then place the design upon the wood, previously having damped it if any of the gum upon it has dried. Of course, the other side of the wood should, in this case, be equally damped, to prevent warping.

When dry, cut through in the usual manner, and the result will be that the design can be taken off bodily, leaving the gummed portions upon the cut-out pieces of wood. It can then be used for months, by pencilling round its edge upon any other pieces of wood that are to be fret-cut. This is rather a laborious process, but in some cases the trouble expended would be well repaid. J. S.

A Staircase Gate.

Some of the many handy fingered parents in this world may have been put to it to devise a gate at the top of their staircases, to prevent their precociously quickfooted offspring from falling headlong and breaking their necks prematurely. When I was requested to make one some time ago, I thought first of bamboos, as being so light and strong; but I found them expensive, and not strong enough to take a spring catch or hinges, and besides, I had no time just then to bend them to any particular pattern. In the next place, I thought of the diamond trelliswork or netting frequently used in post offices as a counter-guard, and in many libraries as a substitute for, or in conjunction with, glass as a book protector. It can be purchased either in brass or galvanised wire, but as the size I wanted would have had to be made to order, and would have caused me delay, it was out of the question. Finally, I decided on making the gate of wood, as follows:—I bought a dozen banister rails, and two battens, 3 ft. by 2½ in. by 1 in. The rails were rather longer than was required, so I cut a few inches off each end, and having bored out suitable holes, half an inch deep, in the two battens, I inserted the rails and glued them with liquid glue. The gate was to all intents and purposes now made. The two top edges of the battens were bevelled, so as to do away with any sharp edges. These battens were fixed to the banister post at the head of the stairs with two small, but strong, back-flap hinges; and one of Cartland's door-springs was fastened at the top to keep the gate always shut.

The gate shuts noiselessly against a pad of indiarubber, and is fastened, or rather fastens itself, with a small spring catch, something like a pew-door or show-case fastening, with a sunk ring to elude infantine eyes and fingers.

The whole gate was stained with two coats of Jackson's satinwood varnish stain, and matches very well indeed with the pitch-pine banister rails of the staircase.

The total cost, with fittings complete, was about 5s. 6d., which is little enough when the protection that is thereby afforded to the tenants of the nursery is taken into consideration. H. J. L. J. M.

Cramping up Joints of Thin Stuff.

In jointing wood, especially thin stuff, such as is used for panels, drawer bottoms, etc., if grooved and tongued, or only slip-jointed, great difficulty is often experienced in getting them close and keeping them together (if the wood is at all crooked or warped) while the glue sets. This difficulty may be overcome by making wood cramps of the following description:—Procure two pieces of stuff 6 in. longer than the widest board you want to joint, and about 3 in. or 4 in. wide, ¾ in. or 1 in. thick; and placing two of them together, bore a ¾ in. hole right through, 3 in. from the end. Serve the other end the same, and fit a dowel of hard wood, say 4 in. long, in each hole; drive them through both pieces, taking care not to have them too tight or else you will split your wood, and then open out your wood on the dowels the thickness of the board you want to cramp; your cramp will then have the appearance on end of Fig. 1, flat way of Fig. 2. If a pair of these cramps are made and slipped on to a joint, and two hard wood wedges, same thickness as the jointed board, driven gently between the top edge of the board and the dowel, as shown in Fig. 3, it will cramp up the joint close, and keep the board quite straight and firm till the glue is set. Holes may be made in the cramps so that the dowels can be put in for different breadths of stuff, and they will easily adjust themselves to the thickness of stuff by simply opening or closing them on the dowels. H. H.

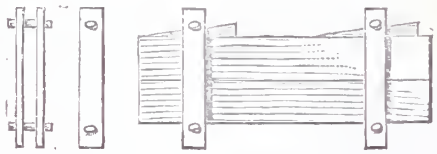


Fig. 1. Fig. 2. Fig. 3.

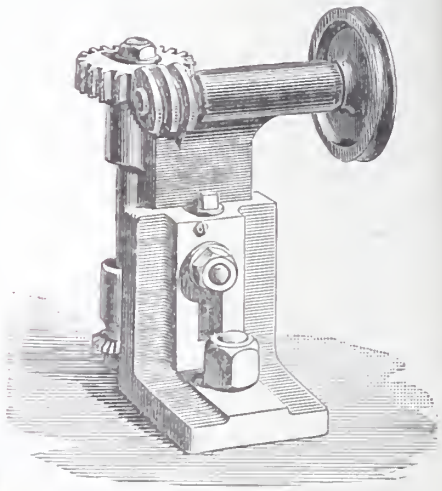
Fig. 1.—End View of Cramp. Fig. 2.—Side View of Cramp. Fig. 3.—Boards glued up and wedged in Pair of Cramps.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

117.—Milnes' New Wheel Cutter.

Readers of Work who are turners will like to have a description of a wheel cutter just brought out by Mr. H. Milnes, of Bradford, of which an engraving is given here. The illustration shows the cutter as fixed upon the tool-plate of the slide-rest by means of the bolt used to clamp the tool; it is, therefore, very easily and quickly fixed and unfixed. The motion is received by a 3 in. pulley from the band of the overhead motion; the quick speed of this band is transformed into the slow and powerful motion



Milnes' New Wheel Cutter.

required for the cutter by a worm and wheel, whose smooth and quiet action is very superior to the rattle of gearing. There is a simple vertical slide for the height adjustment, after making which a nut is used to clamp the slide. The cutter spindle has hardened necks, working in hard steel collars; I took it out for examination, and found them very smooth and bright. There are twenty teeth in the gun-metal worm wheel, and it takes from three to four treads of the foot wheel to turn the cutter once, so that it turns slowly and with great power. The worm and wheel are too large and strong in this first cutter, but they will be reduced, and the small worm shaft will also be hardened and run in hard collars.

The saddles of Mr. Milnes' lathes, as now made, allow the rest to be drawn so far back that the cutter can take a cut across the face-plate, or cut teeth in a wheel 7½ in. in diameter. The cutter costs £4 10s. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

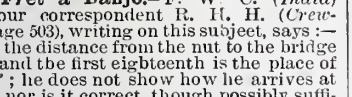
* *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Riddles and Wire Gauge.—J. S. (*London, N.*) writes, in reference to C. T. C.'s remarks (No. 91, Vol. II., page 631):—"You must pardon me for asking whether you would not have given a similar reply to that which I sent in answer to Dandy Roller (No. 86, page 553)? You say 'it is gradually being used' (the imperial standard wire gauge), thereby proving that there is no universally adopted gauge; and it might have been reasonably expected that had I given numbers relating to thicknesses of wires, no useful purpose would have been accomplished. Evidently Dandy Roller is not a riddle maker, or he would hardly have asked the question; therefore, he might have had difficulty in procuring an imperial gauge. I am intimately acquainted with, and by the time this letter is in print shall be relatively connected with, one of the oldest wire-working families hailing from Birmingham. It is on this account that our Editor requested me to write a series of papers on wirework. This family uses an old gauge, which, however, is being discarded. There is a gauge several inches long and about 1 in. wide having a groove or slot down its middle lengthways, the slot being of a certain width at one end, and tapering down to an extremely fine point at the other end. Along the sides of the slots are numbers. I, and doubtless many others, would like to get to the bottom of this gauge question; and for myself will thank you or any other wireworker to give me the benefit of your views through the columns of 'Shop.'"

How to Fret a Banjo.—F. W. C. (*India*) writes:—"Your correspondent R. H. H. (*Crewkerne*) (see page 503), writing on this subject, says:—'Next divide the distance from the nut to the bridge by eighteen, and the first eighteenth is the place of the first fret'; he does not show how he arrives at the figure 18, nor is it correct, though possibly sufficiently near. In the sketch let B C be the length of



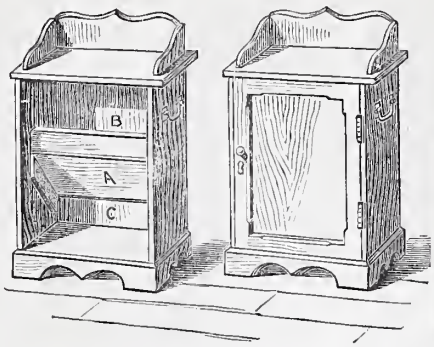
the open string, and Ba, ab, bc, etc., be the lengths of the frets, and let x represent the proportionate part of B C required for Ba. Then $Ba=\frac{A}{x}$ and $aC=A-\frac{A}{x}=\frac{A}{x}(x-1)$; similarly $ab=\frac{aC}{x}=\frac{A}{x^2}(x-1)$ and $bC=\frac{A}{x}(x-1)-\frac{A}{x^2}(x-1)=A\left(\frac{x-}{x}\right)^2$ and $bc=\frac{bC}{x}=\frac{A\left(\frac{x-1}{x}\right)^2}{x}$ and $cC=\frac{A}{x^2}(x-1)^2-\frac{A}{x^3}(x-1)^2=A\left(\frac{x-1}{x}\right)^3$, and so on till the twelfth or octave fret $nC=A\left(\frac{x-1}{x}\right)^{12}$. But as the octave note of a string is always half the length of the open string $A\left(\frac{x-1}{x}\right)^{12}=\frac{A}{2}$ or $\left(\frac{x}{x-1}\right)^{12}=2$. This gives x=17·818, and not 18. The correct lengths of the frets for an open string of 26 in. are as follows:—

	1	2	3	4
To	1·46	2·836	4·136	5·363

and so on."

Artificial Water.—W. E. D. (*Hull*) writes to J. M. (*Manchester*):—"I thank you for your reply (see page 603) *re* 'Water for Models of Ships'; however, the kind you name hardly answers my purpose. I wish to make working models, and the water to move up and down with the ships. Perhaps you would be kind enough to inform me on this point."

Coal Box.—W. H. P. (*Hornsey*) writes:—"I enclose you a rough sketch of a coal box I made some time ago. The idea occurred to me when Mr. J. Scott's coal and coke box appeared on page 81, Vol. II. of Work, and as my son was just beginning to run about and sort out the coals in the scuttle, I thought that with a little alteration of the interior, it was just what I wanted, so I set to and made the enclosed. It is made of ¾ in. pine, except the door, and that I made of ½ in. mahogany. Outside measurement: 32 in. high, 16 in. wide, 15 in. deep. The slanting division, A, I fixed about halfway, 1 in. from front at top, and 3 in. from back at bottom, and a piece 4 in. wide above A to keep the coal in. You put the coal in at B and shovel them out at C, and as you take them out, others fall in their places. Of course you cannot use large coal, but for nuts it is just the thing. It holds from three to four scuttles full. I gave it two coats of Aspinall's Black Enamel, and put a lock and a pair of brass handles on it. A piece of zinc at the bottom



Coal Box, with Door and without.

would make it wear better. You know it is very awkward to shovel up coal out of the scuttle, but here it is very easy and clean."

Heating Plant Case.—J. T. (*Hull*) writes:—"As you were kind enough to reply to my inquiry (see page 521, No. 84), I enclose herewith a sketch of what I have done in hopes that it may prove of

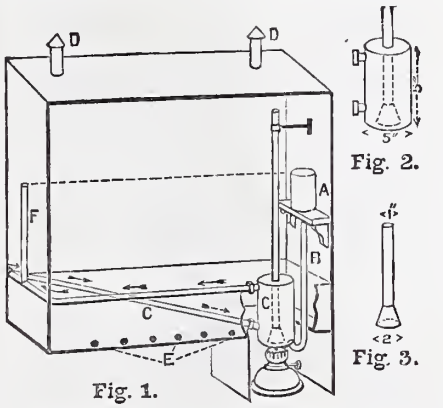


Fig. 1. Fig. 2. Fig. 3.

Plant-Heating Case. Fig. 1.—A, Cold Water; B, C, ¼ in. Gas Pipe; D, Foul Air; E, Fresh Air; F, ¼ in. Vent Pipe; G, ½ in. Gas Pipe. Fig. 2.—Tin, 8 × 5. Fig. 3.—Copper Tube for Boiler.

help to some of your readers. You will notice that I have added a cold water cistern to supply the boiler with water, which answers very well. I am able to keep 60 degrees with a small lamp."

II.—Questions Answered by Editor and Staff.

Emigration to South Africa.—Abstainer.—You do not give either your name or address, so I am utterly unable to answer you by post; and not knowing where you live, and, therefore, what large seaport you may be near, I cannot well advise you as to your route, etc. With the knowledge of the various trades that you possess, I should say go to the Cape or Natal by all means, or, preferably, up the country. Send your name and address, which will be held in confidence by me, and then I will endeavour to give you a useful hint or two.

Books on Carpentry and Joinery.—A Constant Reader.—Write to the Britannia Company, Colchester, for their new Catalogue of Technical Works, sending 7d., which is 6d. for the catalogue itself, and 1d. to frank it through the post. You will find many works on carpentry and joinery mentioned therein at various prices, and be able to make a choice that will suit your requirements and pocket.

Book on Tin-Plate Working, etc.—T. K. B. (*London*).—See above reply to A Constant Reader, and follow the advice given to him. The making of saucepans has been dealt with by Mr. R. Alexander in No. 93 of this Magazine, as perhaps you will have seen before this comes under your notice.

Book on Timber.—Brecknock.—A work on this subject, entitled "The Timber Merchant and Builder's Vade-Mecum," is published by Messrs. W. Rider & Son, Bartholomew Close, London, E.C., and was noticed in No. 81 of this Magazine."

Upholstering.—S. R. (*Chelsea*).—Upholstery work will receive due attention. In the meantime, if you will let us know on what specific point you desire information we will endeavour to help you. There is no book which we would care to recommend unreservedly, as there is none which would be of any real assistance.—D. A.

Dialling.—J. C. (*Rugby*) can doubtless get the rule he requires from any large tool shop—say Buck's, Holborn Viaduct, London. He would do well to write describing what he wants, and inquiring the price. He can then send remittance with order.—A. G.

Etching Classes.—E. A. S. (*South Norwood*).—You would do well to write to the Secretary of the Technical Institute, Finsbury, as to classes in etching near the Royal Exchange.—C.

Crucible.—No Name (*Leicester*).—You might melt in the furnace you sketched. But metal must be thoroughly fluid to be any good. No coal, but coke, and preferably hard or furnace coke, like that employed by iron-founders, should be used. Gas coke will answer, but will be longer in melting. No flux is necessary for melting up turnings, but only for casting into moulds. After you have melted the turnings, pour the metal into a cast iron ingot mould to be melted over again for casting. Then, just before pouring into the mould, drop a bit of yellow soap into the crucible and stir. You can obtain a crucible of the Morgan Crucible Company, Battersea, or of the Soho Crucible Works, Wakefield. The price is a trifle over a penny per pound capacity. Thus a 20 lb. crucible would cost 1s. 10d.; a 24 lb. crucible, 2s. 3d. Either of these sizes would suit you. Model gauge glasses of Bateman, High Holborn, or Lee, High Holborn.—J.

Brass.—J. A. W. (*Glasgow*).—A series of articles on brass moulding, etc., to appear in the future, will contain some chapters on the subject. For metal, write to Messrs. Osborne & Co., 11, Great Garden Street, London, E.—J.

Machine Saw.—J. A. (*Wandsworth*).—An ordinary bow saw, 20 in. long, answers very well both for ripping and cross-cutting, also for circles and fancy shapes. No roller is required to take the thrust; this is provided for by the beam and connecting rods under the table. A roller or stop of any kind at the back of the saw would be injurious, as it would cause friction, and heat the saw.—F. H. R.

Work Numbers.—S. R. (*Newry*).—Volume I. contained 52 weekly numbers. Volume II. began with No. 53, and will end with No. 104; and the publication will be continued in this order.

Microscope.—H. E. A. (*Peterborough*).—An article on "Microscopical Work" will be found in Work, No. 91, page 681. You should purchase an Index to Volume I., and also that to Volume II., when it is published.

Taking out a Patent.—Uncle finds that his invention has been forestalled, but that the former inventor allowed his provisional protection to elapse without completing his patent. Being in doubt as to whether, under the circumstances, he can or cannot himself obtain a patent, his prudent course will be to make some small improvement on the idea, so as to effect a colourable difference, and then to apply for the patent. The former inventor has (presumably) tried the invention in the market. As it stands, it must be considered to have been published, and to be known to her Majesty's subjects, and to be therefore no fair subject for a patent. But it would be otherwise if it were combined with an improvement. Uncle could scarcely feel safe in applying for a patent for an invention of which he well knew that he was not the first and true inventor, without adopting the above legitimate expedient.—C. C. C.

Fluted Silvered Glass.—Reflector.—I think you will be able to get this at Messrs. P. E. Chappuis & Co., 69, Fleet Street, London, E.C.

D Dulcimer.—G. H. (*Camberwell*).—The dimensions of a D dulcimer are as follows:—Length in front, 2 ft. 10 in.; at back, 1 ft. 4 in.; depth of shell, same as for F. The position of the inner bridges are: for the right hand, 3½ in. from the block, and for the left hand, 12½ in. from the bottom and 5½ in. from the top corners of block. Four sound-holes are generally put into a D, and the dots or marks for the centre of these should be made at a distance of 5 in. from the bottom and top edges, 6 in. from the left block for the treble, and 9 in. from the right block for the bass. These should be of 2½ in. diameter for the two lower, and 1¾ in. diameter for the upper ones. The bridges would be the same size as for F.'s, and the wire for stringing would be Nos. 10 and 9 brass and 9 and 8 steel. You would find some difficulty in playing a D and F together, as the difference in pitch (a minor third) would necessitate a considerable amount of "cross-fingering"; but if you were to raise the pitch of your F to G—which it would stand very well if the wire is good—it would be much easier to play them together, although you would not play in the same key on each. The two best instruments to play together are either two of the same pitch, or a D and an octave or piccolo D. For a description of this, see page 615, No. 90.—R. F.

Electro-Motor and Dynamo.—Electro.—The cost of making either an electro-motor or a dynamo will depend very much on the quantity of work you can put into these machines yourself. The rough castings for a small dynamo of five candle-power will cost from 5s. to 6s., and those of a motor about the same. The wire may cost you about 10s. more for each machine. If you have to pay for the labour of fitting the castings ready to be wound, it will cost you from 10s. to 15s. more. You can buy a small dynamo complete for 15s., and a motor for a sewing-machine for 30s. The cost of working these will depend also on the cost of motive power, and this must be reckoned at one man-power for each machine.—G. E. B.

Electric Lighting.—J. F. P. (*Saffron Walden*).—A series of articles, entitled "Model Electric Lights," by Mr. Bonney upon this subject is now running through Vol. II. of Work.

Foreign and Colonial Patents.—CON-JUNGO.—Each country and colony has its own patent laws. The number of inventors who seek protection abroad is comparatively small. Application has to be made to the Government of that country in which the patent is required. Copies of the Patent laws of most foreign countries are in the Free Library of the Patent Office, Southampton Buildings, and may be inspected there daily from 10 to 10 o'clock. There is a monthly publication specially devoted to international protection—*La Propriété Industrielle*. It is published by the office in connection with the International Convention for the Protection of Industrial Property. Publishers, Jent and Reinert, Berne, Switzerland; price, yearly, post free, 5 f. 60 c.—C. C. C.

Firing Terra-Cotta Busts.—C. T. B. (*Kilburn, N.W.*).—The person to fire your busts would be Mr. Lucchesi. His address is, or was, 75, Euston Street, Euston Square, London. Should he have removed, you can doubtless find him through the Directory.—M. M.

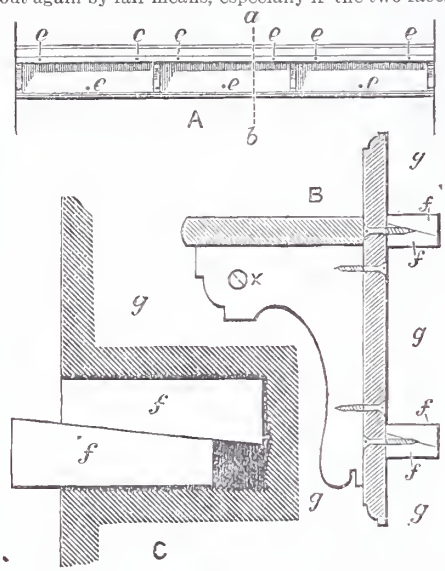
Amalgamating Zinc.—J. J. M. (*Leith*).—Dissolve ¼ lb. of washing soda in one quart of hot water, and wash the zinc plates in this to free them from grease; then rinse them in clean water. Get a stoneware baking-dish, or a deep soup-plate, and put in it a mixture of 1 part oil of vitriol added to 3 parts of water. Put in first 3 wine-glassfuls of water, then add carefully and slowly, 1 wine-glassful of oil of vitriol. Always add the acid to the water *slowly*, as the mixture of the two becomes almost boiling hot, and may spurt about violently. It will blister the skin and burn holes in clothing, so be careful in mixing the oil of vitriol with water. Into the hot mixture pour an ounce or two of mercury—that is, quicksilver; then put in the clean zinc plates one at a time and move each plate about with a stick until the under side is coated with mercury. Turn it over and get the other side coated; then get it out and rub both sides with a wisp of hemp, tow, or linen rag, with a few bits of brass or copper wire in among the wisp. This will cause the mercury to spread evenly all over the sides of the zinc, and cover it with a bright coat of quicksilver. This is named amalgamating the zinc. Treat each plate in this manner, and thus prepare them for use in the battery.—G. E. B.

Galvanometer.—J. T. G. (*Edinburgh*).—You have done quite right so far as you have gone. There is a lozenge-shaped permanent magnet inside the coils—that is to say, there is a piece of hard steel exactly the shape and size you mention. This piece of steel is magnetised and fixed by means of small nuts to the spindle which carries the index needle. The two bobbins are wound with two sizes of wire. First, there is one layer of No. 22 silk-covered copper wire for use when measuring low tension currents. Wind the same quantity on both bobbins, leaving out two small spirals of wire at each end to make connections. Now wind 1 oz. of No. 36 silk-covered copper on each of the bobbins (over the large wire) for use when testing for faults in the line wire. Place the bobbins together with the magnet inside, and connect the wires as you have seen in the galvanometer you mention. Be sure to wind on the wires regular, side by side, and see that they are nicely coated (no breaks, knots, or kinks), and connect the outside or finish end of one coil to the inside or commencing end of the next.—G. E. B.

Electrotyping Casts in Plaster and Wax.—CREWKERNIAN.—The casts must be coated with blacklead, by brushing them with a soft brush charged with very finely powdered best blacklead, applied dry. They must then have a number of fine copper wires stuck in the edges near the design, and these connected to a stout leading-wire of copper, also stuck in the back of each cast. This wire and the small wires serve as conductors of the current to the face of the casts. The casts are then suspended in a solution of copper sulphate and connected to a battery or to an electrotyping dynamo machine until a sufficient thickness of copper has been deposited on them. This is an outline of the process. You will find full details in my article on "Electrotype Copies of Busts," published on August 9th, 1890, in No. 73 of WORK. See also reply to D. G. (*Moorfields*), published on October 11th, 1890, in No. 82 of WORK, p. 489. These back numbers are in print, and can be obtained at a penny each from any newsagent.—G. E. B.

Connecting Cells of Smee Battery.—T. M. (*Belfast*).—Connect the platinised silver plate of one cell by means of a length of copper wire with the zinc plate in the other cell; then connect the silver plate of the second cell to the zinc plate of the third cell, and so on to the end of the whole series or string of cells. This will leave a zinc plate free at one end, and a silver plate free at the other end. Connect one of these to the bell, and the other to the line wire. Lead a wire from the bell to a copper plate buried in damp soil, or connect the wire to a gas pipe or water pipe. At the other end of the line take a wire from the push to an earth plate or water pipe. The earth will convey the current instead of a wire, and a naked wire may be used for the line if this is insulated from the earth by supporting it at intervals on glass or porcelain insulators. The Smee is not the best for bells, nor is the system adopted by your friend the best or most economical; but a bell *can be rung* by such means as you mention. The wire will not suffer much from exposure to the weather, but the resistance will be great, and this will necessitate an extra expenditure of power to get the desired result.—G. E. B.

Shelf.—A. E. J. (*London, W.*).—I take it from your letter that the brackets you intend to use are wood, so that the best way to proceed would be to prepare a 1 inch back-board the whole length of the shelf, and wide enough to take the brackets below and to stand up about 3 in. above to protect the goods or wall, as the case may be, as shown in the enlargement at B. This back-board serves the double duty of making an excellent fixing for the brackets, and hides any part of the wall that gets broken away in cutting the holes for plugs. The best form of plugs for this sort of work is two wedges, as shown in section at C, and the way to do it is as follows:—Cut out of a piece of 1½ in. by 1½ in. sound yellow stuff two wedges about 4 in. long, and you will see if you cut a nice square hole 1¼ in. by 1¼ in. in the brickwork about four inches deep, and insert the thick end of one wedge in first, driving it right home, and then follow with the thin end of the other, that the fact of wedging them in this way thoroughly binds them to the brickwork, and when they are once in, they can never be got out again by fair means, especially if the two faces



Shelf. A, Elevation of Shelf; B, Section through *a b*; C, Enlarged Section of Plugs, *f*; *e*, Position of Screws; *f*, Plugs; *g*, Wall.

of the wedges that touch are smeared with glue before driving them in. You should prepare the back-board first and fit it into its place, then take it down and mark out the position of the shelf and brackets. The brackets should be housed into this and also into the shelf; the shelf would, of course, bear much more weight if it were ploughed into the back-board. Next bore the holes for screwing the back-board to the plugs, as shown in the elevation A. The six top holes are put directly behind the shelf, so that the shelf, being fixed last, hides them. Now offer the back-board up to its place and mark through these screw-holes on to the wall behind, and this will give the exact centre of the holes to be made for plugs. Take down back-board, plug wall (cutting off any piece of plug that may project beyond the face with sharp chisel), screw the brackets on the back-board as section B, and you can now fix the whole back to the wall, except the shelf, which you now lay on and nail or screw to brackets, as you think best. The two end brackets might with advantage be screwed to the side walls, as at X in section B. A much simpler and less expensive way to fix the shelf would be with iron brackets in the centre simply screwed to wood battens about 4 in. wide fixed to plugs in wall as above, and a fillet under each end fixed to side walls.—E. D.

Books on Electric Bells.—T. M. (*Belfast*).—"Electric Bells," by S. Bottone, 3s., Whittaker and Co., London, E.C.; "Practical Electric Bell Fitting," 3s. 6d., F. C. Allsop, 165, Queen Victoria St., London, E.C. Either of these will suit your requirements.—G. E. B.

Granule Battery.—WATER LILY.—Theoretically considered, a battery should yield current according to results reasoned out by Ohm's law. That is to say, knowing by measurement the internal resistance of each cell, and the E.M.F. of each pair, the volume of current given at the terminals should equal the total E.M.F. divided by the total resistance. But, from the moment of closing the circuit of a battery, there are changes set up in the battery itself which entirely upset our theoretical calculations. The most potent of these arises from the hydrogen determined to the negative element by the decomposition of the battery liquids. If this is absorbed there as fast as it is formed, very little alteration is observable in either the E.M.F. of the battery or its internal resistance. But, if the hydrogen is allowed to collect on the negative element, it offers a counter E.M.F. to that of the elements, and also increases the internal resistance of the cells. In all bichromate of potash batteries this tendency to accumulation of hydrogen on the negative plate is most marked, and the fault increases with increased demand for current, because there is an increased volume of hydrogen formed when the volume of current is increased, as by having a low resistance in the outer circuit. This fault is due to the use of an imperfect depolariser, the bichromate of potash being slow in yielding up its oxygen to combine with the hydrogen formed in the battery cells. The Granule battery, being a bichromate of potash battery, shares the fault peculiar to its class, and therefore the current soon falls off after the outer circuit has been closed. The E.M.F. of each pair—*i.e.*, each cell—is as you state: 1·8 volts. The internal resistance of the size cells employed by you would be about ·08 ohm. Taking the total E.M.F. of your 24 cells as 43·20 volts, and the total internal resistance as 1·92 ohm, we should have by Ohm's law,

$$e = \frac{E}{R} \frac{43{\cdot}20}{1{\cdot}92} = 22{\cdot}5$$ ampères as the total current

obtainable from the battery. Now, if we demand a larger volume than 3 ampères of current from this battery, it will polarise so rapidly as to be almost useless in half an hour, but will work fairly well whilst yielding a current of from 1·5 to 2 ampères. What we have to do then, to get the best results from your battery, is to place a lamp of sufficient resistance in the circuit to pull down the current to from 1·5 to 2 ampères. As you only wish to use 20 cells at a time, I think you might employ a 35 volt 16 c.-p. lamp, and this would take about 1·3 ampères of current to light it. If you decide on arranging the cells in three sets of eight cells in series in a set, then get three 12 volt 5 c.-p. lamps. You might try three 14 volt 8 c.-p. lamps, but I fear you would not get current enough to properly light them. I think you would get better results from chromic acid than from bichromate of potash, and use Zn Cl instead of NH_3 Cl in porous pot. I do not know the Victoria Leclanché. All such batteries are only suitable for intermittent lights of from 2½ to 5 c.-p. You cannot get a strong light from them, nor for a longer period than ten minutes at a time.—G. E. B.

Mail Cart Wheels.—J. G. (*Somerset*).—For these you should apply to the Victor Cycle Co., Grimsby, who advertise in the "Sale and Exchange" column of WORK.

Stereotypes.—CREWKERNIAN.—I cannot condense a useful description of the process into a sufficiently small compass to suit the limited space at my disposal in "Shop." Without doubt, as soon as the Editor can see his way to do so, one or two papers on the subject will be given.—G. E. B.

Compound Kaleidoscope.—R. W. J. L. (*Gawler, S. Australia*).—The specialist of WORK staff cannot direct you where to buy, but he will write you as to one of his own make for sale.

Ebony.—E. H. B. (*Marple*).—I do not think you will be able to get the ebony as wide as you require it, but you can join it. Write to Snewin, Timber Merchant, Back Hill, Hatton Garden, E.C.—A. J. H.

Timber Pieces.—G. R. (*Hull*).—Few yards care to cut off short pieces of timber, and as the size you require is not a stock size, you had better get two pieces and join them. I expect the nearest size obtainable will be 8 in. × 8 in., and this you may not be able to get in yellow pine; but you should be able to get red pine, and some of this is soft and easy to make. Here are some firms in Hull you could try, but I am not sure if they cut small quantities:—H. Smith & Co., Hull; W. Hodge, North Side, Queen's Dock; Wikner & Co., Hull; Simpson & Co., Hedon Road, Hull.—A. J. H.

Sign Writing.—C. M. (*Gloucester*).—A letter awaits you at the office of WORK. Please send full address.

Clock-Work Turn-Table.—A. J. L. (*Walthamstow*).—By all means send in description and sketches of your machine—*on approval*.

The Seal Gas Engine.—J. L. (*Leeds*) and others.—Full particulars of the above can be had by writing to J. Seal, 67, Carthew Road, Hammersmith, London, W.

Glass Writing.—H. P. (*Plaistow*) refers to my answer in No. 79, page 436, and says:—"I am much interested in above subject, and with reference to advertising tablets (opal and other glass). The Brunswick black I believe is removed from tablet by stencils. This is my difficulty: how to remove the B B through the pattern. You can understand it would take too long a time to paint them separately. B B is painted all over glass, and pattern brushed out or removed, how?"—I do not understand the foregoing, and will not criticise—that would be cruel; but will H. P. really say what he wants, and then I or someone else will endeavour to help him. I do not think he understands the answer I gave on page 436: that is glass embossing; but I judge what he wants to know is something in reference to lettering labels and signs. He says, the "B B, I believe, is removed by stencils." Is not the stencil laid on the surface to be lettered? And when removed, will it not of course remove the B B, except the stencilled letters? That is plain enough; but he says, "This is my difficulty: how to remove the B B through the pattern?" Does he mean any B B which has soaked through the pattern? I hardly think he does, yet what else he means I cannot tell, as he certainly does not want to remove the

letters which have been stencilled. The last sentence is a conundrum, and I must give it up. "B B is painted all over glass, and pattern brushed out or removed, how?"—O. B.

Air Compressing Pump.—EXPERIMENT.—You would undoubtedly obtain more power by heating the air, and it could be done by putting a fire under the receiver, but this, of course, will consume fuel, and, in fact, make your machine a hot-air engine. A paragraph in your letter suggests that you expect, when you have once charged your receiver, the engine will go on compressing sufficient air to work itself. This would make it a perpetual motion machine—in fact, you would be obtaining power (if only to overcome the friction of the mechanism) from nothing, a result which is mechanically and physically impossible. Your engine will run just so long as the pressure you put into the receiver to start it lasts. If the air is heated by a fire, that is another matter altogether. If my surmise is correct, do not waste time or money on what must prove a failure.—F. C.

Fixing Dial by the Compass.—G. S. (*Walworth*).—It is to the true or astronomical north, and not to the magnetic, that the dial will have to be set. At page 436, Vol. II. (No. 79), directions will be found for fixing a dial by the compass. It is not easy to state precisely the amount of the variation of the needle. The annual variation is now very small, and practically unimportant; but there are local variations depending on local causes, and there are diurnal variations; the needle may also be much affected by magnetic storms. Roughly, perhaps, the variation at Greenwich may be some 18° or 19° W. In taking a walking tour by the aid of a map and pocket compass, the tourist will, we presume, scarcely be so particular as to take the declination of the needle into account, unless he is travelling for scientific purposes.—A. Y.

Roof.—I. F. (*Mullingar*).—I know of no composition with which you could point the slates on the outside with the idea of making the joints proof against the drifting rains. The only thing left for you to do now is to get under the slates from the room below, even if you have to cut a hole in the ceiling, and point between the tails of one course and the heads of another with hair mortar, or, better still, render all over the under side. Of course, you could not do the above if the roof is boarded, and from your letter I should think it is not; but if it should be, you had better strip it, and cover the boards with sarking felt, and re-lay the slates. This latter is a good plan, and delays the passage of heat and cold.—E. D.

Improvements in WORK.—G. P. (*Elgin*).—All the suggestions you are kind enough to offer have been before us before. All have had and will have every consideration.

Back Numbers of WORK.—A. B. (*Aylesbury*).—As your bookseller is so dilatory in obtaining for you the back parts of WORK, you should apply direct to the publishers—Cassell & Co, Ludgate Hill, London, E.C. So, too, should every intending subscriber who may be in a similar plight to you.

Improved Attachment for Lathes.—C. H. S. (*Nottingham*) and others.—For information *re* the above (see page 583, Vol. II.), apply to the makers, Messrs. F. M. Rogers & Co., 21, Finsbury Pavement, London, E.C.

Blinds.—W. W. (*Brixton*).—I appreciate your ingenuity, but can see no probability of profit by persevering with your idea. Venetian blinds are now out of fashion; they will some day again be the right thing, but not yet. Even roller blinds are now being discarded in favour of curtains. But if Venetian blinds were universal, the "cord guide" is not required if the pulleys are good and fit the mortices in which they turn, nor do the pulleys break with fair usage, while in the case of wheels which do not fit the mortice, indicating either wheels not to gauge, or bad morticing, the blind maker will continue to adopt the usual remedy rather than purchase your guides.

Bolt Heads.—W. H. (*Leeds*).—My next article on "Modern Forging" will contain a description of bolt making in the shops, but you must have some appliances and tools.—J.

Petroleum Engine.—R. J. D. (*Edinburgh*).—Doubtful if a small petroleum engine could be made to work. Priestman, of Hull, makes the best in the market. But there is a lot of difference in a model and a large engine. Your safest plan is to get a specialist like "Dugald Clerk," of Birmingham and Manchester, to prepare a design, or advise on the practicability of it.—J.

Repairing.—H. D. (*Hull*).—It is very unlikely that you will be able to match the exact pattern of the stringing on the old furniture you are repairing, as the stringings are made up in large quantities, and it would not pay to make a small lot just to do a repairing job with. Very often the best and most economical way in repairs is to piece up any defective parts of the stringing with bits of suitably coloured veneers. This, of course, means labour. If you determine to buy new stringing, you will find as large a stock at D. Witt & Palmer's, Drummond Street, Euston Square, N.W., as anywhere. It may be easier and quite as cheap for you to buy what you require through a local cabinet maker. You will see that I have referred to inlaid stringing, but if what you want is plain, you can easily make it yourself or buy it from any dealer.—D. D.

Commode.—HONOUR OLD AGE.—A "comfortable" article is that shown herewith. Next to comfort, ranges plainness and simplicity of construction, as you desire. First, there will be a plinth (*i.e.*, bottom part), for making which you will glean sufficient information in back numbers. To the plinth is screwed the carcase proper, which need be nothing more than a plain box with a circular hole in the top. It will answer very well to have a mock panel in front—that is to say, a moulding mitred and glued on to a plain board, instead of having a framing. Pans you can obtain at several shops. The description of the arms and lid must receive your closest attention, as if not made correctly, they will not close together as they are intended to. Four rails morticed and tenoned will make an arm. The height of each arm must be a

Fig. 1.

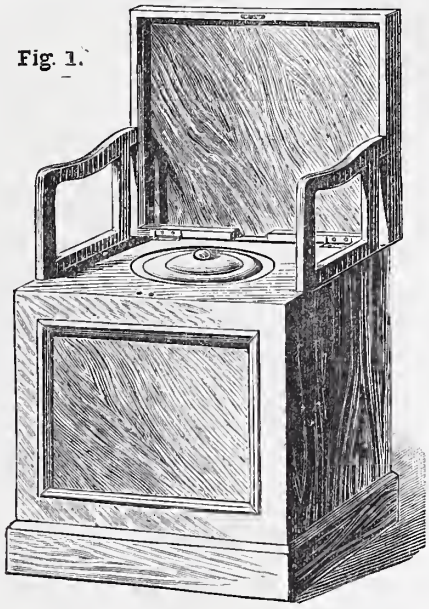


Fig. 2.

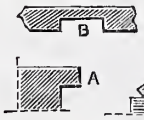


Fig. 3.

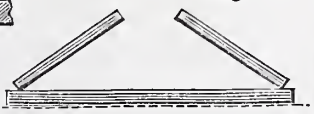


Fig. 1.—Commode. Figs. 2 and 3.—Details.

trifle less than half the width of the commode top. Both arms are hinged to fold together as in Fig. 3. There will be a box lid, the inside depth of which will be sufficient to fit over the thickness of the arms. The sides of the lid will be flush with the side of the carcase; as also will the arms when adjusted. Were the whole depth of the back of each arm to fit close up against the front edge of the lid when they were adjusted, the lid would not close properly; therefore, the greater part of the depth must be at a distance from it equal to the thickness of a side of the lid, while at the top at the back of each arm there will be a projection as at A in Fig. 2; and to accommodate both projections when the arms are folded, a piece must be cut from the side which forms the back of the lid, as in Fig. 2, B, and Fig. 1.—J. S.

Welting.—H. G. (*No Address*).—First buff or scrape the welts well on the grain side (this is the smooth side), and then cut the pair in two, right down the centre, and put them in clean water to get well soaked through. Welts are unlike all other leather in a boot, for they must be worked wet. While wet, take them down to the substance you require them, taking this surplus off the flesh side. Then skive a piece off the whole way down, about

Fig. 2.

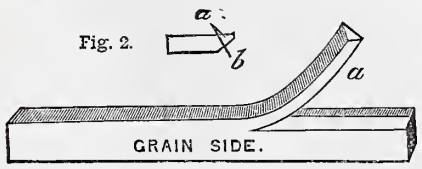


Fig. 1.

Boot Welting.

two-thirds of the way through, and about $\frac{3}{16}$ in. wide; take this off the grain side, as *a*, Fig. 1, then measure the length of the waist with it, and skive the grain off for that distance, leaving the welt half the substance in this place as that which is going round the forepart. When you have sewn in the welt round to the other side of the waist, skive the other end the same. Fig. 2 shows how the welt should look if cut through the centre, and *a b* where it must be sewn.—W. G.

Italian Renaissance Overmantel.—R. H. H. (*Shutter Oak*).—A design and description of this to match the mantelpiece is in the hands of the Editor.

Polish.—S. S. (*Salford*).—In matching up satin walnut, the polisher must use his judgment, for the work can hardly be regarded as mechanical. Naturally, the stain must depend entirely on the colour or tint of the lighter parts, and of those to which they are to be darkened. As a general thing, I think you will find that a little weak brown stain will do anything you require. It can, of course, be altered slightly when necessary in colour by the addition of other pigments, according to the tints desired.—D. D.

Dragon's Blood.—HEN.—All you have to do is to put the dragon's blood in the oil.—D. D.

Polishing.—AMATEUR.—Without seeing the whatnot, it is impossible for anyone to state positively the cause of the colour having changed, and the defect in the polish. Perhaps both, especially the latter, may have been caused by the use of some unsuitable mixture as a cleanser or polish (reviver, for some of these are extremely deleterious to French polish. The fault may be in the polish itself, and your description might indicate that too much glaze has been employed. Then the wood may have been damp. I can only recommend you to submit the thing to the inspection of an experienced French polisher. It is not likely that the original colour and gloss can be restored without repolishing.—D. D.

Damaged Flute.—YUCATAN.—The only means of repairing the damage described is to remove both pillars, and then cut a piece of German silver or silver plate to form a new base for them; cut away the wood round the broken part and between the pillars to shape of plate to form a seating for it, so that it may lie flush. Then solder on your pillars (with silver solder), and screw the plate into position with three small screws. The plate would look best if oval in form, but you will be guided as to this by the size and shape of the broken part. Unless YUCATAN is a very expert mechanic, we should advise him not to attempt letting in a piece of wood. He would almost surely spoil his instrument, whilst there is no great difficulty in the plan suggested above. The key pads of wind instruments could not be made in the way described. The cardboard would be too hard to take the impression of the keyhole, and would, consequently, not be air tight. The best pads are skin pads, *i.e.*, a fine skin drawn over wadding. These pads are mostly imported from abroad, as it is difficult to procure skin of the proper thickness here—the bladder skin referred to by YUCATAN being too stout, and gold-beaters' skin too fine. The pads most generally used, however, are made from lamb skin. The cuttings from a glove manufacturer's answer admirably.—G.

Triple Optical Lantern.—J. P. (*Blackburn*) and others.—Messrs. T. S. & W. Taylor, Slate Works, Leicester, can supply the entire lantern fronts ready for attaching to the woodwork at the following prices:—A pair of fronts for the lower or twin lantern, well finished in brass, with adjustable slide stages open at the top and sides, and fitted and hinged together ready for 4 in. condensers, £1 18s., or with double or triple draw tubes (for convenience of focussing when lenses of varying foci are used), £2 8s. and £2 18s. respectively. If a rolling curtain diaphragm is fitted to either of the above, the charge will be 5s. extra. The cost of the remaining front for the top lantern will be proportionate to the above. Readers desirous of fitting the lanterns with these ready-made fronts will do well to obtain them previous to cutting the condenser openings in the woodwork, as it may be necessary to plant the latter in a slightly different position in order to suit the fronts. Messrs. David Noakes & Sons, Billingsgate Street, Greenwich, are also willing to supply amateurs with all parts required in the construction of lanterns.—C. A. P.

Whetting Gravers, etc.—S. T. R. (*Dursley*).—The graver should have been a "lozenge" one. You will, no doubt, be able to cut a sufficiently fine line with the one in question. Yes. The ordinary eye-glass is much used for small work, but for large work a larger glass is used, mounted on a stand with a projecting arm, which can be raised and lowered, and also swivelled round in any direction circumstances may require. The letters cut with a flat bottom are done with a graver whetted at an acute angle like the one sent, and then flattened off to the required width. A great deal of cheap lettering is done with a shading graver of the required width of cut, and then finished with the ordinary angle graver. Use a much shorter graver than the one sent, and, by the way, you will find our English gravers quite as good as those of foreign make.—N. M.

Decorating Overmantel.—APPRENTICE.—There can be no objection to your decorating the top panel of the overmantel you have made with fretwork. This should naturally be of such a character that it will harmonise with the rest of the design. I am inclined to think that by "top panel" you mean pediment, in which case if the overmantel is a tall one you will probably find a few bold lines and broad treatment more effective than a quantity of small niggling work.—D. D.

Squeezing Wax.—F. W. H. (*No Address*).—Take half a pint of boiled linseed oil, half a pound of best beeswax, two ounces of Burgundy pitch, two pounds of best flour, and one pennyworth of

dragon's blood. Cut the wax into thin slices, place it an earthenware pot along with the boiled linseed oil and Burgundy pitch, and melt slowly. When the ingredients are thoroughly well blended, put the flour on a tin tray, and pour the mixture gradually in, rubbing the flour thoroughly well into it. It is difficult to mix wax quite properly, but very good wax can be obtained ready mixed from a carver—say W. Angus, Northumberland House, Purves Road, Kensal Green, W., at 2s. 6d. a pound. Orders must be accompanied by the money and postage.—M. E. R.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Feather Sorter.—C. J. (*Birmingham*) writes:—"Kindly tell me, any reader, how to make or where to buy a cheap feather sorter and duster for hand-power to take about 20 lbs. or 30 lbs. at a time."

Printing on Tin.—D. E. E. (*Banchory*) writes:—"Will any reader kindly give me any information regarding the process of printing on tin? I am led to believe I am to be put on such a job shortly, and not having done such before, a tip or two from you might come in handy. The job will be in three or four colours."

Frosting.—BETA writes:—"Would any reader kindly let me know how to frost or obscure glass (windows)?"

Lacquer for Brass.—PATIENCE would thank anyone who would tell him the receipt for a good lacquer for brass.

Indiarubber Ornaments.—ADIE writes:—"Will any reader kindly tell me how to melt and mould indiarubber for making ornaments, etc.?"

Browning Gun Barrels.—C. B. F. (*Seacombe*) writes:—"Will any reader give me information through 'Shop' on browning gun barrels?"

Photography.—C. E. H. (*Horwich*) writes:—"Some two years ago I saw an advertisement in a paper about painting photographs on glass; it was not crystoleum, but was a word that sounded like "trans-toleum." I quite forget the word, but it was a new way to paint photographs. It was somewhere in London, and they supplied you with work. Will any readers kindly tell me what they know about it."

Joiners' Bits.—A. A. W. (*Leicester*) writes:—"Will some reader give me a list of the bits joiners use for boring purposes, their name, and what they are used for, and why? I notice there are several kinds of twill bits (I think that is the name). Is one better than another in certain cases, and why?

Soldering.—NORTHERNER writes:—"I shall be very glad of a few hints regarding the hard soldering of delicate articles. I do not manage so well as I could wish, and shall be very thankful for a hint or so from one who knows. I should like to know, for instance, how a thin gold bevel for a Geneva watch is repaired when it is broken. My method of doing it is to fasten the bevel down to a charcoal block—the ends together—then apply the borax, and when it has gone all round, lay on the solder; but here I, not long since, miserably failed, as I found to my cost, for a new bevel had to be bought. Whether the solder was too hard for the gold or not, the bevel was spoilt and could not be repaired. I generally have little difficulty in doing solid rings or articles of some substance, but fragile pieces I generally fail in. I use a spirit-lamp and ordinary blowpipe. I should also like to know how spectacle frames are treated after soldering in order that the blue may be of even shade, and the usual method of bluing. I have seen boracic acid mentioned in the hardening of small steel articles. Is it simply used as a flux to prevent scaling, or is it for some other purpose?"

Silk.—J. S. (*Ramsbottom*) writes:—"Can you inform me (*a*) How to keep silkworms? (*b*) Also the best way to dispose of the silk profitably? (*c*) Also where to procure the eggs? (*d*) Being a cotton weaver, would it be best to weave it myself?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

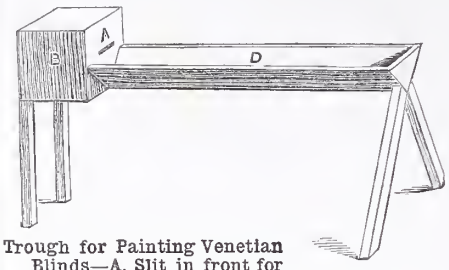
Bursting Water-Pipes.—G. F. UNDERWOOD (*Habberley Road, Kidderminster*) writes:—"In reference to bursting water-pipes (see No. 86, page 554), if GLASGOW will give or send me his address, I will send him sketch of a valve of my own invention that I think will fulfil his requirements."

Picture-Frame Moulding.—J. H. B. (*Pendleton*) writes, in reply to H. R. (*Bacup*) (see Vol. II., No. 83, page 506):—"I have found Mr. G. Williams', 9, Albert Bridge, Manchester, a good shop for the above."

Patent.—F. A. E. (*Tufnell Park*) writes, in reply to G. L. S. (*Darlington*) (see page 686, Vol. II.):—"Messrs. Ayrton & Thomas, of 9 and 10, Southampton Buildings, London, W.C., are trustworthy; they are taking out my father's patents all over the world. They publish a book called 'The True Position of Patentees,' 1s., post free."

Heating Tools.—W. H. P. (*Hornsey*) writes, in reply to A. T. M. (*Lichfield*) (see page 686, Vol. II.):—"If he has access to a kitchener, he will find it answer well to let the ends of the tools rest on the top of range. If not, an iron shovel placed on top of an ordinary fire will do as well; he will find the tools keep much cleaner this way than putting them in the fire."

Venetian Blinds.—G. H. (*Liverpool*) writes, in reply to ASPIRANT (see No. 84, page 522):—"You can make a 'boat' for rapidly painting Venetian blinds in the following way:—Make a wooden trough with V-shaped ends (say about 6 in. or 7 in. deep) of any convenient length, 3 ft. or 4 ft. long might do, to hold the mixed paint, supported on legs, and at the left-hand end place a wooden box made to hold two ordinary scrubbing brushes placed one over the other face to face, allowing just sufficient room for a Venetian lath to pass comfortably between them. The lath is first dipped about one-fourth of its length in the paint trough to take the paint, and then



Trough for Painting Venetian Blinds—A, Slit in front for passing Lath through; B, Box containing Brushes; D, Paint Trough or Boat.

passed through the opening in the box, passing between the brushes and out at the back of the box, being caught by finger and thumb of both hands on its edge at each end as it passes out, so as not to rub off more of the paint than can be avoided; the lath is then hung on projecting rods to dry, the rod passing through the holes in the lath. Top and bottom rails are usually painted by hand. Brushes must be so fixed in box as to be steady and not move when laths are being passed through. I send small sketch, and hope the hints may be of service to ASPIRANT, but would strongly advise ASPIRANT, if he takes up Venetian blind painting and making for trade purposes, to add upholstering to it, as the Venetian blind trade is so cut up nowadays that it requires one's utmost care and economy to make it pay."

Coloured Patterns on Canvas.—J. H. B. (*Pendleton*) writes, in reply to To Po (see Vol. II., page 554):—"To Po will find Briggs' patterns useful. They are sold on sheets of white tissue paper, and are stamped by applying a hot iron to the back. Books of patterns are kept by most small-ware dealers."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. H. S. (*Dover*); A READER (*Hackney*); E. H. H. (*Chatham*); J. H. S. (*Romsey*); L. U. N. (*Liverpool*); A. T. (*Burnley*); J. E. A. (*Aldershot Camp*); VARNISH; VENEER; LUX ET VERITAS; W. W. (*Bradford*); T. T. (*Birmingham*); PUCK; W. J. (*Heaton*); A. M. (*Stoke-on-Trent*); TALBOT (*Highgate*); H. S. O. (*Hammersmith*); J. J. M. (*Ebbw Vale*); W. J. C. (*Islington*); W. G. (*Barnsbury*); A. J. S. (*Edinburgh*)

Trade Note.

KING'S COLLEGE, LONDON.

DEPARTMENT OF TECHNICAL INSTRUCTION.

Building Construction and Architecture.

The Carpenters' Company, acting in connection with the Council of King's College, London, have resolved on establishing at King's College in the Strand, Evening Lectures on Building Construction and Architecture, and Drawing Classes. Lectures:—These will be given on Mondays, from 7.15 to 8.15, by Banister Fletcher, Esq., F.R.I.B.A., Professor of Building Construction and Architecture at King's College. Each Course will last twelve weeks or thereabouts. Subjects:—Foundations, Brickwork, Building Stones, Timber, its various forms and use, Iron, and its use in Building, Plumbing and Sanitation, Limes, Cements and Concrete, Masonry, Fireproof Construction, Carpentry (roofs and their construction), Plastering and Materials, Architecture and its History. Fee, £1 1s. for each Term.

Drawing Classes and Classes of Design.

These will be held on Mondays, from 8.15 to 9.15, by Professor Banister Fletcher, assisted by a Demonstrator. The Lecture Room, Museum, and Library, will be open free to all students on Friday evenings for Sketching and Study from 7 till 9, the Demonstrator attending. Fees, 10s. 6d. for each Term. Students nominated by the Carpenters' Company for either the Lectures or the Drawing Classes will pay half fees. Application to be made in writing, giving particulars of circumstances, to S. W. Preston, Esq., Clerk of the Company. There will be an Examination at the end of each Term. At the end of the Academical Year, Certificates, money prizes, and silver and bronze medals will be awarded, provided the work is of sufficient excellence. The First Course began on Monday evening, January 19th, 1891. All fees must be paid in advance on the first day of each Term, at the Office of King's College, at which place, as well as at the Hall of the Company, further particulars may be obtained. Those attending the Lectures or the Drawing Classes will have the advantage of a Technical Reference and Lending Library, the Librarian attending each Monday evening.

J. W. CUNNINGHAM,
Secretary of King's College, London.
S. W. PRESTON,
Clerk of the Carpenters' Company.

NOTICE.

A Special Exhibition Number of

"WORK"

(*Separate from the Weekly or Monthly Issue*)

Has been published, and is now on sale, price 3d. (post free, 4d.). This Number consists of 32 pages in a wrapper, and contains an Illustrated Descriptive Account of the most remarkable Exhibits.

Amongst the contents of the Special Exhibition Number are:—

Working Model of Steam Fire Engine.
The Story of the "Work" Exhibition.
Protected Exhibits under Certificate of Board of Trade.
The Value of Art Training to the Professional Workman. By C. R. ASHBEE.
Sir John Lubbock, Bart., M.P.: His Services to Science and Labour.
Fifty Years of Recreation Work. By the Rev. C. C. ELLISON.
Our Exhibits and Exhibitors.
Work and the "Work" Exhibition. By the SECRETARY.
My Ideas about Hobbies. By OPIFEX.
Special Gift Books to Exhibitors.
The Story of the Prize Certificate and Medal Competition.
Certificate Granted to Prize Winners.
"Work": Its Utility and Importance to all Workmen, Professional and Amateur—
I. From the Professional's Point of View.
II. From the Amateur's Point of View.
Statistics of the "Work" Exhibition.
"In Memoriam."
The Polytechnic Institute: Its Work and Its Workers.
The Jurors: How Appointed.
The Jurors' Awards, "Work" Exhibition, 1890-91.

To those readers of WORK who have been unable to see the Exhibition itself, this Special Exhibition Number will be of particular value and interest.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [6 R

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [11 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

Lettering and Sign-Writing made Easy.—Illustrated instructions, and diagrams for marking out eight alphabets, 1s.—F. COULTHARD, Terrace Road, Bournemouth.

Cheap Lots of Designs.—100 Fretwork (speciality), 100 ditto (last season's), 100 Carving, 100 Repoussé, (all full size), 100 Cake-Icing, 300 Turning, 400 Stencils, 500 Shields and Monograms. Each packet, 1s. 100 Decorators' Stencils, 60 large sheets, 2s. 6d. All postage free. Lists sent free.—F. COULTHARD, Terrace Road, Bournemouth. [1 S

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E. [2 S

How to Make a Dynamo.—Third edition, illustrated, 2s. Price lists of Dynamo Castings, Stampings, Wire, &c., 1½d. post free, from ALFRED CROFTS, Electrician, Dover. [3 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

ESTABLISHED 1851.

BIRKBECK BANK,
Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

CASSELL'S TECHNICAL MANUALS.

Illustrated throughout with Drawings and Working Diagrams, bound in cloth.

APPLIED MECHANICS. By Sir R. S. BALL, LL.D., F.R.S. Cloth, 2s.
BRICKLAYERS, DRAWING FOR. 3s.
BUILDING CONSTRUCTION. 2s.
CABINET MAKERS, DRAWING FOR. 3s.
CARPENTERS AND JOINERS, DRAWING FOR. 3s. 6d.
GOTHIC STONEWORK. 3s.
HANDRAILING AND STAIRCASING. 3s. 6d.
LINEAR DRAWING AND PRACTICAL GEOMETRY. 2s.
LINEAR DRAWING AND PROJECTION. The Two Vols. in One, 3s. 6d.
MACHINISTS AND ENGINEERS, DRAWING FOR. 4s. 6d.
METAL-PLATE WORKERS, DRAWING FOR. 3s.
MODEL DRAWING. 3s.
ORTHOGRAPHICAL AND ISOMETRICAL PROJECTION. 2s.
PRACTICAL PERSPECTIVE. 3s.
STONEMASONS, DRAWING FOR. Cloth, 3s.
SYSTEMATIC DRAWING AND SHADING. 2s.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

A. T. TALLACK
Engineer & Patent Agent.
28 HATTON GARDEN, E.C.

English, Colonial, and Foreign Patents at Reasonable Charges.

SPÉCIALITÉ.

The Patenting, Working out of Inventions, and making Practical Models, Special Tools, Drawings, Engravings, &c.

If you have a novel idea which has merit, provisionally protect it at small cost, and you can make money out of it.

PARTICULARS FREE.

USEFUL MANUALS.

PRACTICAL ELECTRICITY. By Prof. W. E. AYRTON, F.R.S. With Numerous Illustrations. Fourth edition. 7s. 6d.

NUMERICAL EXAMPLES IN PRACTICAL MECHANICS AND MACHINE DESIGN. By ROBERT GORDON BLAINE, M.E. With an introduction by Prof. JOHN PERRY, M.E., D.Sc., F.R.S. Twenty-six diagrams. 2s. 6d.

APPLIED MECHANICS, ELEMENTARY LESSONS ON. By Sir ROBERT STAWELL BALL, LL.D. 2s.

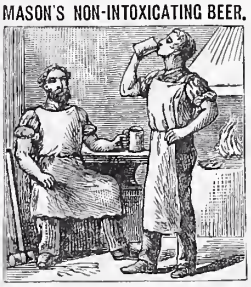
THE AGE OF ELECTRICITY, FROM AMBER SOUL TO TELEPHONE. By PARK BENJAMIN, Ph.D. 7s. 6d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London*

TOOLS
MOSELEY & SON
323 HIGH HOLBORN LONDON.W.C.
200 PAGE CATALOGUE
700 ILLUSTRATIONS
PER POST 6D
ORDERS OF 10/- CARRIAGE PAID

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER.



MASON'S WINE ESSENCES.

These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. One Tablespoonful of Mason's Extract of Herbs makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, *Nottingham.*

The Important New Serial Publication.

In Monthly Parts, price 7d., CASSELL'S

C. S. of G. I.

STOREHOUSE OF GENERAL INFORMATION.

FULLY ILLUSTRATED WITH HIGH-CLASS WOOD ENGRAVINGS, AND WITH MAPS AND COLOURED PLATES.

Part 1 ready January 26, 1891.

This is an **entirely New** Dictionary of General Information, written by the best authorities, comprehensive in subject and detail, brought up to the latest date in all departments, and fully Illustrated by clear and skilfully executed Engravings, in addition to Maps and Coloured Plates.

☞ With *Part 1* will be presented a Series of *Four Coloured Plates*, illustrating in a novel and attractive manner, *Botany, Geology, Architecture,* and *Human Physiology.*

*** Full Prospectuses may be obtained at all Booksellers', or will be sent post free from the Publishers,

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

MANUALS OF

TECHNOLOGY.

Edited by Prof. AYRTON, F.R.S., and RICHARD WORMELL, D.Sc., M.A.

THE DYEING OF TEXTILE FABRICS. By J. J. HUMMEL, F.C.S., Professor and Director of the Dyeing Department of the Yorkshire College, Leeds. *With Numerous Diagrams. Seventh Thousand.* 5s.

STEEL AND IRON. By WILLIAM HENRY GREENWOOD, F.C.S., M.I.M.E., &c. *With 97 Diagrams from Original Working Drawings. Fourth Edition.* 5s.

SPINNING WOOLLEN AND WORSTED. By W. S. BRIGHT MCLAREN, M.P., Worsted Spinner. *With 69 Diagrams. Second Edition.* 4s. 6d.

CUTTING TOOLS. By Prof. H. R. SMITH, Professor of Mechanical Engineering, Sir Joseph Mason's College, Birmingham. *With 14 Folding Plates and 51 Woodcuts. Third Edition.* 3s. 6d.

PRACTICAL MECHANICS. By J. PERRY, M.E., Professor of Mechanical Engineering, City and Guilds of London Technical College, Finsbury. *With Numerous Illustrations. Third Edition.* 3s. 6d.

DESIGN IN TEXTILE FABRICS. By T. R. ASHENHURST, Head Master, Textile Department, Bradford Technical College. *With 10 Coloured Plates and 106 Diagrams. Third Edition.* 4s. 6d.

WATCH AND CLOCK MAKING. By D. GLASGOW, Vice-President, British Horological Institute. 4s. 6d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

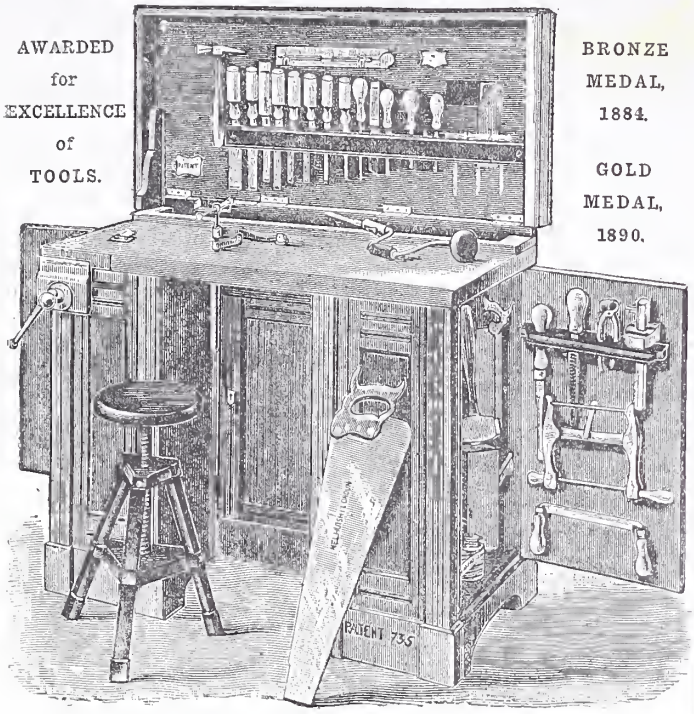
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

FLUID WATER RESISTING **GLUE** (*Patent*) PATENT TINS.

Invaluable for all Out and Indoor Repairs.

FLUID WATER RESISTING **GLUE** (*Patent*) PATENT TINS.

No Brush—No Boiling—Will securely join Wood, Glass, China, Metals, &c.

By Post, 2d. and 1s. 3d. per tin. Through Ironmongers, Chemists, Chandlers, &c., 6d. and 1s. per tin.

Manufactured only by THE WATERPROOF GLUE CO., 62, Dale St., LIVERPOOL.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

Just Commenced, a NEW WEEKLY ISSUE, consisting of the most Popular Volumes in

CASSELL'S NATIONAL LIBRARY,

With Additional Volumes not hitherto published in this Series, and the cloth binding greatly improved in style.

Price *3d.*; or cloth, *6d.*

The following is the order of issue for January :—

NOW READY.

The Haunted Man ... ... DICKENS.

The above Work has not hitherto appeared in the Library.

NOW READY.

Utopia ... ... Sir T. MORE.

NOW READY.

Lays of Ancient Rome ... MACAULAY.

READY JANUARY 28.

Essays on Burns and Scott... CARLYLE.

*** *Intending Subscribers are requested to order the Volumes by Name (not by Number), and to ask for the New Issue.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

New Serial Issue in Monthly Parts, price *7d.*

The Life and Times of Queen Victoria.

With Several Hundred Illustrations.

Part 1 ready *Jan. 26.*

*** *With* Part 1 *will be given a magnificent Portrait of* Her Majesty the Queen, *in her State Robes, taken at the time of the Jubilee in 1887. The Portrait will be printed on a Tint, and will be produced on Plate paper, size 30 in. by 20 in.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY**, imparting **NEW LIFE** and **VIGOUR**. Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION**, and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET**, eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE**, and giving tone to the entire system.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill**, with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design SENT GRATIS with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 98.] SATURDAY, JANUARY 31, 1891. [PRICE ONE PENNY.

Fig. 1.

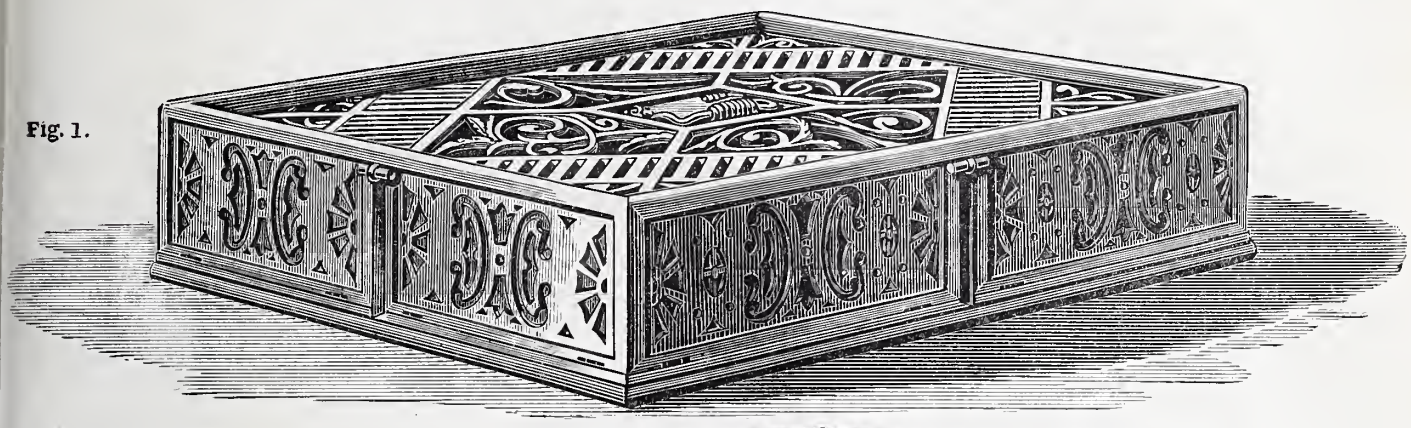
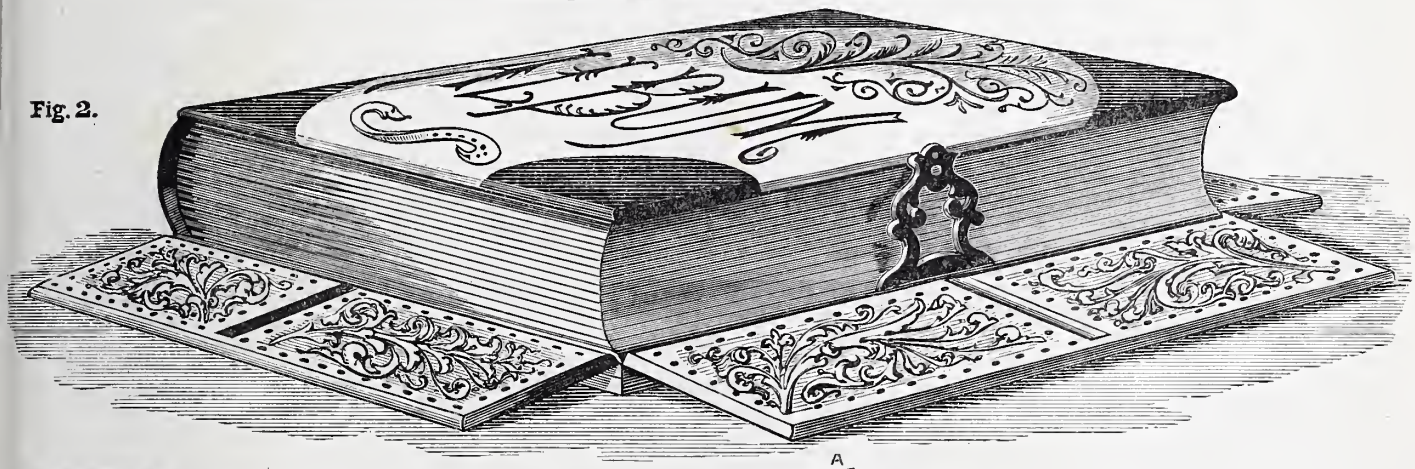
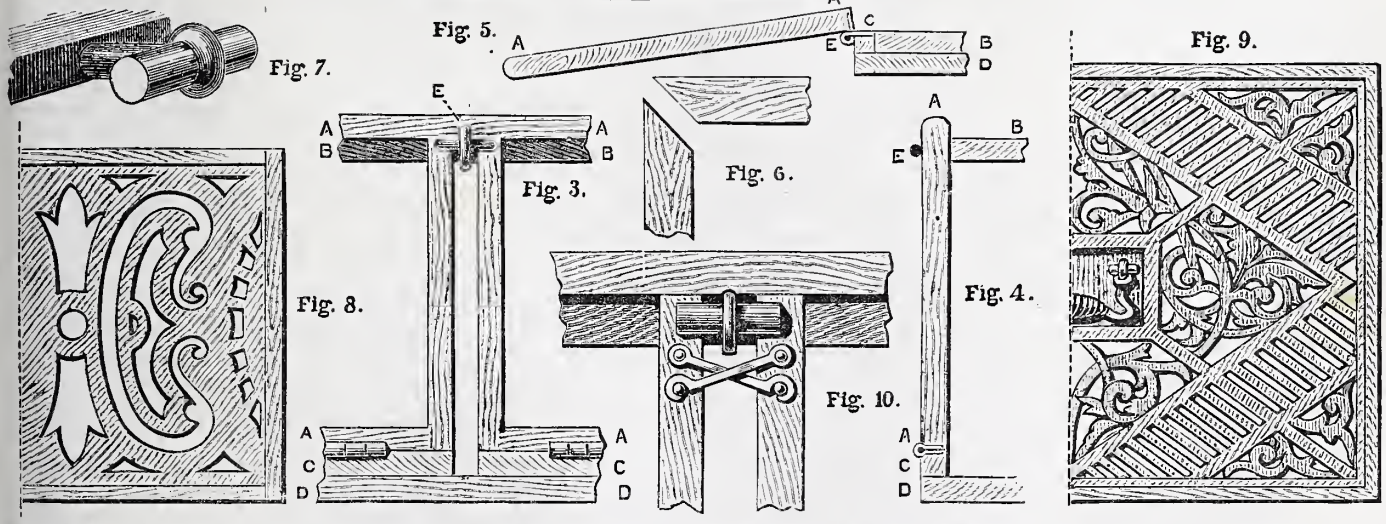


Fig. 2.





AN ALBUM CASE. Fig. 1.—Case with Album inside. Fig. 2.—Case with Album displayed. Figs. 3, 4, 5.—Diagrams showing how Top Board (B) with Peg Arrangement (Fig. 7) works along Side Frames (A, A, A, A). Fig. 6.—Method of cutting Edges of Side Frames. Fig. 7.—Peg shown at E in Figs. 3, 4, 5. Fig. 8.—Pattern of Fretwork for Sides. Fig. 9.—Pattern of Fretwork for Top. Fig. 10.—Hooks (either one or two) to keep Top from falling inwards.

AN ALBUM CASE IN FRETWORK.

BY JAMES SCOTT.

PERSONS who are the possessors of albums, or books of any value at all, naturally have a desire to keep them free from the dust and dirt of daily life, and yet they may have an equal desire to expose them to the eyes of themselves and of anyone who may chance to visit them. The album is, of course, always in demand on the occasion of a visit; but to my mind it does not look right to see it extracted—sometimes with difficulty—from the bottom of some drawer or cupboard; but I am aware that it must be kept in some such place if it is to be taken care of.

With the view of keeping the album always ready at hand, and at the same time to keep it free from dust, etc., I have designed the small article here represented. It will be found very simple to construct, and anyone who can use a fret saw with any amount of skill will doubtless find a certain amount of pleasure, as well as profit, in making one. It is really a fret-cut box, the sides of which are hinged to the bottom piece. When it is wished that the album or book is to be kept free from dust, it is enclosed within the case; when the desire is to exhibit it, it is taken out of the case and placed on the top of it in its opened condition. The top of the case, when empty, is pushed down to the bottom board, the four sides falling down at the same time, three of them being connected with the top part by a peg arrangement (Fig. 7), the other side being free, and serving as a lid.

It will be apparent that a merely fret-cut case will not serve to keep the dust out. Knowing this, and also considering its embellishment, I should advise painted pieces of satin, silk, ivorine, or some similar substance, to be fastened, by means of plush-covered or brass-headed studs, to the inside of each side piece, and also to the under part of the top board. The effect to be produced by this showing through the fretwork will be very pretty, and it will afford a desirable change as ornament when the album is displayed upon it.

It will be almost useless to give sizes of this case, as the dimensions of albums, etc., vary so much. Unless the hooks shown in Fig. 10 are used, it will be preferable to make the case of such size that the intended contents will just fit it. If the hooks are made use of, it will not matter if the case is a little larger than the album.

All the parts used in the framework should be of the same thickness. Fig. 1 shows it as it would appear with or without the album inside it. Fig. 2 shows it as it would look when open, and with the album displayed upon it. It will form a tasteful ornament whichever way it is shown, and will not be without its use. All the parts are connected one with the other, and whether open or shut, neither part will be entirely separated from its fellow pieces.

First—we have the bottom board, which should be a trifle larger than the outside dimensions of the case proper, and rounded on its edges. Round the top of this is fitted pieces of the same thickness, and square in section. Presuming that on one long side will be the lid, it will be necessary to cut a small piece from the middle of each of these last-named pieces (C, C, C, Figs. 3, 4, and 5), with the exception of that piece on the side of the lid. Then for each of the three side frames we require one long top strip, two bottom pieces, and four uprights. These are joined together, as can be seen by a glance at Figs. 1 and 3. The lid need consist of only four pieces. Each end of each of the four sides will have to be canted, to allow them to fit properly together (Fig. 6), and must not be glued. The top part must be of a size that will fit *exactly within* the sides. A peg (Fig. 7) is intended to be screwed into the thickness of the top part on three sides, in such a manner that it will work freely up and down the space in the middle of each of them. E, E, E, in Figs. 3, 4, and 5, indicate this peg. When the top board (B in Fig. 3) is pushed down it will fit between the three pieces C, C, C (Figs. 3, 4, and 5), thus releasing the sides A, A.

A small handle must be fitted in the centre of the top board, and must be sunk flush with the surface of the wood; as, if it projects above it, the album will not lay flat. Fastenings for the lid are so numerous that I shall not dwell upon them here.

This idea admits of a great deal of improvement. The sides might be higher, and shaped on top, instead of being quite straight, as I show them; or the case might be raised on four turned columns or brackets, thus allowing the four sides to fall down perpendicularly. Then, of course, different patterns of fretwork more according to the taste of the maker could be used. At all events, whether carried out as I describe or improved upon, as I said before, a pretty and useful ornament can be made.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

GRAINING ROSEWOOD, AMERICAN WALNUT, BIRCH, TEAK, AND OTHER FANCY VARIETIES OF WOOD.

THOSE varieties of native or foreign woods the imitations of which have already been treated in this series may justly be considered the staple lines of the grainer's craft. Beyond these, there are, however, a useful selection of woods without a practical acquaintance of which no competent grainer must rest satisfied. Ever-changing fashions in furniture and cabinet work have much to do with the demand for or neglect of some of these imitations; I have, therefore, selected those likely to be of the most practical service to the worker of "to-day."

American Walnut is a hard wood so much in vogue at the present time, and withal of such an admirable nature for painted imitation, that I give it some prominence in this selection. The ground for this should be of the medium oak shade, but very much more *neutral* than the grounds for knotted walnut. Although a little Venetian red and ochre are required for the colour, the burnt umber pigment must be in excess of both, a "drab" resulting.

If executed upon woodwork which is well lighted, the imitation is best without much contrast between ground and grain colours; but for ordinary staircases and dark positions the ground should be kept lighter, this plan being preferable to overloading the graining with strong glazes and black veins of pigment. In imitating this wood, we may get a very passable effect in one distemper process; but for good work, binding down and a second treatment is necessary. Assuming that an ordinary door is being worked, we will take the first method. The tools most useful for this imitation are a thin oak overgrainer, a large mottler or worn-in sash tool, a veining fitch, and the indispensable "water tools"—badger, sponge, and leather. Good burnt Turkey umber, finely ground in water, gives the best colour for the graining; but as this is rather difficult to get, vandyke brown may readily be substituted for it. A portion of this pigment being rubbed up with the palette-knife and also a little ivory or lamp-black—the latter worked up with beer—they are placed handy in separate vessels; whilst some dilute beer will also be required. With the mottler, or large tool, we first rub in the panels of our door, dipping the brush first into the clear liquid, and then into the brown pigment. By using the brush slantways down the panel, we readily get a variety of *shades*, and give a lead to the grain. With the badger we then work in a finer grain, using it not as a softener, but with pressure upon the sides of the hair. After a little practice it will be found that every required variety of grain can thus be made, and a natural softness is finally given to it by delicately softening this work *across* the grain at a slight inclination. The panels are now allowed to dry, and for many purposes this is all that need be done to them. The stiles are next rubbed in and treated in the same manner, working up from the bottom, and finishing each rail and stile as we proceed. The moulding "quirks" must, of course, be done with the stiles, and the success of the latter will naturally depend upon the *variety* of colour-depth and grain we get when rubbing in and badgering. If the broad mottler is used for spreading the colour, we may get the occasional effect of cross-reflected lights upon the stiles, and these in the badgering are broken up to the least possible extent. The mouldings are run in at the last, and with either a darker or lighter tone than the rest of the door, or, better and quicker still, coated with beer and pure black, in imitation of ebony. When well varnished this combined effect is very good, and particularly agreeable to those who believe in the grainer always "operating with reserve." When "cost" is subjective to effect and finish, we varnish the first graining, and then with a hog-hair veining fitch proceed to run in the dark top veins. If the panel is now rubbed over with a *slightly stained* weak beer-wash, we can the better work the fitch and soften off the veins. The stiles may here be slightly darkened all over; they will then "cut up" and contrast much better with rails in which a little strong grain is put in, than were all parts to be equally figured. From the foregoing, it will be gathered that the badger is the most important tool used, and that for the threefold purpose of making and softening the undergrain, and for stippling the plainer portions, no better means could be desired, nor better effects otherwise obtained.

Rosewood, or Palisander—by which latter name it is generally known in continental Europe—is a variety of hardwood that is now rather out of fashion for furniture. There are very few persons, however, who have not seen it, if only in the form of a fancy writing-desk, or such article. As rosewood has characteristics not common to any other wood here mentioned, and since it is a very useful variety for ornamental work and imitation inlays, I append brief instructions for graining it.

Rosewood is found in many varieties in India, South America, and Africa; and that with which we are most familiar is of a dark and rich general tone, having a ground of red shades, and being beautifully marked with dark brown and black figure and veins. This red ground may be made with Venetian

red, a little white lead, and burnt umber. If for a bright and strongly marked sample, vermilion may be used with the Venetian, whilst yellow ochre will furnish more orange tones, if desired. The earlier grainers were rather partial to the bright reds, but the most natural and "restful" imitations will be obtained with softer and broken tones. In graining, we may with advantage use warm tones—vandyke and burnt sienna—and also the cool tones of indigo or blue-black ; or for a simpler effect, a mixture of sienna and black will suffice. In both cases a good black pigment is required for the veins, and a little victoria or mahogany lake for the after-glazing.

The tools are those we use for mahogany and walnut, the appearance of rosewood partaking of the silky mottle and rich colour of the former with some of the strong figure and veins of the latter. A thin "warm" wash of dilute beer being spread with the tool or mottler, and with varied and richer tones of colour, the panel is then streaked into light and dark portions of wood. The light portions are now broadly mottled with a "cool" wash, and then the whole softened. Whilst still wet, we take the thin oak overgrainer, and put in the black and vandyke veins, working the tool as for walnut, but with more black and less curly markings. The veins are now well badgered, and any plain portions may be stippled ere the panel dries. If desired, it may afterwards be wetted over with clean water and a broad mottler, and the black veins then worked up and added to with the veining fitch or sable pencil. Varnishing, or "binding down," comes next, and then a wash of mahogany lake and vandyke. This is slightly mottled or wiped out with the leather, the knots worked up and shaded, and then all softened with the badger, after which a good coat of varnish completes the imitation. The richness and beauty of good rosewood can scarcely be gathered from such small surfaces as were previously indicated. A piece of old solid rosewood furniture which recently came under my notice, and the wood for which had been brought to this country by a master mariner, was of such unusual beauty, that I was almost tempted to try and reproduce it in black and white herewith ; but wiser thoughts prevailed. It consisted of a large heart-shaped centre or knot, out of which bright and reflected rays, or lights, spread out on either hand ; shaping up and surrounding which was black veining of so pretty and symmetrical an arrangement, that had it been a grained imitation, I verily believe any person acquainted with the subject would have condemned it for this very prettiness. It is therefore advisable that the student of graining should endeavour to fix in his mind all such natural grain arrangements of the more costly woods that he may come across, and then work them out in his practice and study.

Teak is another variety of Asiatic growth, imported for the most part from India and Further India. It is of very massive growth, and its extremely hard and durable nature makes it invaluable for ship-building purposes. In the neighbourhood of seaport towns we occasionally find it used for the ornamental parts of house woodwork and for furniture. Its varying qualities of suitability for cabinet-work—some logs being much more amenable to fine work than others—give it only a limited scope in that line. In appearance it partakes of the grain of pitch pine, but in colour, when polished, it more nearly approaches cheap walnut. It may be easily imitated in water graining, after the method explained for pitch-pine. The ground is rather stronger in yellow than for walnut, and much lighter in tone. The graining colour should be brown, free from any "lakey" tone—either burnt Turkey umber or black and burnt sienna —and the veins and figure pure black and very deep browns. The general method of working advised for the two preceding imitations may be followed for teak with equal success.

Imitations of Birch are seldom used for house woodwork, but may be usefully employed for furniture, since bedroom *suites* of the real wood are much in demand. As it is impossible to explain its exact appearance to the student by letterpress or verbal description, I merely append the simple mode of working it, which will be easily interpreted with a real specimen to study from. The ground is a light clean buff, made from white lead, stained with either yellow ochre or raw sienna in oil. In graining, we brush over the surface with a thin wash of warm brown, making the panel of two or three broad colour shades. With a large maple mottler we then mottle from the darker parts into the light, working slantways as for maple, but leaving a broad and stiffer mark. While this is still wet we soften the panel, and then slightly mottle across the previous work to break it up. When this is thoroughly dry we carefully wet the work over with clean water and a clean mottler, and then put in the darker overgrain with a thin oak overgrainer or overgrainer in tubes, using a stronger wash of the same graining colour. A light varnish is advisable for this imitation.

Silver Wood imitation is a variety that has also been, at times, much in request as a finish for bedroom furniture. In "genus" and "order" silver wood is really related to the sycamore and maple, and when graining it many experienced workers rather exaggerate the blue-grey tone which is usual to the real wood. Since woods that possess a general cool tone are very uncommon, this slight forcing of its blue colour may at times be a pardonable matter, but when used in combination with red woods, for imitation inlays, its natural greyness only should be aimed at.

The ground for silver wood should be quite white, prepared from white lead or zinc white. If, as is usually the case, the imitation be worked upon oil-paint ground, it is as well to slightly neutralise the yellowness of the linseed-oil by adding a touch of blue-black. The graining colour is a weak beer wash, stained with blue-black and indigo blue (finely ground in water). This being spread, the "silvery" mottle is worked with a camel-hair mottler in straight sharp lines across the panel, making some portions plainer, as with maple. If the work permits, we at once proceed to wipe out the clear reflected lights from amongst the previous mottling, this being done with, preferably, an old, or "burnt edge," camel-hair mottler. Should the panel dry too quickly over the mottling process, we may leave it until, by wetting over again with clean water, we are able to obtain the desired effect. To finish the imitation, we now put in a fine straight overgrain, crossing the mottling at right angles, and after the growth of the plainer treatments of maple. A thin wash of vandyke brown, used so that the overgrain is just perceptible, will bring out the full value of our cool tones, and whilst softening the form of the mottle will give the faint warm hue which is found in this variety of real sycamore. Softening and stippling with the badger will further be advisable, as in all water-graining. It need scarcely be added that the purest of white varnish should be used for silver wood. For furniture, much of this work is done upon distemper-prepared grounds, as explained in an earlier paper, and for finishing which a white *spirit varnish* is used.

Tulip Wood imitation is an ornamental variety, very useful for painted inlays, being of a rich red colour, and having an uncommon appearance of grain. The tree which is popularly so styled is seldom seen growing to any size in this country, and rarely elsewhere than in gardens. The mature growth of a hundred feet is, however, common to it in its natural climes of North America. Although used both by cabinet-makers and coach-builders, it is seldom worked in any size for furniture. Its imitation for inlay-work may easily be obtained upon a light yellowish-red ground by spreading a thin coat of mahogany lake and a little vandyke thereon. This is slightly stippled, and then the cross lines of darker reds are painted in with an overgrainer or pencil, according to size of surface, using the lake and burnt sienna to the desired tone. When used for inlay the stripes are shown crossways of the line or ornament.

Amboyna Wood is the name of a richly coloured variety, so called from the place it is imported from—viz., the Island of Amboyna, of the Moluccas. Its chief characteristics are masses of small knots, somewhat similar to the clusters found in our native pollarded oak, the colour, however, being brighter and more gairish. As this is seldom used in mass, but only for small surfaces or inlays, imitations of very small knot-clusters of oak will usually suffice. For graining, the ground may be similar to that for tulip wood, or rather more yellow. The knots are put in with a round fitch and pencil, using burnt sienna and burnt umber, or vandyke and sienna ; and the final glaze, after binding down, may be done with varying tones of red and brown.

New Zealand Oak—or Yew, as it is sometimes termed—is a wood very similar to Amboyna, so far as growth and grain goes, but without any of the redness of the latter. In large surfaces we find the masses of knots surrounded by very pleasing surfaces of a plainer nature, wherein are fine grain and soft mottle—in fact, all the features of English pollard oak upon less regular lines. The best colour for imitating this is burnt Turkey umber, with vandyke brown for warmer parts and for the glaze and overgrain.

Purple Wood is the name given to a very deep red variety. As it is used chiefly for fine lines and in minute pieces, its colour-opacity, or positiveness, is the main quality. It is usually worked in soft veins and markings of mahogany lake, ivory black, and vandyke upon a very deep red. In the cheaper imitations of inlay upon light furniture Indian red pigment alone is used.

Black, for painted imitations and inlaying of ebony, may be either lamp-black well rubbed up with old beer, or ivory-black, which can usually be obtained finely ground in "turps." This latter should be put on blotting-paper to draw out the turps, and may then be readily mixed with beer. For line work and fine ornament the purest neutral black must be used ; and the simple plan described above is much to be preferred to that of imperfectly rubbing up the dry drop black.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

Carving in Marble.

The Material, Carrara and Sicilian Marbles—Rough-hewing—The Pointing Machine—Work of the Pointer—Work of the Carver—Tools: the Chisel, the Hammer, the Dummy, the Drill—Sharpening Tools—Carving Hair, Flesh, etc.—Rasps—Sanding Marble—Stopping Holes—Removing Discolorations—Polishing Marble—Carving without Pointing.

Modelling clay and plaster of Paris, however admirable may be the forms embodied in them, are but mean and unenduring materials; and the noblest works of the sculptor cannot be said to have reached their full development until they have been carved in marble. Sir Joshua Reynolds, in one of those well-known "Discourses" for which it has been claimed that they are "canons in art," goes so far as to affirm that sculpture deals with but *one* material—namely, white marble. We of the present age are more catholic in our ideas than were the men of old Sir Joshua's time. We admit that there may be sculpture worthy of the name in metal, in terra-cotta, in stone, in ivory, or even in wood, as well as in marble; nevertheless, marble remains the most noble, the most beautiful, and, all things considered, the most enduring, of the various materials which the statuary has at his disposal.

The marbles used by the sculptors of old Greece, and so familiar to us in classical writers, and in allusions to ancient art—namely, the Parian and Pentelic—are unknown to the practice of the modern worker. Those used by us are almost exclusively Carrara, for indoor, and Sicilian for outdoor purposes. It is the Carrara which we emphatically term *Statuary Marble*, and it is a material worthy of such a distinction. It is imported in good blocks, of a pure, uniform, and brilliant whiteness, semi-translucent, admitting of free cutting and of the most delicate finish. Its defects, or rather, shortcomings, are that it will not bear exposure in the open air to the climate of this country, and that it readily stains or becomes discoloured with smoke. It is costly in England, especially in large and fine blocks; its price, which varies considerably with the quality and size of the blocks, may be, say, from 25s. to 50s. per cubic foot at the importer's yard.

It is quarried at Carrara in Italy, where are works which have been carried on for ages, and some of them are on a colossal scale. The texture varies somewhat in different blocks. Some are much softer than others, and cut with comparative ease; but the sculptor generally prefers the harder blocks, if they are not too hard and flinty, as they permit of much finer finish; the softer blocks are apt to have too great a resemblance to loaf sugar, and to crumble on the edges where delicate work is attempted, which more than counterbalances any advantage they may offer as regards easy working.

Sicilian marble, of which the name denotes the source from which it is derived, is of a firmer, closer, and if the term may be used, tougher texture, than Carrara. It suffers little from exposure to the weather, and is for that reason preferred for monumental purposes and outdoor sculpture generally. Though white, it has not the sparkling, snowy brilliancy of Carrara, but inclines to a slightly bluish-grey tinge; it is nevertheless very pleasing to the eye when the block is one of uniform colour, but it is more subject to dark veins and spots than Carrara. It is less expensive than that variety, costing at a London importer's yard, say, perhaps, 8s. or 9s. per cubic foot. In this there is no difficulty in obtaining blocks of large size, as there may sometimes be in Carrara. Some carvers say that they prefer working in Sicilian, for though harder and needing more highly tempered tools, it has no tendency to crumble, and the chisel can be used upon it much more freely and boldly than on the more delicate stone.

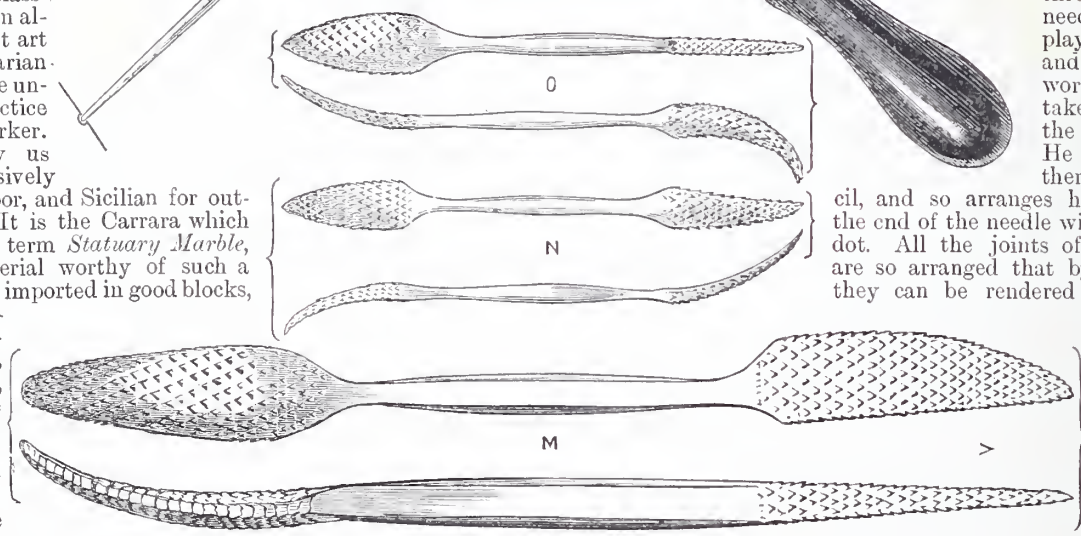
Both kinds of marble are subject to dark spots or markings, more or less, which may be almost or quite imperceptible in the rough block, and only become apparent when the mass has been hewed into something like its required form. These are sometimes so disfiguring as to necessitate having another block. A person of experience in marble working ought, however, from the outward appearance of a block, to be able to form a tolerably close estimate of its internal colour.

The labour of rough-hewing a block of marble into the form of a statue or other piece of sculpture is necessarily very considerable, and contrary to the traditional practice of Michael Angelo, the ordinary carver leaves this to be done by a mason. He can do this in safety by the help of an apparatus known as the "pointing machine." This instrument is of vast service to the art, not only in the above-named respect, but also from its leaving, after the mass of superfluous material has been removed, a series of points or measured distance marks on the face of the marble, which serve to guide the carver in his work. Though the carver is not supposed to do the work of a pointer, it will be both desirable and interesting to explain the manner in which this invention acts. The rough diagram, Fig. 32, will serve to illustrate its principle.

In this we will suppose A to represent a graduated bar of iron, fixed in front of a stone table, on which the plaster model to be pointed from is placed; B will represent a metal upright, which can at pleasure be pushed backwards or forwards on the bar A, or removed from it; C is a cross-arm sliding up and down the upright B; D is a second cross-arm, united to C by a joint, and having at its other extremity a socket, through which a needle, E, can be played backwards and forwards. The workman wishes to take a point, say, on the lobe of the ear. He marks a dot there with his pencil, and so arranges his machine that the end of the needle will just touch the dot. All the joints of his instrument are so arranged that by turning screws they can be rendered perfectly rigid. Having made them quite tight, he moves his machine to a second graduated bar, fixed in front of a second stone table, or "scale stone," on which the block of marble is placed. The scale marked on the second bar is precisely the same as that on the first, and he places his machine at the number corresponding to that from which he has removed it; and it will now be obvious that (as all the joints remain unaltered) when the needle is pushed through the socket to the same distance, it will touch a point on the marble that will exactly correspond with the dot on the model. The pointer hews away as much of the superfluous material as he now sees that he may remove with safety, and drills a hole into the block until the needle will enter to the required distance. The point being now found, he makes a dot on the marble at the bottom of the hole with his pencil, and is then ready to take a second point.

Fig. 34.—Sculptor's Drill and Bow.

Fig. 35.—Sculptor's Rasps, about half size—M, Rasp for Large Surfaces; N, O, Rasps for Small Surfaces.



This diagram is made as simple as possible, that the principle of the apparatus may be more clearly explained, but the reader will see that by interposing additional lengths between C and D, with joints which can be made to bend in every direction, there will be no part of a work of sculpture to which it will not be possible to bring the end of the needle, E, or to take a point. Every required measurement can thus be transferred from model to marble with all but mathematical precision.

So far as we are aware, the pointing machine was unknown to the sculptors of classical times, and to the masters of the Renaissance. Our own great portrait sculptor, Sir Francis Chantrey, has the credit of perfecting it. Before its introduction, measurements had to be taken in a primitive manner, with plummet and compasses. It is chiefly used in marble work, in which great accuracy is most essential, but it is sometimes applied to carving in soft stone, and in wood.

In rough-hewing the marble the workman employs the pick rather than the chisel—a pointed rather than an edged tool. This shells off the waste material in large flakes, and is less liable to bruise or "stun" the marble beneath than a cutting tool. D, Fig. 33, is a small pick.

The number and frequency of the points to be taken depend on circumstances. In the more important parts, as in the face, or where detail abounds, it may be desirable that they should not be more than the fraction of an inch from each other; whilst on broad and comparatively unimportant surfaces, as, say, about the back, it may be sufficient for them to occur at much less frequent intervals. But the carver, as a rule, likes to have plenty of points. With the dots to guide him, the pointer is able to clear away the superfluous material to within, in most parts, $\frac{1}{4}$ in., or even $\frac{1}{8}$ in., of the required surface. In the latter part of his work he exchanges his picks for chisels, and in thus roughing-out the hair and some other portions he will probably use a "claw tool"—that is, a tool with a notched edge: G, Fig. 33, is an example of a carver's claw tool. The block of marble when it leaves the pointer's hands, and whilst as yet untouched by the carver, will generally bear a far stronger resemblance to the finished work than might be supposed possible.

At this time both model and marble have a curious appearance, however, from being pitted, so, to speak, all over with dots in blacklead, those on the marble being all at the bottoms of little holes. The carver requires his work to be perfectly firm; if, therefore, the marble is not of sufficient size to stand without moving under his blows by its own weight, he fixes it with plaster to a block of stone; and that the different parts of the work may be readily brought under the eye and hand, it is well to have a strong turn-table on which to carve, the model being placed on a turn-table beside it. If the object be a bust, it is well to have the head much on a level with that of the carver, as he *stands* at his work; and the light, as in modelling, should fall on model and marble alike, and somewhat from above.

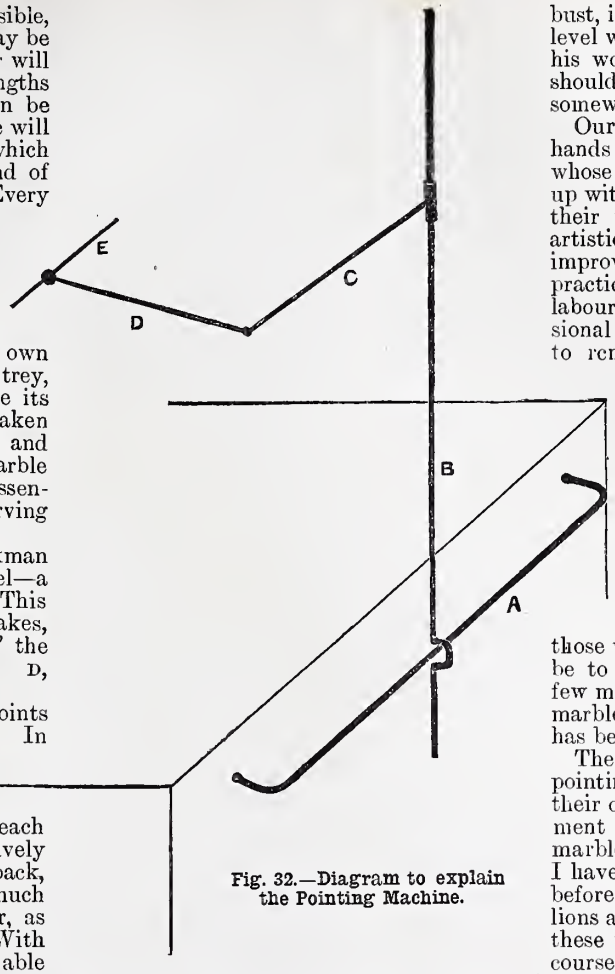


Fig. 32.—Diagram to explain the Pointing Machine.

Our best-known sculptors, men whose hands are always full of commissions, and whose valuable time is almost wholly taken up with modelling, are accustomed to limit their work on the marble to some few artistic finishing touches, and such minor improvements on the model as they may find practicable at the last. By such men the labour of carving is chiefly left to professional carvers, whose business it is simply to render the marble a facsimile of the plaster model. Skilful art-workmen, if not artists, are needed for this, and many of those so employed in this country are Italians. Indeed, it is not an unknown thing for English sculptors to send their models to Italy to be copied in marble near the quarries. The humbler class of sculptors who are less full of employment commonly do their own carving, and so do most amateur sculptors. Indeed, those who follow the art for pleasure, would be to blame if they did not, for there are few more pleasing occupations than carving marble, after all the laborious rough hewing has been done by the pointer.

The more busy sculptors have their own pointing machines, and employ pointers on their own premises; those of less employment place their models in the hands of marble masons who point "for the trade." I have the prices of one of these persons before me. He undertakes to point medallions at from £3 3s.; busts, at from £6; to these prices the cost of the marble has, of course, to be added.

When the carver begins his work, following the pointer, he has no need to trouble himself as to the general form or proportions; of these the machine has already taken care. He has little more to do than to look to the due rendering of such forms as lie between point and point. His work is thus, especially in its earlier stages, wonderfully simplified. As he works down more nearly to the required surface he will, however, find that neither the pointer nor his machine is absolutely infallible. In a delicate work of art, an error of but the fiftieth part of an inch may have serious results, and some of the points are sure to be a little beside the mark, or the holes may possibly have been drilled scarcely far enough, or a trifle too far, and must therefore be accepted with caution;

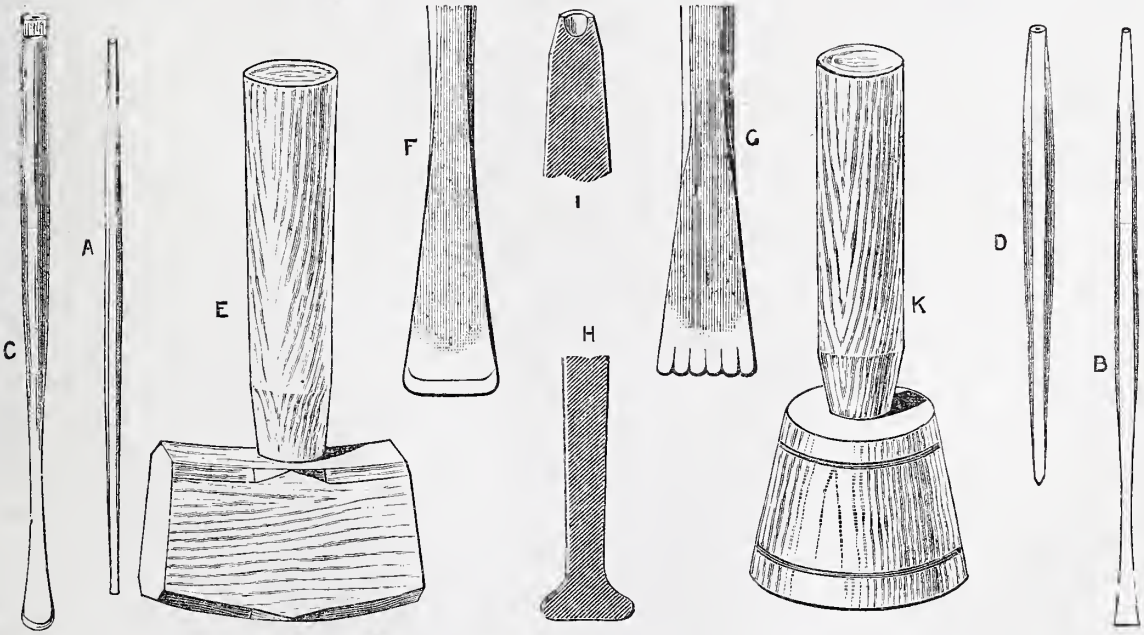


Fig. 33.—Tools for carving in Marble—A, B, Carver's Chisels; C, Boring Bit; D, Small Pick; E, K, Sculptor's Hammers; F, Chisel with Corners rubbed down; G, Carver's Claw Tool; H, Section of Chisel for carving Soft Stone; I, Section of Head of Carver's Chisel.

presently some of them will work out altogether; and as his work approaches completion the worker will have to trust less and less to the points and more to his eye.

The more especial tool of the carver is the chisel. Some of these tools are drawn at A and B, Fig. 33. They will be perhaps some 8 in long, and $\frac{1}{3}$ in. thick at their middles, and will have cutting edges from $\frac{1}{8}$ in. to $\frac{3}{4}$ in. wide. Their heads, instead of having a broad, flat surface like the tools used for carving soft stone (a section of one of which is shown at H, Fig. 33), will have a narrow, cup formed head, such as is shown in section at I, Fig. 33. This form is given that the hammer may bite upon it and not slip when driving the chisel through the hard material which has to be cut. Such tools will cost, say, from 6s. to 9s. per dozen. When bought, they will have sharp square corners, as in B, Fig. 33, but at least some of them will be found more useful if the corners are rubbed down and rounded off more as in F, Fig. 33. Against so hard a material tools soon become blunted, and need frequent grinding or rubbing to an edge again. A slab of Yorkshire paving-stone with water answers very well, and a finish can be given on an ordinary oil-stone. After repeated rubbings they will become too thick, or the ends of some may snap through the temper being too short. Some of the tools will always be out of order, for which reason the carver should scarcely have less than a dozen to start with. The disabled tools have to be handed over to a blacksmith to be drawn out and retempered. It is well to give this mechanic a hint as to the kind and hardness of the stone on which they are to be used, that he may temper them accordingly: the ordinary charge for drawing out and tempering is 6d. per dozen.

These tools are either driven with a sculptor's hammer or with a dummy. The hammer is shown at E, Fig. 33. It has a short handle and a thick heavy head of solid steel, weighing some two or three pounds. Such a hammer costs about 3s. 6d., and for refacing it when battered with hard work the blacksmith will probably charge 4d. The dummy, K, Fig. 33, has a handle of much the same length, but is not quite so heavy in the head. It is chiefly used for carving the hair and similar parts, which, unlike the flesh surfaces, are finished by the chisel. The dummy is most frequently made of lead, but this is a little too soft and is soon battered out of shape. Zinc is sometimes used, but this is full hard. Pewter, which is between the two in hardness, but more expensive, makes an excellent dummy. Dummies are bought per pound according to the metal.

The chisel when in use is held at an oblique angle to the surface of the work; for if held at too nearly a right angle. there would be danger of bruising, or as it is technically termed, "stunning" the marble. When this is done, instead of a sparkling surface there will be a dead chalky one, and in the final operation of "sanding," much of the bruised material will work out.

Another and most valuable tool to the marble carver is the drill. This is safe as well as useful: there is no danger that it will stun the marble. The occasions on which it can be employed are numberless. It can be brought into use wherever there is any decided hollow or undercutting; with it are formed the openings of the ears and of the nostrils, the corners of the eyes and mouth, the hollows between locks of hair and folds of drapery, etc. etc. Fig. 34 shows a sculptor's drill and the bow for turning it, and at C, Fig. 33, one of the bits for it is drawn on a somewhat larger scale. Such a drill, with half a dozen bits running up to, say, $\frac{1}{2}$ in. wide, would cost about 25s., whilst the bow for driving it (L, Fig. 34) would cost some 2s. more. Drill bits, like chisels, wear down with use, and need to be placed occasionally in the blacksmith's hands.

On the flesh and similar parts, it is not the practice of marble carvers to chisel quite down to the actual surface. It is considered safer to remove the last film of waste material with rasps. These are made and sold for the purpose in a vast variety of shapes and sizes. In Fig. 35 are drawn three rasps to about half the actual size: M is a splendid tool for large surfaces; N and O are for small work; M would cost about 3s. 6d., the others 9d. or 10d. each. As left by the rasps, the surface has of course a scratched look, but the scratches can be removed with medium and fine sand-paper.

Some few carvers finish their work entirely with sand-paper, holding that by so doing they preserve a better colour in the marble; but this is not the usual method, nor is it the one which the writer would himself recommend. The further and final process commonly employed is that known as "sanding." The worker takes a little piece of some soft and even grained wood, pine generally, say, of much the size and shape of a finger (any wood with a ribbed, unequal grain is not suitable, as it does not wear away regularly). This will be rounded at the end, but the exact form is of little moment, as it will soon wear and shape itself to fit the surfaces with which it is brought in contact. He wets some fine washed and sifted sand in a saucer or similar vessel, and dipping his stick into it, works it over the surface of the marble, giving a sort of circular motion as he does so, and taking up fresh sand as often as he requires it. The sand must be free from coarse and gritty particles or it will scratch the work. The effect of this sanding is to remove the chalky appearance, and to bring out the beautiful sparkling translucent qualities of the marble. After a part has been sanded, and the sand washed off with a sponge, it will often be seen that some scratches still remain, and that a local re-sanding in places will be necessary. The sticks used in this process wear away rapidly.

But there are some parts of the work in which a brilliant surface is not desirable, and these are not to be treated in the same way. Of these will be the hair, probably some parts of the drapery, etc. As to the hair, it is usual to leave it almost untouched from the chisel. It is by continuous strokes of the chisel that hair is represented in sculpture, these strokes being more sweeping or more abrupt as flowing or crisp hair is to be shown. In some places, indeed, as for instance just at the parting line, it may be desirable to use sand-paper, and even to a certain extent to sand—the latter being rather done to make the different parts harmonise together—but in such cases it will generally be better to apply the sand not with the stick, but with a scrubby, hard, hog-hair brush, which, to a certain extent, will have the effect of regular sanding.

After the work has been otherwise finished, it is possible, and indeed probable, that some small natural holes may appear in the surface, or a point or two may have been drilled too deep. These must be stopped. There are various substances used as stopping. Melted borax is held to be a good and lasting one; upon Sicilian, for outdoor purposes, a mixture of white lead, japanner's gold-size, and turpentine makes a good and enduring stopping; for indoor work in statuary marble, nothing is more easily applied than spermaceti wax, which can be squeezed in cold with the point of a knife. Such holes, if they occur at any specially important part, are an annoyance, but far worse are the natural discolorations, dark spots and markings, which perhaps do not develop themselves till the surface is almost reached, or possibly do not show till the work is sanded. Should one of these occur in either of the more delicate features, as the eye or the mouth, it may altogether change the expression. It would seem impossible to have any absolute security against these disfigurements, but the best hope of avoiding them lies in leaving the choice of the block to an experienced marble-mason.

Merely accidental stains and discolorations, which can be removed, are less vexatious. Brooke's "Monkey Brand" soap answers very well for removing ordinary dirt and grease from marble, or a very efficient mixture may be made by dissolving American potash in warm water, and stirring in powdered whiting so as to form a paste. This has to be painted on the marble, and when washed off it brings all dirt with it. As there is a possibility that the caustic potash may corrode the face of the marble, it is not well to let it remain on too long; a few minutes only will suffice in ordinary, but obstinate stains need more time. Some recommend chloride of lime for an obstinate stain, but the writer has known potash left on for twelve hours remove every trace of stains on which the chloride had no effect. Not unfrequently, and more especially in the foul atmosphere of our large towns, the marble will seem to get thoroughly impregnated and discoloured throughout with smoke. This is not easy of removal. But something may be done by laying the piece of marble in water, so that a small portion only may remain above the surface, and on this exposed part sprinkling dry, powdered pipe-clay or whiting. The water drives the colouring matter upwards and the powder absorbs it. Some say that a bath of wet sand is better than water for this purpose.

In connection with carving, it is sometimes found desirable to polish certain parts of the marble. Such parts have to be rubbed down perfectly smooth with sand and water, then with the coarser and the finer grit-stones (grits Nos. 1 and 2), next with snake-stone; and the actual polishing is finally done with "putty powder." This powder is applied wet with a pad of thick felt glued on wood, and a considerable amount of patient rubbing is needed to get a good polish. The addition of a little "salt of sorrel" helps to brings the polish more quickly, but this last is a thing to be used with caution. Both the putty powder and felt are sold by the pound, and all these materials are supplied by marble merchants.

The small round pedestal or stand on which it is usual to mount a bust, and which is commonly polished, is both turned and polished in a lathe. Making this is rather the work of the marble mason than the carver. This craftsman will hollow out the back of the bust, prepare the pedestal, and fix it on with a copper bolt, for about 25s. or 30s., marble included.

It has throughout the above remarks been assumed that the carver will have followed the ordinary and convenient course of having his work pointed. But it must not be inferred from this that pointing is absolutely necessary.

Sculpture existed long before the pointing machine, and could go on without it. The importance of the machine as a saver of time is not to be questioned, yet there are those to whom time is of less value than money, and these can, if they like, work without it. The beginner in marble carving may not be well able to spare the few pounds or shillings which the pointer would demand, and he will get as good or better practice by working at first more from the eye. Probably the majority of first works in marble are carved without pointing. Such a matter as a medallion may easily be copied with accuracy by measurements with the compasses, and on some work of this kind the first essay will most likely be made. For roughing out such a relief, the small pick, D, Fig. 33, will be found a useful tool; as also will the claw tool, G, Fig. 33, when the surface is more nearly approached.

For gaining familiarity with the use of the tools, and with the nature of the material, it is, perhaps, quite as well that the beginner should make a first attempt without pointing.

HINTS TO WATCH WEARERS, AMATEURS, AND OTHERS.

BY HERR SPRING.

In my last article I took the opportunity to deal with the variations which are caused in the time-keeping of watches by changes of position. Readers of my preceding contribution in page 679 of this Volume will remember that with an experimental watch of ordinary quality we found in lying on its back for eight hours it gained twenty seconds, but when hung up for eight hours it lost ten seconds, being a total variation of thirty seconds. By a process described in my last paper we contrived to reduce the error to fifteen seconds in eight hours, which, of course, was a long stride in the proper direction. But I promised that in this article I would endeavour to show how the existing error may be still further reduced. Although there is no great certainty that in the case of an ordinary commonplace watch a much greater degree of accuracy can be obtained, still we must make the attempt. What I am about to say is difficult to say with perfect lucidity; moreover, it may be "above the heads" of some of the readers who have followed my former contributions. But I have no doubt that my observations on the question of "positions" will be of very great service to some of the more advanced readers of WORK; at any rate, we cannot always be in smooth water. With this brief apology, let us jump *in medias res.* It will be found that the rounding of the jewel holes, the "touching up" of the balance pivots, and the other little arrangements described in No. 94 of WORK, have not only reduced the error in positions from thirty seconds to fifteen seconds in eight hours, but have also improved the action of the balance, and therefore added to the time-keeping qualities of the watch generally. Let us assume that the variation of fifteen seconds is made up as follows:—In hanging up, five seconds slow; in lying on its back, ten seconds fast. Now let us try to find the remedy. In the first place, you can do a great deal by manipulating the hairspring. Bring the balance to a dead stop, and then examine how the hairspring stands in the curb-pins. Then let the balance go on, and observe the action of the hairspring in the curb-pins until the motion of the balance reaches its highest point. Now, when the balance is at its highest point (which it reaches when lying on its back), you will see that the hairspring in expanding presses hard against the outside curb-pin: an action which, of course, tends to make the watch go fast in lying. Therefore, with a suitable instrument move the outer curb-pin the least degree more outwards; by this alteration the hairspring will not press so tightly when the balance is at its highest point of motion (when lying down), and the action in the curb-pins will be nearer equal in lying and hanging. It is possible that this alteration might effect all the change needed, but one cannot say this with certainty. However, we have by this means brought the watch nearer to true time. The next thing which can be done will tend to diminish the losing rate of five seconds in hanging. Take the watch in your hand so that the twelve o'clock be uppermost if it be an open face, and the three o'clock uppermost if it be a hunter. Then, having your eye in the right direction, seize the outer coil of the hairspring, and gently bend it in such a way that you throw the whole body of the spring slightly in the direction of twelve or three o'clock, as the case may need. The result of this is that when the watch is hanging up the tendency of the spring, owing to the bend, will be more upwards than previously—it will expand more towards the twelve or three o'clock. The extra expansion upwards will, in a slight degree, lift the balance upwards, and therefore lighten the downward pressure of the pivots when the watch is hanging up. These two alterations, though they can be done in a few moments, may make a vast improvement in the error. The variation of fifteen seconds in two positions in eight hours may now be reduced to seven and a half seconds, which, for argument, we will suppose to be all in one position—that is to say, the watch is now going right to time in hanging, but is still gaining seven and a half seconds in lying down. Now, the most sensible thing would be to stop any further experiments, but if you wish it we will try one more. Take the balance carefully out of its place, and with a ruby file flatten the point of the bottom pivot the least bit in the world. You must not flatten the whole point of the pivot, for that would make an immense alteration, and destroy all you have so far accomplished. The faintest touch of the ruby file is quite sufficient. You need to flat the point only so much that when you examine the end of the pivot with the strong glass you see merely the extreme part of the dome touched. If you have no ruby file, use a good burnisher, seeing in both cases that the flat you make is really at the extreme point of *the point* of the pivot. This touch of flatness creates a little extra friction when the watch is lying down, and causes it to go slower. There are numerous little experiments that may be made in connection with timing in positions, but I do not think it advisable to carry the matter any further than I have done. If, however, any of the readers of WORK find themselves in want of information or in a difficulty, I shall be glad, with the Editor's permission, to answer their inquiries on each and every point. I cannot, however, close this paper without explaining that the above experiment is, from a scientific point of view, comparatively crude. But we have been dealing with an ordinary commonplace watch, and have had to make the best of a bad case. There are, be it remembered, other positions in which a *good* watch should be tested. A first-class instrument, made with a special view to accuracy in positions, must be tried lying down, with twelve up, with three up, and with nine up. Then you will observe a watch when at rest in the waistcoat pocket is neither upright one way or the other. The size of the pocket, the weight of the gold chain, the shape of the body of the wearer, each tends to give the watch, when in the pocket, some special position, and that may possibly be just the one position in which there is a maximum of error. I am acquainted with some careful watch wearers who possess the finest-rated watches; but the finest watch has its faults. One man has a watch whose rate is one second in twenty-four hours slow in hanging, and one second fast in twenty-four hours in lying. Now, this wearer is terribly precise, and is greatly disturbed if his watch goes out even a few seconds. So he utilises his knowledge of its positional variation to keep it very near mean time. If, from one cause or other, his watch begins to take a losing rate, he keeps it lying down through the night, and whenever he has an opportunity, and as it gains in lying, he gradually brings the losing rate back to mean time, and *vice versâ.* I must caution people who hang their watches on a nail at night that the practice is a bad one. The motion of the balance of a watch gradually conveys itself to the whole watch, and, as a result, I have seen a watch on a nail swing about almost like a pendulum. There is also a danger in watch-bags hung over the bed. Such bags are usually very loosely made, and when the watch is put into them it may take all sorts of unexpected positions—leaning forward or backward, sideways or what not. A watch-bag over the bed should be so made that the watch is always in one position.

AN ADJUSTABLE READING DESK.

BY LAWRENCE S. LITTLE, C.E.

Although by no means an advocate for the wholesale "transmogrification" of all kinds of articles (and especially articles of furniture) into *something else,* or of the folding up and uncomfortably jointing and hingeing that which would look far better in its natural (?) state, and, generally speaking, contriving that

"Things are not what they seem;"

so that a cupboard becomes a bedstead, a pocket-knife an armoury of offensive and defensive weapons, a travelling bag a canoe, etc., etc.; yet I frankly admit that it is expedient that considerations of space, etc., over which we have, occasionally, little or no control, should *sometimes* decide this point for us.

Accepting this dictum, I designed, some time ago, for the use of a scientific society, the Adjustable Reading Desk here illustrated. It was required to stand on an ordinary table, or other like support, to give a considerable range in height, suited to the varying altitudes of the speakers at the society's meetings (which, like the subjects they discuss and the length of their communications, fluctuate considerably), to be adjustable to varying angles, and to be rigid enough to resist even those orators who, like some popular preachers, are sufficiently energetic to "ding the stoor oot o' the pupit."

It will be observed from the drawings that the top may be placed at any desired

slope, either backward or forward, or horizontal, and, with some simple modifications (such as making the projecting lower edge to turn round so as to present a plain rounded edge), a very useful writing or drawing table may be constructed in the same way.

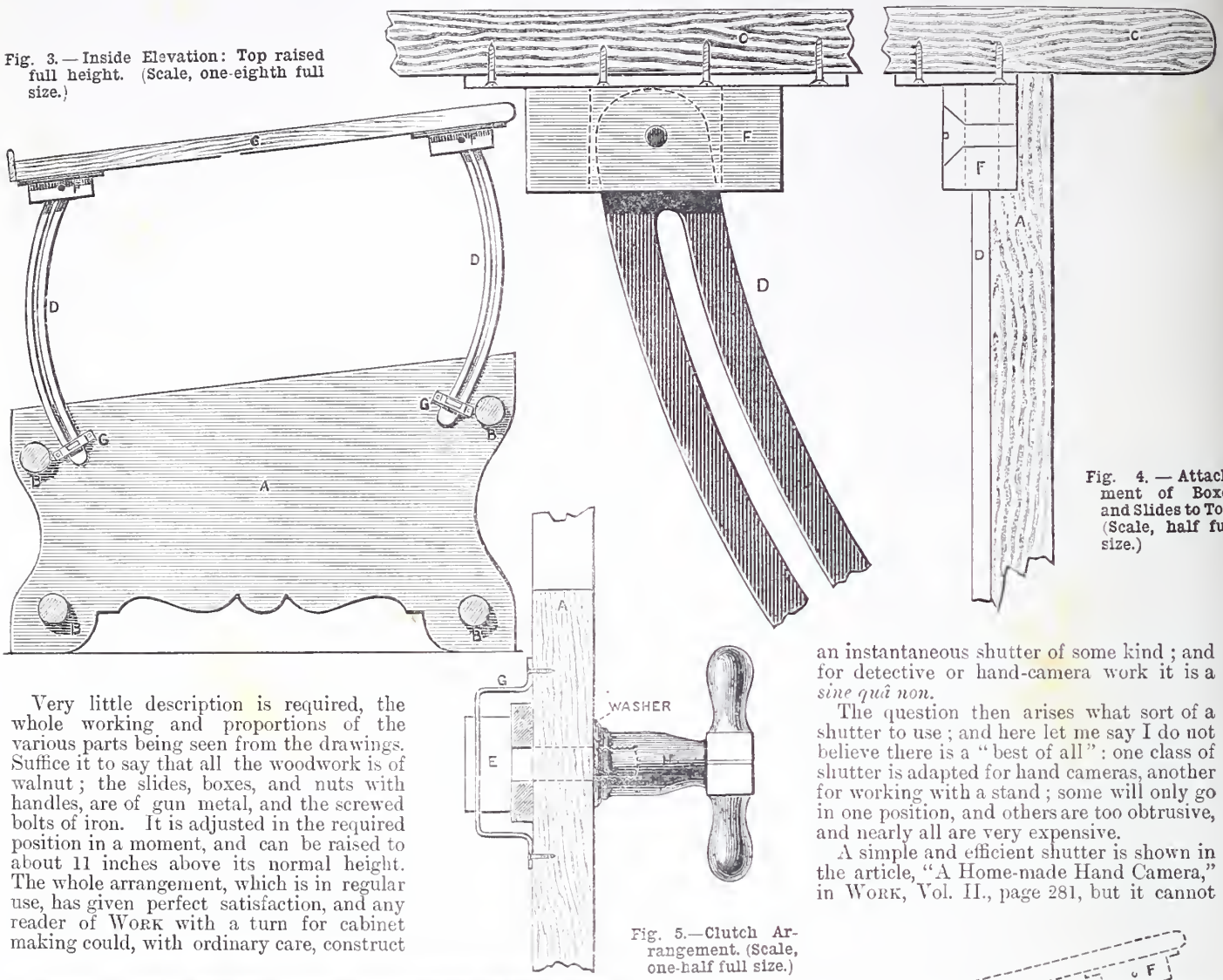


Fig. 3.—Inside Elevation: Top raised full height. (Scale, one-eighth full size.)

Fig. 4.—Attachment of Boxes and Slides to Top. (Scale, half full size.)

Fig. 5.—Clutch Arrangement. (Scale, one-half full size.)

Very little description is required, the whole working and proportions of the various parts being seen from the drawings. Suffice it to say that all the woodwork is of walnut; the slides, boxes, and nuts with handles, are of gun metal, and the screwed bolts of iron. It is adjusted in the required position in a moment, and can be raised to about 11 inches above its normal height. The whole arrangement, which is in regular use, has given perfect satisfaction, and any reader of Work with a turn for cabinet making could, with ordinary care, construct

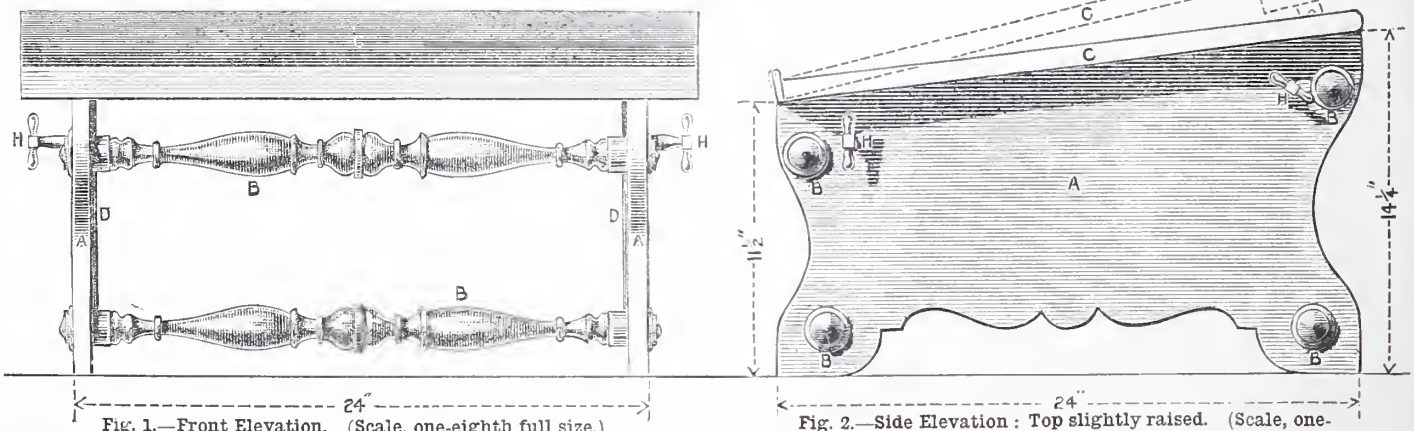


Fig. 1.—Front Elevation. (Scale, one-eighth full size.)

Fig. 2.—Side Elevation: Top slightly raised. (Scale, one-eighth full size.)

something similar. Needless to say that all the parts must be carefully fitted.

The standards A, ¾ in. thick, are connected by the four rails B. The top C, also ¾ in. thick, carries the flanged boxes F, in which are hung the slotted slides D, working on ⅜ in. bolts E, having oblong heads (which are held in position by the hasps G). The nuts H, working on the bolts E, with washers, clutch the slides to the standards and fix the top in the desired position. No guide pins are required, and the top is prevented from swinging past the line of front or back by the heel of the slide, which is rounded, working against the ends of the box. The play of the slides can be regulated, if necessary, by means of screws through the boxes. Some of the parts are a little too heavy, and might, with advantage, be lessened. This, as the reader will readily understand, will give a lighter appearance to the desk.

A ROLLER-BLIND INSTANTANEOUS SHUTTER.

BY W. E. D.

Everyone who has practised photography for any length of time has felt the need for an instantaneous shutter of some kind; and for detective or hand-camera work it is a *sine quâ non.*

The question then arises what sort of a shutter to use; and here let me say I do not believe there is a "best of all": one class of shutter is adapted for hand cameras, another for working with a stand; some will only go in one position, and others are too obtrusive, and nearly all are very expensive.

A simple and efficient shutter is shown in the article, "A Home-made Hand Camera," in Work, Vol. II., page 281, but it cannot be used in an ordinary camera; and besides, if you have a lens with a large working aperture, it requires a wide space to work in; and again, a simple "drop" or "go and return" answers very well with the latter, but cannot be used with the former, when the whole box has sometimes to be turned to take a different way of the plate. After

making some of nearly all sorts, I settled upon a blind shutter as being the best to use with both classes of camera, and which had the further recommendation of being cheaply and easily made, considering its efficiency, and the least noticed in a detective, as it can be made to work from behind the lens, the lens being fastened to the shutter itself, and the shutter sliding into the grooves of the rising front of the camera. I had better describe it first, so that the instructions for making may be more easily understood.

By referring to Fig. 1 you will see it looks like a small flat box, with the lens inserted in the middle of the top. The size is about 5 in. by 3½ in. by 1 in. Working inside between the two sides are rollers, one at the top and the other at the bottom (Fig. 2, *a* and *b*), having a piece of light-proof india-rubber cloth (Fig. 2, *k*), with a hole in the centre to make the exposure, fastened by the ends to the rollers; the top one has fixed to it a watch barrel (Fig. 2, *e*), containing a mainspring, one end of the spring being fast to the barrel and the other end to the spindle (*c*), which runs through and is held firm outside by a ratchet wheel (*d*): this is to allow you to wind the spring tighter, so as to make a quicker exposure, and to let it down again when needed, and thus secure different speeds. The bottom roller (*b*) has its spindle (*g*) fixed in the wood; one end has a thread cut on it, a round piece of brass (*h*), with two nicks for the trigger (*n*) to hold, being screwed on, and secured by a winged nut (*i*), which also answers for winding the blind on to the bottom roller, to set the shutter.

Now for the way to make it.

You will first require some ¼ in. mahogany—an old cigar box will answer all purposes if you are inclined to be economical. Cut one piece for the bottom, say 5 in. by 3½ in. by ¼ in., then two pieces for the sides, 5 in. by 1 in. by ¼ in.; fasten the sides to the bottom with screws, so as to be easily removed when you want to insert the rollers; but it is as well to fix it first, so as to get the exact size for the rollers.

You must now procure the brass barrel (*e*) with the watch-spring in at a watchmaker's; they have very often second-hand ones, just as they come out of the watch. Do not get a stiff spring, or you will find a difficulty in making the shutter slow enough. By opening the box you will see that one end of the spring is fastened to the box, and the other end to a little piece of steel, called the arbor. This must be removed, as you will want to fasten this end of the spring to a spindle; for the spindle (*c*), take a good stout new skewer (a knitting needle is better, but much more difficult to work); solder on to this, about 1 in. from the end, a piece of brass, as nearly the size of the arbor as possible, drill a hole in the rim of the brass, solder a stout pin in, and bend into the form of a hook (Fig. 7). This goes through the hole in the free end of the spring.

The next thing is to turn up two rollers of wood, the same diameter as the brass barrel, and of a length to just work between the sides, say 2½ in., making one, however, ¼ in. shorter than the other; this is the top one, and allows for the brass barrel to be fastened on; make a hole through this (the top one), large enough for it to work freely on the spindle, pass this through the hole, and fasten the barrel containing the spring to the roller, by soldering two small pieces of brass with holes in one end to the barrel, and screwing them with very small screws to the roller (Fig. 2, *f*).

Now drive two pieces of stout wire (round French nails with the heads off will answer) into each end of the bottom roller, first cutting a screw on one (Fig. 2, *g*).

The next thing is to provide a blind. This must be of some material which will not allow the light to penetrate; for mine I used a piece of a lady's old waterproof (using a part where it was double), as being thin, yet strong, and impervious to light. Take a strip about 9 in. by 2 in. (or 2¼ in.); in the middle cut a hole 1 in. square (Fig. 2, *l*); glue thin narrow strips of wood, or cane, along the top and bottom of the hole, quite across the blind (Fig. 2, *r*, *r*); this will not interfere with the working, and will keep the blind from puckering when the strain of the spring is on. Fasten an end to each of the rollers, using glue and very small tacks; be careful that the tacks are not so long as to reach into the middle of the top roller, and thus touch the spindle, and prevent it working easily.

The rollers are now ready to pass through the sides. Mark the side at a proper distance from the bottom, so that when the spindle is passed through, and the blind wound upon the roller, it will just clear the bottom of the shutter.

Four small brass bearings must now be made, like Fig. 5, and screwed on the inside of the sides, for the spindles to work upon.

Glue a piece of velvet round the hole in

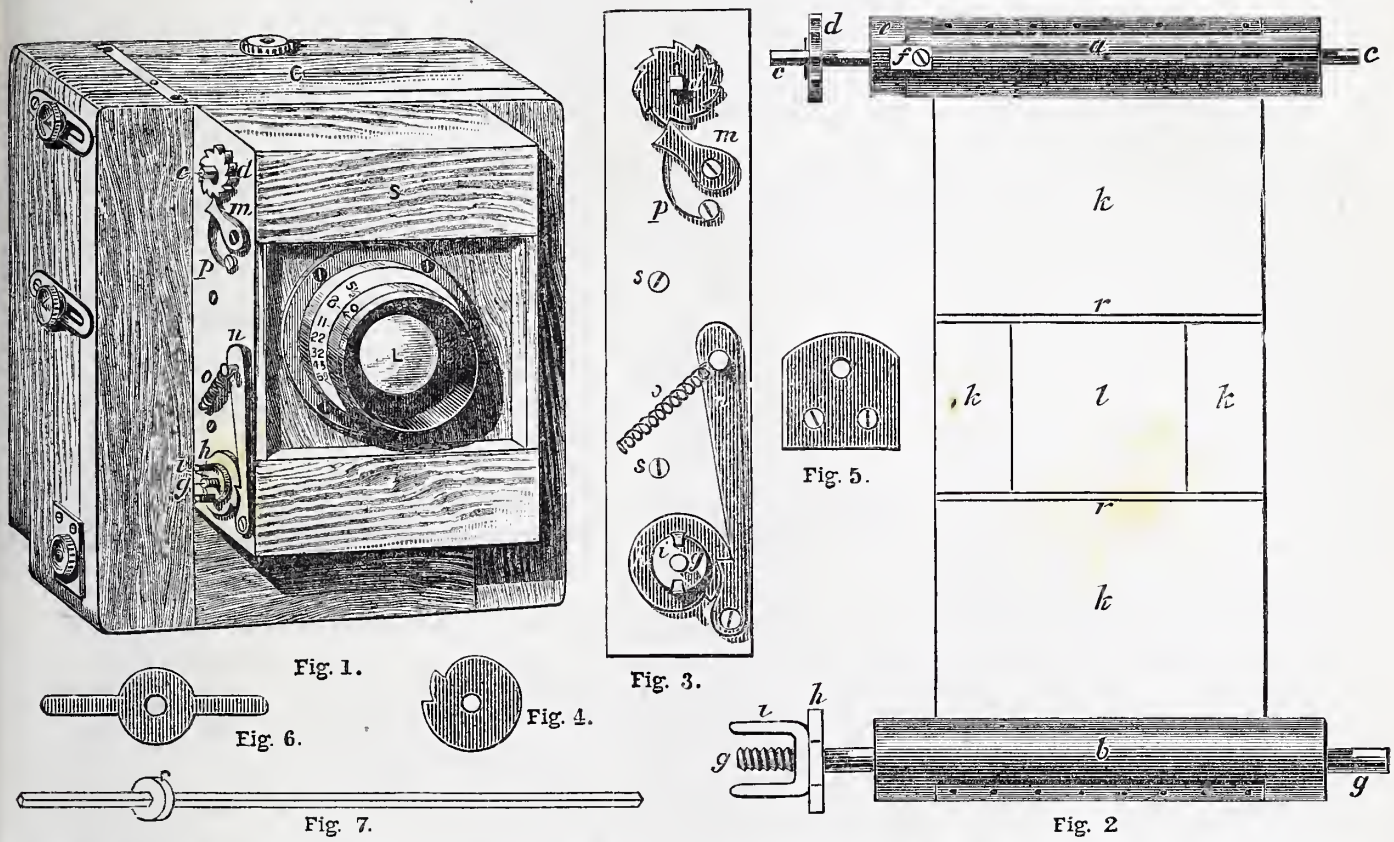


Fig. 1.—Shutter in Position on Camera, carrying Lens. Fig. 2.—Roller and Blind. Fig. 3.—Side of Shutter. Fig. 4.—Wheel with Nicks to hold the Blind down. Fig. 5.—Plate to carry Spindle. Fig. 6.—Shape of Brass for making Winged Nut. Fig. 7.—Spindle, showing Arbor and Hook. References to Letters in all Figs.—C, Camera; S, Shutter; L, Lens; *a*, Top Roller; *b*, Bottom Roller; *c*, Top Spindle; *d*, Ratchet Wheel; *e*, Barrel containing Spring; *f*, Pieces to fasten Barrel to Roller; *g*, Bottom Spindle; *h*, Wheel with Nicks; *i*, Winged Nut; *k*, Blind; *l*, Opening in Blind for exposure; *m*, Catch to hold Ratchet; *n*, Trigger; *o*, Spring; *p*, Spring of Catch; *r*, Thin Splines of Wood; *s*, Screws to fasten the Wood carrying the Lens.

the bottom of the shutter; the blind will pass close over this, and so make it light-tight and secure.

We can now wind the blind on to either roller, but it will not come back of its own accord—this is because the top spindle goes round with the roller; it must be made fast before the spring can act. Square the end of the spindle, and make a ratchet wheel (*d*, Fig. 3) by cutting notches in a round piece of brass (it does not matter if it is not cut exactly true; all that is needed is that when the spring is wound up, it shall be held in that position); make a square hole in it to fit tightly on the spindle, and pass a pin through to prevent it coming off; a brass catch with a spring (Fig. 3, *m* and *p*) will keep it fast, and yet allow it to be wound up tighter when a shorter exposure is wanted.

The bottom roller must now be finished; a thread has already been cut upon one end of the spindle. Make a round piece of brass, and tap the centre to screw on the spindle (Fig. 4). When you have done this, wind the blind halfway on the bottom roller, so that the hole in the blind corresponds with the hole in the wood, mark the brass, and cut a nick so that the trigger may keep it in that position to allow the lens to be open for focussing; then wind the blind to its full extent, quite covering the lens, and make another nick; a winged nut is needed to lock this and keep it in its place, and also to wind up the blind to set the shutter (*i*, Figs. 2 and 3). Cut out of brass a piece the shape of Fig. 6. turn up the ends at right angles (this is like the winged nut on Lancaster's tripods), and tap the middle hole.

A trigger, the shape shown at *n*, Fig. 3, completes the brasswork, and a weak spiral spring made out of a thin piece of brass or steel wire (*o*, Fig. 3), or a rubber band, fastened to the trigger, makes it engage in the notches.

You must now decide where you will place the shutter: if on the hood of the lens itself, the back of the shutter has a piece of cork glued on, with a hole in it to fit the hood tightly, and the front and ends are boxed in with thin mahogany; but I prefer to use it as shown in Fig. 1—viz., immediately behind the lens. In this position I always think there is not so much danger of any vibration, and for detective work it is more out of the way, and not so noticeable; if you choose the latter plan, cut a piece of wood to carry the lens, let it down between the two sides as near to the blind as you can without preventing it working, and fasten with screws (*s*, Fig. 3), then enclose the ends and the rest of the front with thin mahogany; but before finally fixing, black all the inside with dead black; varnish or French polish the outside, and the shutter is finished.

The blind is first wound on the *top* roller as far as it will go, and the ratchet fixed by the catch; now when the blind is wound on to the *bottom* by means of the winged nut, the spring in the brass barrel is tightened, and when the trigger is released, it causes it to rapidly resume its place on the top, and the picture is taken when the openings coincide; to make it work faster, give two or three turns with a watch key just as you would wind a watch up, the top spindle being squared for that purpose.

The sizes given are for a Wray $\frac{5}{4}$ R.R. lens with $1\frac{1}{2}$ in. hood; if for a larger or smaller one, vary accordingly.

Some, perhaps, may not be able to make their own brasswork, or would prefer the better-looking articles made by professionals; these I would advise to write to Messrs. Watkinson & Lonsdale, New Briggate, Leeds, who advertise in WORK, and who have had experience in making shutters: I have their permission to say that they will undertake for the readers of WORK any article in brasswork if proper sizes and drawings are sent, which latter can be copied from the illustrations to this article. I am sure that those who send for brasswork will be well satisfied with what they get.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

118.—MANGNALL'S DOMESTIC GAS REGULATOR.

MR. JOHN MANGNALL, 40, Staveley Street, Harpurhey, Manchester, writes:—"Taking advantage of your public invitation in 'Guide to Good Things,' I submit for your criticism and notice a Gas Governor which I have designed for Mr. John Pollitt, engineer, 43, Lower Mosley Street, Manchester, who is the manufacturer of them. It consists of an ordinary valve cock, the valve of which is automatically related to its seat by its connection with a corrugated metallic diaphragm, upon which the pressure acts, causing the valve to open or close, according to the pressure exercised upon it by the gas, and thus regulating the supply. In principle it is identical with that used in the construction of the aneroid barometer and Schaffer's Steam Gauge, both of which have withstood the test of the last thirty years. In price it is very low, putting it within the reach of all gas consumers, however small, the prices ranging from 5s. 9d. for a $\frac{3}{8}$ in., or six-light supply, to 15s. for 1 in. supply, or forty lights, the intermediate sizes being $\frac{1}{2}$ in., or twelve lights, 7s. 6d., and $\frac{3}{4}$ in., or twenty-four lights, 11s. 3d. each. Erratic gas bills being so common, a few remarks may not be deemed out of place, as there are some who think checking the gas *before* it enters the meter has a special merit. This is erroneous, as the meter *cannot* record any consumption unless there is a passage of gas through it, and *all* meters are compelled to pass a Government test and be stamped as correct registers before they are allowed by law to be fixed. The cause generally lies in the gas companies supplying gas (which they are compelled to do to meet a fluctuating demand) at much higher pressure than it is economical to burn it. This necessarily forces the gas through the burners without giving a corresponding increase of light, and, consequently, a greater flow of gas passes through the burners than is efficiently utilised, and, as a matter of course, a higher register of the quantity passed through the meter. To correct this and deliver the gas at an uniform lower pressure at which the utmost economy of gas in relation to the gas consumed is secured, is the special function of a gas governor. I enclose a sketch, should you prefer to illustrate your notice of it." The question is, How does the "Domestic Gas Regulator" act when put to a practical test? At present, I do not gather that exists, except in design, and, as the proof of its utility lies altogether in its testing and the results obtained therefrom, anything further must be left until it has been made and tried. I am glad, however, that Mr. Mangnall has availed himself of my request to seek notice and criticism in the pages of WORK. I have called attention to it, but, manifestly, I cannot criticise it until I have had an opportunity of testing it, either personally, or by somebody else who is duly qualified to do so.

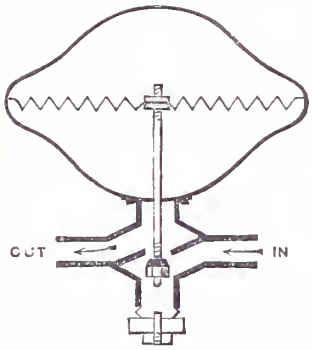


Fig. 1.—Mangnall's Domestic Gas Regulator.

Fig. 2.—The "Gem" Portable Saw.

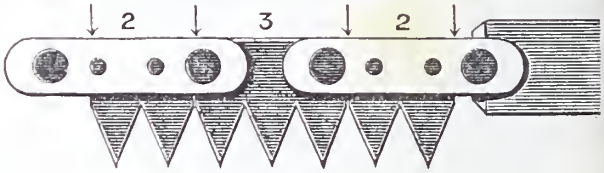


Fig. 3.—Diagram showing construction of Saw.

119.—THE "GEM" PORTABLE SAW.

In page 506 of this Volume I described a folding saw known as "Stanley's Portable Saw." I have now to direct the attention of my readers to another tool of the same class, which is much stronger in its make, easily twisted up in the form of a coil, and very much cheaper. This saw appears likely to be of the utmost value to all those who have occasion to use a saw in woods, forests, etc., as, owing to its portability and extraordinary flexibility, it can be brought into action in many places and for many purposes in and for which an ordinary saw could not be conveniently worked. To surveyors, emigrants, miners, engineers, etc., its compactness will render it preferable to any other kind of saw. For felling trees it will be found to be most serviceable, as, by its aid, they can be cut level with the ground. Some idea of the saw itself and its adaptability for coiling up into a very small compass may be gathered from Fig. 2. Its peculiarity of construction is clearly shown in Fig. 3, from which it will be seen that the saw-teeth, which in form are very much like those of a rip-saw, are made of hardened steel plates, notched in twos and threes, and are put together throughout the length of the saw in regular alternation. The two-teeth plates are riveted to long narrow plates set lengthways, as shown, and through each end of these plates and each end of the three-teeth plates a loose rivet is placed, which forms a joint on which the adjacent plates turn. The saw is worked by cross handles slipped into rings, one at each end. The handles are withdrawn for packing. Ropes may be used instead of the handles for cutting branches of trees out of reach. The saw is 3 ft. 6 in. long, and 1 lb. in weight. It is made by a French firm (Messrs. Peugeot Brothers), and is supplied at 9s., post free, by Messrs. Moseley and Son, 323, High Holborn, W.C. When the advantages to be derived from the use of this saw are considered, it appears somewhat strange that it has not been thought of before, and equally singular that the idea should have suggested itself simultaneously to two makers, one in France and the other in England.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

In consequence of the great pressure upon the "Shop" columns of WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Fretting Banjo.—R. H. H. (*Shutter Oak*) writes in sequence to J. G. W. (*London, N.W.*) (see page 583, Vol. II.):—"If you will refer to my letter in WORK for October 18th, you will see I referred to F. H. (*Streatham*), and not to you at all. J. G. W.'s system is quite correct, and I have re-fretted several banjos for friends in the same way. I also made a tool of two mahogany strips with needle points at ends, with a pin or pivot at the first division on one end, the whole being marked in nineteen equal divisions. I find the easiest way is to use a slide-rule, which gives the exact distance to set the compasses for each fret, instead of continuing to travel the compasses step by step up the finger-board till the exact eighteenth is found. I should have said, 'Grand Concert,' which is the one I possess; the vellum is 12 in. by 12½ in. over all."

Bent Hand Saw.—A. R. (*Scorrier*) writes:—"The following may be useful to carpenters and others who have an amount of work to do with the hand saw. When a saw gets bent, the carpenter often takes a block of wood and places the saw on the end grain and tries to straighten it with his hammer, but, to his astonishment, makes it worse than before. The mistake is that he goes the wrong way to work. Instead of a block, he should have placed the saw on an anvil, and have hammered it with a cross-faced hammer, as indicated by marks in the annexed sketch (Fig. 1). Then he should turn the saw and hammer on the other side at H H, toward the heel and point, taking care not to strike very heavy blows, or he will make the saw a useless tool. I would like to add that in my reply to SAWYER (No. 87, page 568), in reference to hammering twisted circular saw, the hammer marks should he as shown in the annexed sketch (Fig. 2), and not in the position as given in the above number. SAWYER will please pardon me for not correcting mistake before."

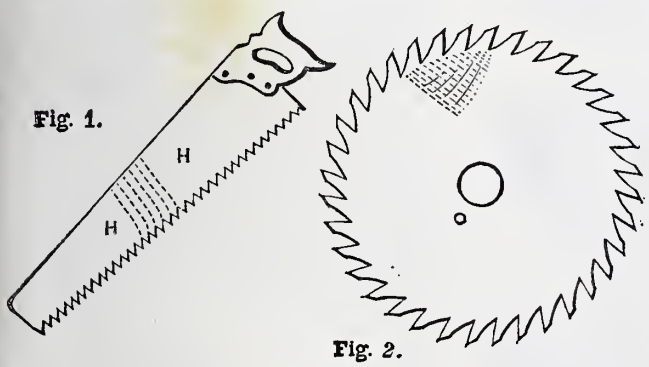


Fig. 1.

Fig. 2.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Polishing.—T. R. (*Plymouth*).—I am not acquainted with the minutiæ of the German methods of French polishing, but in the main the processes are much the same as ours. I quite agree with you that the polish on the German piano, etc., looks well at first, if you like even better than good English work, but have you compared the durability of the two? I think you will find that the foreign work in this respect is not in it, at least that is my experience, and I know the instruments made by the firms you name very well. The use of whiting as a filler is by no means new, in fact, it is one which I always recommend in preference to those which are largely composed of tallow. I do not know what to say about the use of sulphuric acid in conjunction with whiting, but I must say I am not favourably impressed with the idea. Possibly I may have mistaken your meaning, as your description of the process told you by your German friend is rather involved. As you say he was a tuner, and did not profess to know much about polishing, I am driven to the conclusion that he has misled you—doubtless, unintentionally—in his explanation of the process. I fancy that the thin liquid which is a transparent polish, but is not ordinary white polish, must be "glaze." Glad you find WORK an assistance to you, and you may be sure that letters such as yours are always welcome.—D. D.

Magic Lantern and Transparencies.—MAGIC LANTERN.—I will shortly place in the Editor's hand a brief paper on the lantern subject for his approval. With reference to transparencies for the lantern, if M. L. will turn to page 812, Vol. I. of WORK, he will find his need met, as I have there described the method usually adopted by the profession.—O. B.

Crystoleum Painting.—W. A. H. (*Stockport*) writes:—"What is the advantage of having two glasses to paint on? I have a friend who paints a little himself, and he assures me that one is equally as good as two. I have noticed that the crystoleum paintings on the window of an artist's shop have a glassy appearance, while those of my friend's have not." W. A. H. supplies the answer to his own question. If one glass does as well as two, then why does not his friend's work look as well. It is needless to waste space in giving reasons why one glass is not so well as two. The fact is clear to all who have tried that there is a difference in favour of two glasses. If W. A. H.'s friend is pleased with his work, there is no reason why he should not pursue the course indicated. But that he can produce the same soft and delicate effects is impossible. By using two glasses, the body or opaque colours show through and blend with the transparent colours on the front. This, I think, of itself will constitute much of the charm of the picture. I have worked with two glasses, and know the result. I have not tried one glass, and should never think of producing good work by this means.—O. B.

Phonograph.—E. D. (*Royston*).—Have you two diaphragms, or only one, on your instrument? In Edison's there are two diaphragms and two points, the one gouge-shaped and the other fine, but blunt, somewhat hall-shaped. The composition of Edison's cylinders are equal parts of oleate and stearate of lead, with sufficient gum dammar to harden it. You might also try a compound of paraffin-wax and finely precipatated chalk. Your springs may be too strong, causing the needle to bear too much upon the cylinder. Try these dodges, and report if the results are better. The phonograph is such a delicate piece of mechanism that it is difficult to get the best results at all times.—W. D.

Electric Alarum.—W. P. S. (*Southwark Bridge Road*).—I cannot undertake to fit up an electric alarum, but if you like to give me more particulars concerning your clock, I shall be glad to help you through "Shop"—L. P. C.

Cylinder.—A READER.—For single cylinder, about 7 in., double about 4½ in., boiler 14 in. or 15 in. diameter, speed perhaps four to five miles an hour, according to build.—J.

Graph.—W. J. T. (*Milnthorpe*).—The specimen you send has certainly not been printed on any of the gelatine or graph arrangements. It has apparently been produced by means of the cyclostyle, or some very similar appliance. I believe these are all covered by patents, so that you would not be at liberty to make without arrangements with the proprietors. In any case, unless you are prepared to lay down plant and incur considerable expense, it would be impossible for you to make as cheaply as you can buy. When things are made in large quantities they can be sold, even after allowing for the necessary profits of middle men, for less than it would cost to make only one or two by an amateur. If you want to get one, apply to any good stationer in any large town, or to W. J. Richardson & Co., 12 and 14, Queen Victoria Street, London, E.C.—D. A.

Picture-Frame Making.—MYTHOLMROYD.—The firm you refer to as advertising in our columns is of undoubted repute. If the communications you addressed to the firm in question were like the one you sent here, it is little wonder that you have received no replies. You should put your full name, address, and date, on every letter you write. On the one to us there is neither name, address, or date.

Easily Made Lathe.—TURNER.—Why not send this through "Shop" for the benefit of all readers of WORK?

Chip Carving.—H. T. W. B. (*West Bromwich*).—The first article on the above subject appeared in WORK, No. 64, and the number can be had from the publishers, Messrs. Cassell & Co., post free for 1½d.

Book on Electro-Motors.—W. G. (*Falmouth*).—You may learn much by reading a little book by Messrs. Whittaker and Co., 2, White Hart Street, Paternoster Row, London, E.C. This treats of small electro-motors, and shows how they are made and used. The price is, I think, 2s. 6d.—G. E. B.

Screws.—A. H. (*Southport*).—External screws are cleaned more easily than internal ones. It is not considered difficult to chase screws by hand, but it requires practice, and a single object lesson will do you more service than a long description. The best material to practise on is a piece of box or other hard close-grained wood. The chasing tool is held barely touching the rest, in order that there shall be perfect freedom of manipulation. The lathe being slowly revolved, the tool is made to traverse the blank once or twice in a slightly curved direction before commencing the cutting, in order to get the strike or pitch of the screw. Then the first cut is made: a mere scratch on the surface. This is afterwards deepened, and finished by successive movements of the tool. After the first cut there is little difficulty, the path of the deepening cuts being guided by the first. The only difficulty then is to catch the threads right with the tool. The tool is slightly tilted on the rest, to stand radially with the work. If in striking the serrations of the tool do not correspond exactly at the termination of a single revolution, the screw becomes wavy or drunk, and is useless.—J.

Springs.—J. H. B. (*Bristol*).—You do not say what kind of springs—there are several kinds, some of which have already been noted in "Shop." Refer to the Index of Vol. I. of WORK, price one penny.—J.

Pattern Drawings.—J. S. (*Barnet*).—Why not advertise in WORK?—J.

Apprentice.—F. V. (*Manchester*).—It is not clear whether you want a full account of everything pertaining to apprenticeship or merely how to get yourself bound. To give the former is, of course, out of the question; and in regard to the latter, it may be said that you must first arrange with some employer who may be willing to take you on the general terms. The custom of the trade on which you intend to enter will probably regulate these to a certain extent.—D. D.

Polishing Organ.—H. C. T. (*Dulwich*).—Possibly simply varnishing your organ might improve its appearance sufficiently to suit you. As it has been painted, it will be quite beyond your power to ebonise it in the way pianos and other things are done. The nearest approach you can get to a good smoothly polished black surface will be by repainting carefully with ordinary paint, rubbing down after each coat is dry with fine emery-powder, and finally varnishing. Unless all this be very carefully and skilfully done, as good or better results will probably be got by simply using one or other of the enamel paints, such as Aspinall's or the Foochow enamel. Gold decoration will look very well if in moderation and properly done.—D. D.

Chair Seats.—BRITANNIA.—These are obtainable from J. C. Plimpton & Co., 65, Victoria Street, Liverpool, or from almost any good wholesale furniture factor. Prices vary, and must be arranged with vendor.—D. D.

Black Surface.—OVERMANTEL.—Japan black is not suitable for your overmantel if you have any regard for its appearance, though of course you may use it. The best way will be to French polish. First stain the job black, and then polish in the usual way, using black polish. This can easily be made by mixing ordinary polish with gas-black. Polish the whole of the job; never mind the places which you intend to gild, as the black will not show through the gold. When the polishing is finished it will be time enough to attend to the gilding. This you ought to do with real gold-leaf if you want it to last. Do not polish over the gilding. None of the gilding powders or bronze paints keep their colour equal to gold, though some of them are tolerably durable, especially if they are protected from the action of the atmosphere by a coat of varnish.—D. D.

Grandfather Clocks.—M. L. (*Rochdale*).—For grandfather clock movements and dials, try Potts and Sons, Leeds; Gillett, Bland & Co., Croydon; or J. Smith, Clerkenwell, or Evans, Birmingham—that is, for new work. If old works, try at sales or auctions, where they may often be picked up cheap. If you mean wheels or parts now, or for repairs, try J. Mayes, 55, Red Lion Street, Clerkenwell, E.C., who makes a speciality of wheel cutting.—A. B. C.

Quarter-H.P. Steam Engine.—W. M. (*Hingham*).—The dimensions of the engine you ask for are: cylinder, 2 in. diameter, 4½ in. stroke, fly-wheel, 16 in. diameter, speed 120 revolutions, pressure 50 lbs. per square in. The boiler I have not dealt with, and scarcely think any but a boiler-maker should undertake to make it; it should be at least half-h.p. You will require a good lathe to make the engine, say a 5 in. sliding and screw-cutting lathe; and, if you want something to go on with, you might be going on with the boiler, or getting your workshop and tools in order. I think the simplest and cheapest way to manage the boiler would be to have a cylindrical boiler set in bricks in a fireplace, the fire-stove being taken out; this would take a good while to get up steam—perhaps fifty minutes; another way would be to have a simple vertical boiler which would be low enough to stand under the chimney; this might raise steam in thirty minutes, and a single cross-tube would make it quicker and add to its efficiency. I would rather some other contributor should take up the boiler.—F. A. M.

Carpentering Classes.—THISBE.—For particulars as to Carpentry classes, apply to the Secretary of the City Guilds and Technical Institute, Finsbury, London, E.C.

"Work" Exhibition Catalogue.—The published price of this catalogue is twopence. If you still want one, apply to Messrs. Cassell & Co., London, E.C. Submit any likely MS. you desire, on approval.

Printing Press.—R. J. H. (*Penzance*).—You should advertise your press in the "Sale and Exchange" column of WORK. AMATEUR will then, doubtless, see your advertisement.

Waggon Building. — RAINFORD. — Your aim should be to please your customer as to size, shape, and weight. I advise you to select a good waggon in the neighbourhood, and if it suits your client, take the size and style of the body, and arrange to make any slight alterations you may agree about. Make the frame of two sides and two summers, a hind ear-bed morticed on, and a front ditto notched down on to the top about half an inch; also a centre ear-bed, which must be notched upwards on the underneath of the two sides and summers. The hind and centre ear-beds must be long enough to take iron shore-stays or "knees," to support the sides; the front one, not taking shore-stays, must not be so long. Fasten the front and hind ear-beds at the corners with $\frac{7}{16}$ in. "boss"-headed bolts. The centre one may also be bolted to the summers in a similar manner, but not to the sides, as they are secured by iron standards, as you will see presently. You will next require the blacksmith's help. Get him to make at least seven iron standards: one for each corner, two for the centre car-bed, and one for the centre of the front. The bottom ends of these standards will vary in length, but the ends must all be threaded and fitted with nuts, as must also the top ends of all of them. The bottom ends of the four corner standards should be bent like Figs. 1 and 2, to facilitate repairs when the ear-beds require renewing. The other three will be straight like Fig. 3, and they will all be tapered from $\frac{3}{4}$ in. round at the shoulders to $\frac{7}{16}$ in. round at the top. When these are ready, fix them in their places, and give them the amount of "splay" necessary

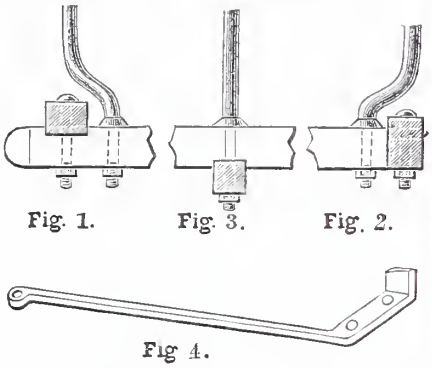


Fig. 1. Fig. 3. Fig. 2.

Fig 4.

Waggon Standards and Stay.

to suit the waggon you may decide to make. Next prepare your raves, mark them on, and bore holes in them to fit your iron standards, and drive them on in their places. Mine has three raves in each side, thus giving a deep panel at bottom and two narrow ones on top of that; there was also an outrave, making four in all. However many raves you decide on having, fix them all (except the outrave, of course). Cut some small pieces of $\frac{3}{4}$ in. deal in lengths to correspond to the various widths you intend to have your panels, and place them in position temporarily behind your standards; screw up the top ends of the latter, and you will thus have your framework rigid for marking the pins. Get sufficient mild Bessemer steel $\frac{3}{8}$ in. round rods for the pins; they will not bend like iron, and will cost very little more. If you prefer the iron, it should be $\frac{1}{2}$ in. round. Set out your pins on the outsides of your framework top and bottom with your compasses, and mark them distinctly on the face of all your raves, etc., with a straight-edge, and pencil ready for boring. Be careful about this, as unless your pins are all "splayed" in continuous order, the finished waggon can never look well. Next mark all your shore-stays, outrave stays, and other irons, so as to guide you in "shaving" when you come to that part. Cut off all the steel pins to their right lengths, and lay them in consecutive order in some safe place where they will not get mixed. They should not go through the top rave by $\frac{1}{4}$ of an inch, nor through the side by the same amount, but if your waggon is to be deep, you may allow two on each side sufficiently long to take a nut on each end, and place them midway between the iron standards to keep your top raves down. Your panels will require fastening to these pins by staples made of thin hoop $\frac{1}{2}$ in. wide, each fixed with two boss-head wood screws. If you put alternately two staples on one pin and one on the next, it has a nice effect. Scollop the top edge of top panel between each pin, to make it look lighter. We have next to consider the under parts. I certainly would make it lock in its own length by allowing the front wheels to run underneath the body. That being so, you must fasten the hind axle-bed and riser (or risers, if more than one is necessary) to the body by four long bolts down through the lot, and two iron stays like Fig. 4 in lieu of clasps to keep the axle steady. Remember to fix the hind axle midway between the centre and hind ear-beds. You will require two wheel-plates for the front carriages, and unless your smith is used to making them, you will get them cheaper from a coach ironmonger. Fix the top wheel-plate on a stout centre bolster, and two pieces the same depth as the bolster, but not nearly so stout, for the front and hind edges to rest on. These may be shaved to look very light without making them necessarily weak. The same remark applies to the bottom carriage also. Allow your two bolster plates, through which the perch pin works, to be each $\frac{1}{8}$ of an inch thicker than the wheel-plates, or your waggon will be hard to "lock" when loaded. Fasten your bolster-plates with bolts, or they will work loose. One word of caution, which also shows the need of always seeing your job finished before you begin it. It is this: your centre ear-bed and your front bolster must be so relatively fixed that the wheel does not strike against the former when run underneath the body of the waggon in locking. If you provide a skid for the hind wheel, let it be drawn from a chain fastened to the perch pin, between the top of the axle-bed and the riser above it; it draws easier for the horses, and does not strain the body. I certainly would draw a plan and elevation of one side and front and rear, setting out all the sizes, before I commenced work. However rough it may be, it would save time, temper, and probably material.—J. P. S.

Gas Engine.—F. B. (*Harkefield*).—It is impossible to point out the fault of the engine without making an examination, or having a very full description of its behaviour. There must be something very peculiar to cause its action to vary on different days. You should write to the makers.—F. C.

Picture Framing.—J. M. (*Stoke*) does not explain his method, so I cannot help him to improve his style of manufacture. Does he use the shooting-block and plane, which removes any roughness that saw leaves? Booth's mitre cutting machine is simple and effective for smooth joints.—J. R.

"Hearts of Oak" Emblem Frame.—H. S. (*East Knoyle*).—Design mostly used is a beaded edge, as in figures. I have found either of these designs very good and economical. H. S. can get a variety ready made at any frame maker's at a very low price—much cheaper than an amateur can possibly make them, considering the hard nature of the wood. If he wants designs in carving, oak leaves or a rope pattern I should suggest as suited for his subject. I framed mine some time back and bought a very

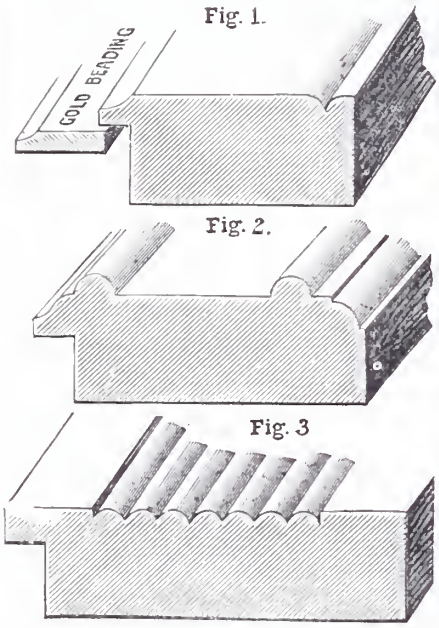


Fig. 1.

Fig. 2.

Fig. 3

Frame Mouldings.

beautiful carved solid oak $2\frac{1}{2}$ in. wide, 6d. per foot, and 1 in. washable gold flat, $1\frac{1}{2}$d. per foot. If H. S. thinks he would like the same, I will try and find the address if he communicates with the Editor of WORK.—G. R.

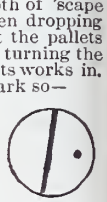
Book on Preserves.—F. S. (*London, E.C.*).—The "Royal Confectioner," by Francatelli (Chapman and Hall), may suit you. Most of the subjects mentioned are treated in "Cassell's Dictionary of Cookery," price 7s. 6d.

Spelter.—T. D. B. (*Bury*).—You are mistaken in your application of the word spelter; there is no such thing as spelter lead. In the market quotations you see spelter at so much per ton, that means zinc, that being the name that that metal is known by commercially. Another kind of spelter is the ordinary hard or brass solder used for brazing. I have never seen any special quotation of price for tea lead, and I should imagine it would be the same price as any other kind—say, about £15 per ton on an average.—R. A.

Patent—Extension of Protection.—P. M. M. (*Glasgow*) can get a month's extension of time—ten months instead of nine. The form (Form U) costs at the Post-Office £2. We advise P. M. M. to combine some slight improvement with his invention, and apply for protection *de novo*, using Form A, which will cost him £1; and he will proceed in the manner directed in our article to which he alludes.—C. C. C.

Mounting Prints.—FITZHUGH.—Cut your print down within 1 in. of the actual plate—sponge with clean water the back of same print, then paste about $\frac{1}{2}$ in. of margin (back), and lay same on a good stout board; then cut an eight sheet Whatman board with an opening to show the print, but be sure to cut it on the level, and be careful that it is cut to show just the "sight" of the print, margin $2\frac{1}{4}$ in. Woolley's, of Holborn, will send you their list of prices for boards. The best back is, of course, a panelled strainer, but for "Graphic" prints I would advise strained brown paper.—F. B.

Clock Cleaning.—LEROY.—You have bent a pivot of one of the wheels in putting the clock together, or you might have bent a tooth in one of the wheels, or one or other of the wheels is bound between the plates; or again, through age or bad thick oil, the mainspring may not be working as it should. Take the clock to pieces, and examine all pivots and teeth; if any are bent, put them straight, only be careful they do not come off; take off the covers of the barrels and the mainsprings out by taking hold of the inside coil and gently pull it up, but hold it tight, also the barrel. Clean the spring nicely with a little benzoline on a rag, and clean out the barrel; also the arbor that goes through, and the holes in barrels and covers; replace spring, by putting the outer end of it in the barrel and on the hook, then bend it round, and press it in till back in its place again; then put a little oil to the springs and on the bottom of barrels, also covers and the pivots of the arbors; put your clock together again, and try now. Before putting the pallets back, see if they are worn where the 'scape wheel works; if so, drive the pallets up the square a little distance, so that they shall work on a fresh place. Then put them in their place and see if the tooth of 'scape wheel seems to fall a good distance when dropping off one pallet on to the next; if so, put the pallets deeper in towards the 'scape wheel by turning the movable disc that the pivot of the pallets works in. In the front plate, you will see a saw mark so—like a screw head, and the hole is near the edge, on purpose to regulate the depth of the escapement; put it as deep as it will go without catching on the tops of the teeth; its being worn or too shallow will account for its gaining, as you say. Do not alter the pendulum by making it lighter; I believe in heavy pendulums. If the clock does not go after following the above instructions, it may be some of the pinions being worn from bad depths and old age, or because some of the pivots or holes are worn and want replacing. Regarding the pallets for the Grandfather—do you mean that it does not tick level, and is not in beat? If so, bend the bottom of crutch—the part that carries the pendulum—to the right or left till it ticks level. I do not quite understand what you mean about this clock. The best book is "Britten's Watch and Clockmakers' Handbook, Dictionary, and Guide," price 5s.; order it from Grimshaw & Baxter, 35, Goswell Road, Clerkenwell. I forgot to say that perhaps the springs may, through age, be cramped. When out of the barrels, and free, they should be about 6 in. diameter; if much smaller than this, have new ones fitted, price about 1s. 9d. each.—A. B. C.



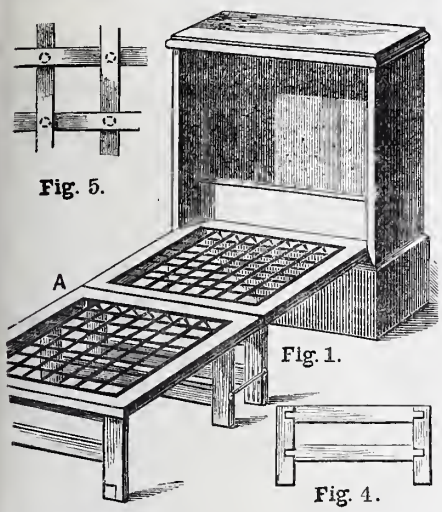
Oboe Reeds.—R. L. H. (*Glasgow*).—Professional reed makers employ no solution to give a moisture-resisting surface to the reeds. In good reeds by the best makers, it will be observed that the natural surface of the cane in the centre of the reed is left untouched quite high up towards the top, as shown in our illustration. This gives a sort of ridge or backbone to the reed which strengthens it and helps to preserve its form. For scraping down, a piece of sharp-edged glass or Dutch rush will be found most useful, and the finishing process is best accomplished by the very finest glass-paper. A special tool is used by oboe reed makers for cutting the hole in cork which receives the staple. It is formed of two pieces of brass or steel (preferably steel) tube, one inside the other with sharpened edges. Another method is to use one tube with cutting-edge to cut the hole in the cork. (The tool must be wetted from time to time to make a clean cut.) Then fix the cork on the staple and turn it down to the required thickness in a lathe. In order to flatten an oboe which is sharp, it is better to put a little longer cane.—H. R. G.

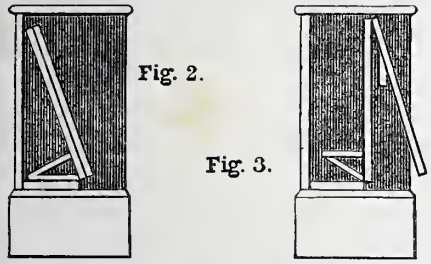
Oboe Reed.

Polish.—G. H. W. (*Bilston*).—The polishing of pine is done in the same way as other woods, with the exception that the article should be sized instead of being rubbed with filling. The size, of course, answers the same purpose. If the size has raised the grain more than you care to see, as is almost certain to be the case, smooth down with the finest glass-paper, or even with a coarse, harsh bit of canvas, before applying the polish. If the wood is to be stained, do so before sizing.—D. D.

List.—You ask for "a good retail price list for bookbinding (forwarding), or refer me to some firm." Now I cannot tell whether you want a price list for tools and appliances, or for charging work done.—G. C.

Press Bed.—SERGEANT.—A press bed, to accommodate two persons, and to stand about the height of a chest of drawers when closed, is made as follows. Let it be 15 in. from the ground. Two morticed and tenoned frames are hinged at A (Fig. 1), and the front frame folds underneath the back one. On no account have the front frame to fold over the back one. The further end of the back frame should be hinged to a fixed board in the bottom of the chest (Figs. 2 and 3). At that part—the head—it will be advisable to have two long boards and two small ones joined, as in Figs. 2 and 3, in order that pillows, etc., may be placed against them. I will not occupy space in explaining my reasons for showing these boards with the intention



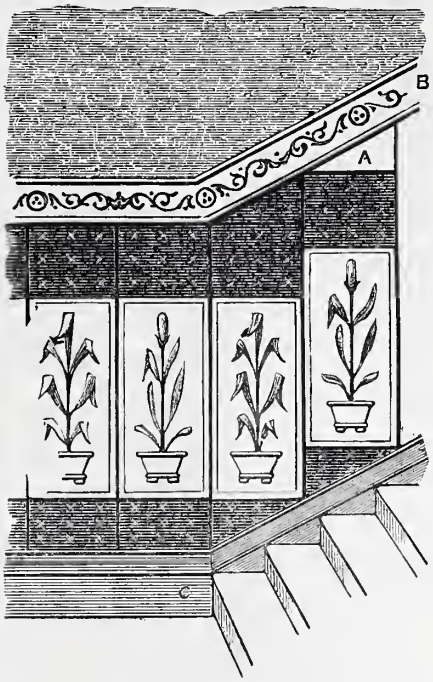


Press Bed. Fig. 1.—Bed Frames unfolded. (It is intended that Chest shall have two Doors, but they are not shown in Sketch, in order that the latter may be clear.) Figs. 2 and 3.—Side Elevations, showing the Frames folded inside Chest, and being unfolded respectively. Fig. 4.—A Frame Support. Fig. 5.—Method of weaving and stitching Webbing to receive Bed, etc.

of accommodating the head here in preference to reposing far back in the interior of the chest. Three upright frames (Fig. 4) will be necessary to support bed. They should be either hinged or pivoted (preferably the latter) between the side rails of bed frames, in the positions shown in Fig. 1. They could then be folded flush with these frames. To keep them firm, a hook or pin at each end of the middle pair will suffice; and a flush or other bolt at the bottom of the remaining one, entering a small hole in the flooring, will keep that one firm. Other means, however, can replace the latter course. Across the frames secure wide strips of webbing, by passing each strip over and under those which it comes in contact with (Fig. 5), and tacking the ends to the wood; also stitching all pieces at their junctions. Suitable dimensions are:—Width of each large frame, 3 ft. 3 in; length, 4 ft. 3 in.; width of the rails composing them, 3 in., thickness, 1 in.; height of chest, 4 ft. 6 in.; thickness of sides, 1 in. If the supporting frames are not strong enough, have either four or six turned legs to screw into the under surface of the large frames, allowing them to be removable at pleasure.—J. S.

Vending a Patented Article Made Abroad.—T. D. G. (*Ilminster*) asks:—"If a patent is taken out in England only for an article, can that identical thing be made in any other country and sold, and used in England with impunity?"—[Certainly not. If the sale of such pirated articles in our country were legal, it is obvious that the protection offered by our patent laws would virtually be worthless.—C. C. C.]

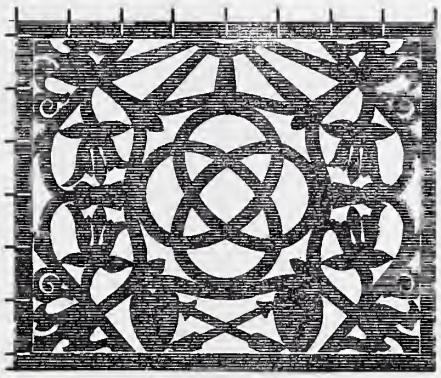
Wall Dado.—W. N. (*Wood Green*).—I take your note to refer to a panelled dado when hung on the staircase rake. These designs are usually made: two panels to the width of paper, and having a plainer diapered space above and below the panels. For the level landings, etc., the panels are hung in pairs as printed, but for the rake—the top chalk line, of course, being set out to work by—the paper is split up into single panels, and the top piece of waste fitted in at the bottom vacant spot, or *vice*



Wall Dado.

versâ (see sketch). The dado border is put on after both dado and filling are fixed. If for varnishing, all must be butted.—F. P.

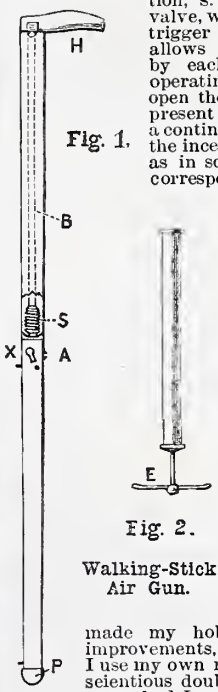
Fretwork Panel for Spoon Box.—NEMO.—The neat sketch on your letter requesting a panel with lover's knot in the centre is hardly correct. Obtain the catalogues of fretwork firms who advertise in WORK, in the event of this design not



Spoon Box Panel.

meeting your taste. I have drawn it proportionately to your measurements; therefore you can easily reproduce it full size by the "squaring" methods described by myself and others several times. The space between each pair of short lines at the side and top represents an inch; therefore, if NEMO will draw lines straight across sketch, taking these short lines as starting points, he will have little difficulty in reproducing it full size.—J. S.

Walking-Stick Air Gun.—ZERO AND R. G. (*Preston*).—Both these readers wish to make walking-stick air guns. The subjoined sketches of an air gun and condensing syringe of the best and most approved make and efficient action will aid description. The gun is in two parts, screwed together in the middle of the barrel's length, marked A in Fig. 1. The handle, H, screws off to receive a light gun-stock for shoulder holding, if desired. A ferrule-cap, P, screws over the muzzle to protect it when used for walking. It weighs, without stock, about 1½ lbs. The size of the stock is 1 in. at the handle, and ¾ in. at the muzzle; the bore of the barrels is $\frac{3}{16}$ in. for the bullet, and a little more for the air barrel. The air charge is contained in the part marked B to the joint A. The charge of bullet or shot may be put into the muzzle and rammed in, or at the breech marked X, opened and closed by a small projecting knob at that part. The trigger is kept flush with the stick surface, and can only be got out for use by a square key, to be carried in the pocket. This is pressed against a flush stud close to the trigger stud, and when inserted, turned enough to force out the trigger stud ⅛ of an inch. The finger pressure on this releases a portion of the air in the chamber B, and the charge, if a bullet $\frac{3}{16}$ in. diameter, is impelled with force enough to kill a rabbit at forty yards, and so on successively as the bullets are dropped into the breech-hole, and the breech bolted by turning down the knob and pressing the trigger. Of course, the final discharges by air pressure are not so powerful as the first ones, but still effective for less distances. Shot may be used in prepared cartridges, or by a first wad of felt being rammed in; then the shot, and another wad to retain them in the barrel. But air is not effective in sending shot far. A special barrel is fitted in the stick, and the bullet barrel taken away to admit the charge when wanted. Any postmaster will tell you if you need a licence to carry an air gun when away from your own house. The condensing syringe is about 12 in. long, with a T-piece at one end, E, to put the feet on to hold it while charging the barrel with air. To do this, the syringe is screwed on to the part B that has been unscrewed from the breech, or forward part of the barrel or stick. The charging is simply working the barrel up and down the piston of the syringe, driving the air into the air-chamber of gun B. The greater the strength of the operator, the more the air is compressed, and the more efficient action on the bullet at each explosion—or expulsion, rather. The gun shows an exposed section, S. This is the spring and valve, which keep in the air till the trigger action, by forcing it back, allows a charge of air to escape by each touch of the trigger operating on the spring to force open the valve. There are not at present any air guns which supply a continuous flow of bullets to meet the incessant touches of a trigger, as in some magazine guns. The correspondents will realise the fact that these guns require critically exact working appliances to bore the barrels; cut the joint-thread or screw that unites them, bore the breech hole trigger-holes, make and adjust the coil-spring, and fit air-valves. Defective work means failure, and often that failure may be due to so slight a deviation from exactness as not to be perceptible except to an expert. From a long experience of shop exigencies, I have found it ensure success and to be an immense gain of time, saving needless worry, to buy as a model a gun, instrument, carriage, etc., whichever I desired to imitate—for it is imitation by guess-work to do without a model. Having made my hobby, perhaps with some improvements, I sell my model. If a gun, I use my own make: that spares me conscientious doubts about results to other users had I sold it instead of my model. Your correspondents, having tried and doubtless succeeded by this description in making an air gun walking-stick, will find they have at the same time acquired a large fund of technical knowledge of lathe working and spring forging, hardening and tempering, which will be available for other high-class work, for what they aspire to make is just the delicate piece of mechanism which will teach perseverance and some of the most skilful operations in lathe work and fitting. It is the work of at least four skilled men, each masters of their craft; but this need not discourage an amateur if he has the time, the tools, and the talent. To help him, I urge this advice, as I do to all learners: do not try to do it all under your own hat, which means hugger-mugger messing and final disappointment, not from the want of time and perseverance, but from doubt of which is the right way, and working with the untrained touch in handling tools. A model serves for a standard of excellence. As ZERO asks for a maker's name and address, it seems as if he had the right idea of how to go to work to avoid failing "under his own hat," and yet make a working gun. Air guns are a speciality of a large London firm, which sells air guns of every description, from £2 15s. to £4 10s., including condensing syringe.—J. C. K.



Walking-Stick Air Gun.

Bench.—T. H. W. M. (*Bolton*).—There have been descriptions of benches in recent numbers of WORK (see No. 92, page 647), either of which would do for boys' use, if only the height is modified according to the stature of the boys using the bench. To ascertain this, let the boy plane a piece of wood of ordinary thickness, using a jack-plane in the usual way; the boy ought to be able to place his arm from wrist to elbow in a horizontal position, without stooping or obvious reaching upwards. A bench which is too high may cause the inexperienced a blow on the elbow; but a too low bench is bad, as it causes a stooping attitude (see No. 50). Avoid any iron stops or anything of iron in exposed positions, or the teacher will have a quantity of unnecessary grinding and sharpening to do.—B. A. B.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Boot Making.—W. G. writes, in answer to THE LAST THAT SHALL BE FIRST (see page 650, Vol. II.):—"I must first say that the initial 'M' was a misprint, it should have been 'W. G'; and next that it would be impossible to answer all the questions asked in 'every particular and detail' in 'Shop.' You want to know how to make a pair of boots, from beginning to end: you must wait for articles on these. I would advise you to try your hand as much as possible at repairing, so as to get used to holding the tools, and the easiest way to hold your work. This, when you go to make a pair of boots right out, will all tend to make you more contented with the result. In my answer to M. M., I did not explain the meaning of shanked, skived, scats, lefts, and split-lefts, because those questions were not asked, but to properly answer M. M.'s question, 'How to make a sewn seat,' I was obliged to use those terms."—W. G.

Glass Cement.—MIEUX QUE ÇA writes, in reply to O. H. O. (*East Dulwich*) (see page 650, Vol. II.):—"Get some plaster of Paris and mix up with white of egg and a little vinegar to a stiff paste. See that your parts to be cemented are properly cleaned, else it is of no use to try. If your glass is smooth and has no edge to hold cement, you had better get a piece of pumice-stone and rough it well. It will be a long time setting, so let it stand for twenty-four hours or so, when you may lift it up without fear."

Blackboard.—MIEUX QUE ÇA writes, in reply to F. T. (*London, N.*) (see page 650, Vol. II.):—"Stain? I suppose you mean to paint it *black* so that you can chalk on it? If so, the following will settle the job. Prime as usual; second coat ditto, and finish with two coats of flat drop black with about half a pound of fine emery to one pint of said black. Keep well stirred up while being used. Three of Japan gold-size to one of turps in last coat."

Terra-Cotta Painting.—A. A. (*Coventry*) writes, in reply to J. E. H. (*Southampton*) (see page 650, Vol. II):—"One would have thought instead of asking questions, J. E H. would have tried both oil and water colour. I believe Sir Joshua Reynolds was once asked by a fashionable lady how he managed to paint so beautifully. He said, 'Get the right sort of brushes, the right sort of colours, and with the brushes put the colours on the right places.' 'Oh,' she said, 'how easy! I will go home and begin at once.' If J. E. H. knows anything about flower painting or drawing, and will get a little of Young's patent size or a small piece of glue dissolved in water (and keep it warm while he is at work), and then paint his design with it on terra-cotta, he will find his oil-colour will work beautifully on it and dry with a gloss. I have painted a great number of flowers, and landscapes, too, on terra-cotta, and I find the following colours are most suitable:—Burnt and raw sienna, vandyke brown, pink, cobalt, lemon yellow, yellow ochre, and madder lake. There are many other useful colours, but these will do to begin with in addition to flake white."

Blackboard Preparation.—JOHN M. PROCTOR AND CO. (*St. Ann's Ink Works, Nottingham*) write, in reply to M. (*Bolton*) (see page 686, Vol. II.):—"If he will forward his address to us we will gladly send him a sample of blackboard paint. He will find a reference to us in No. 77, Vol. II. of WORK, page 402, September 6th, 1890."

Vaporiser.—W. W. L. (*Wrexham*) writes, in answer to J. B. (*Colchester*) (see page 670, Vol. II.), *re* "Steamy Windows":—"I have some tins of 'preparation' now in my possession, and which are rapidly becoming popular amongst all shopkeepers for the prevention of steam, fog, and frost adhering to glass wherever situated. I shall be glad to send J. B. full particulars if he will write to 2, Manley Road."

Painting Flowers.—MIEUX QUE ÇA writes, in reply to J. E. H. (*Southampton*) (see page 650, Vol. II.):—"I should advise you by all means to use oil-colour for your terra-cotta plates. If you use water-colour, you will find out at the end of a twelve-month or less that a singular action has been going on, causing your distemper to fall off in little scales, which is very annoying indeed. To work in oil and prevent this, act as follows:—Fill your plates (terra-cotta) with good linseed oil. Let them stand in a clean place for, say, ten or twelve hours. Pour off oil and polish up with rags, and lastly a nice clean wash leather. Wrap each one up in a clean rag and stand in the sun. Remember, don't expose it to the sun. When they have stood, say, for twenty-four hours or so, supposing it to be warm weather—artificial heat is a mistake—have a look at them. If the tone of surface be uniform and hard, take a little fuller's-earth and a clean leather, and again polish (moisten with water of course). See now that there is a nice solid rich dull surface. You can now start with tube colours with the usual tools and in the usual way. If you wish for further information on this subject, I fear you will have to go to someone for lessons. All I could write here would never teach anyone to paint a flower. If you cannot afford to pay for lessons, and have some talent, practise hard, and you may in time astonish yourself."

Gilding.—MIEUX QUE ÇA writes to JACK:—"My last note (see page 602, Vol. II.) on this subject, as you are aware, is intended for inside work where there is no draught or gusts of air to blow your dust about. This note I intend to enable you to gild out-of-doors, as it is too often my misfortune to have to do this severe weather. At your stationer's get two or three pennyworth of white tissue paper. At home on a clean smooth table, board, or sheet of glass, spread your tissue out. Now with a soft lead pencil gently mark it all over in a careless, foolish-looking manner, as you have noticed a child do when trying to write. This done, get about 2 in. of common wax candle, rub it on something to flatten one side of it, and with your left hand placed on the tissue you begin and wax it all over. If you rub too hard, you will cause your wax to tear the tissue and also cause small shavings of wax to come off and stick here and there, and so make a mess. Your top sheet thus far prepared, you fold it nice and straight; fold it again and again, and so on, until you have folded it up to about 4 in. one way and about 3½ in. the other, there or thereabout, the only object being to keep it larger than your leaves of gold. Now with a table-knife begin and cut it as you would cut this paper, only you must go all round the edges of the tissue, taking care to leave no edge or fold uncut. You will find some trouble in this if you have never done so before. Now, you see, as you cannot see which side of those leaves are waxed, the pencil marks tell you at once, for of course the folding and re-folding cause the waxed sides to be some up and some down. Take hold of your book of metal in the manner of rough sketch, beginning at the leaf next the table when in this position. Now let the first leaf of book slip, as it were, from your thumb. You will, by this means, expose one leaf of metal to view. With your right hand lift one leaf of tissue, and pencil side down or next to gold; pop it into book, and gently close the book without letting go your hold, and before raising your hand again let slip another, and so on, as fast as you like. When full, gently press it. 'But hereby hangs a tale.' I cannot tell you what pressure to exert unless I were to wax it myself. This is what we call transfer in the trade. You apply the tissue leaves with gold on them to tacky size with pad of mad. I use my thumb."

Tuning Concertina.—J. W. (*Homerton*) writes, in reply to C. I. (*Addingham*) (see page 686, Vol. II.):—"I should advise him to write to Mr. Fletcher, Fletcher's Music Stores, opposite Sun Street, Bishopsgate, London, giving him full particulars, and no doubt he will be able to come to terms about his concertina."

Painting a Blackboard.—T. E. U. (*Rotherham*) writes, in reply to M. (*Bolton*) (see page 686, Vol. II.):—"Take half a gallon of shellac varnish, 5 oz. of lampblack, 3 oz. powdered iron ore, or emery. If too thick, thin with alcohol. Give three coats of the composition, allowing each to dry before putting on the next. The first coat may be of shellac and lampblack only. The 'Harvard" liquid slating sold by paint-houses is likewise an excellent preparation for this purpose, but I do not know if it can be bought in England. The above is an extract from the *Scientific American* of December 24th, 1887."

Gate Designs.—W. A. Y. writes, in reply to G. A. T. (*Ilfracombe*) (see page 634, Vol. II.):—"He will find Bayliss, Jones, & Bayliss, of Wolverhampton, or Hill & Smith, of Brierly Hill, Dudley, will send him designs of gates if he is a bonâ-fide tradesman."

Mute.—W. A. (*Cambridge*) writes, in reply to VIOLIN (see page 650, Vol. II.):—"I made a very effective mute out of a piece of stiff brass wire about 12 or 14 W. G. Bend this into something of the shape of a M, and set the middle leg out a little; this will fit on the bridge between the strings, and is at once cheap and efficient."

Glass Cement.—M. writes, in reply to O. H. O. (*East Dulwich*) (see page 650, Vol. II.):—"Use the finest plaster of Paris mixed to the consistency of thick cream; put it on quickly, as the plaster soon sets; clean off all oil before joining. This can be procured from a plasterer."

Painting Flowers.—M. writes, in reply to J. E. H. (*Southampton*) (see page 650, Vol. II.):—"Use oil colours in tubes, mixing them with megilp; when dry, varnish painted part only with best copal varnish. In purchasing the material, state the purpose for which they are wanted."

Cabinet Fittings.—M. writes, in reply to W. H. (*Hinchley*) (see page 602, Vol. II.):—"You can get these from Messrs. J. H. Skinner & Co., East Dereham. Send 3d. for their catalogue, which gives drawings."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. B. (*London, W.C.*); B. W. (*No Address*); H. B. S. (*Liverpool*); F. W. E. (*Woolwich*); LABOURER; J. J. (*Ottawa, Canada*); LEARNER; C. J. P. (*Derby*); A. R. (*Scorrier*); AN ANGLER; COALY TYNE; J. E. (*Upton*); PHOTOGRAPH; SANITARY; J. M. (*Parkestone*); BUYER; L. F. (*Maidenhead*); A. B. (*Dundee*); NOVICE AT WORK; M. P. B. (*Chiswick*); JERRY; W. W. M. (*Glasgow*); J. N. (*Manchester*); J. C. D. (*Southport*); SQUARE PEG; C. E. K. (*Hoshiapur, N. India*); T. L. D. (*Dewsbury*); C. G. W. (*London, N.*); C. B. (*Huddersfield*); J. J. (*Guernsey*); J. S. (*Jedburah*); J. E. S. (*Stoke-on-Trent*); E. P. W. (*Warrington*); AN INQUIRER; C. W. S. (*Liverpool*); R. H. (*Southport*); A. L. L. (*Farnham*); A. B. (*Suffolk*); H. C. (*Herts*); CLYDESIDE; J. McB. (*Sheffield*); W. H. (*Belfast*); W. B. (*Manchester*); G. H. E. (*West Bromwich*); WORKER BEE; COMP.; W. J. E. (*North Wales*); J. E. W. (*Wolverhampton*); E. P. (*Warrington*); A. T. S. (*Lincolnshire*); H. P. (*Leeds*); W. G. H. J. W. (*Bristol*); BERTIE.

Price **3d.**; post free, **4d.** The

Special Exhibition Number of

"WORK"

(*Separate from the Weekly or Monthly Issue*).

Containing an Illustrated Descriptive Account of the most remarkable Exhibits.

Among its contents are:—

Working Model of Steam Fire Engine.
The Story of the "Work" Exhibition.
Protected Exhibits under Certificate of Board of Trade.
The Value of Art Training to the Professional Workman. By C. R. ASHBEE.
Sir John Lubbock, Bart., M.P.: His Services to Science and Labour.
Fifty Years of Recreation Work. By the Rev. C. C. ELLISON.
Our Exhibits and Exhibitors.
Work and the "Work" Exhibition. By the SECRETARY.
My Ideas about Hobbies. By OPIFEX.
Special Gift Books to Exhibitors.
The Story of the Prize Certificate and Medal Competition.
Certificate Granted to Prize Winners.
"Work": Its Utility and Importance to all Workmen, Professional and Amateur—
I. From the Professional's Point of View.
II. From the Amateur's Point of View.
Statistics of the "Work" Exhibition.
"In Memoriam."
The Polytechnic Institute.
Jurors' Awards, "Work" Exhibition, 1890-91.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [6 R

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [11 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

Magnificent Solo Violin, copy Niclaus Amati; beautiful, rich, and powerful tone; suit professional or any player; cash wanted; baize-lined case and silver-mounted bow; only 15s. 9d. lot. No rubbish, and very valuable bargain; bound to please; 20s. worth of music given in free.—GRAHAM, College Buildings, Ipswich. [1 S

Model Engine Castings, separate parts, half castings, etc. Illustrated catalogue, 4d.—STIFFIN & CO., 324, Essex Road, London, N. [3 S

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E.

Lettering and Sign-Writing made Easy.—Illustrated instructions, and diagrams for marking out eight alphabets, 1s.—COULTHARD, Terrace Rd., Bournemouth. Note.—100 Decorator's Stencils (60 large sheets), 2s. 6d.

Fretwork, Carving, and Repoussé.—100 full-size designs for either, 1s.; 300 Turning, 1s.; 400 small Stencils, 1s.; 500 Shields and Monograms, 1s., post free. Catalogue, 3d.—COULTHARD, Terrace Rd., Bournemouth. [2 S

2,000 Lots of Second-hand Lathes, Drilling Machines, Gas and Steam Engines, and miscellaneous items. Call at 100, Houndsditch, London, or send 4 stamps for Register.—BRITANNIA CO. Tool Factory, Colchester.

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

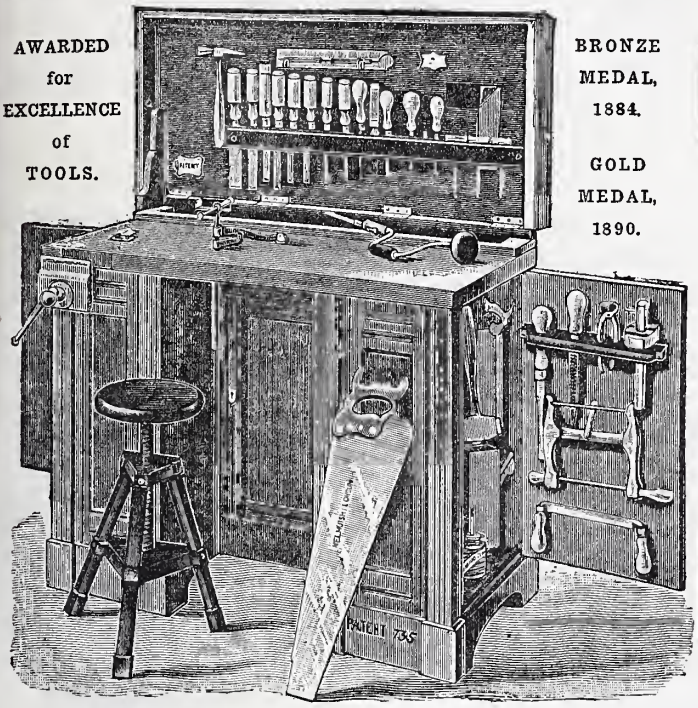
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

RP. MELHUISH & SONS,
84, 85, 87, Fetter Lane, LONDON.

Price 1s. 6d.
Guide to Employment for Boys on Leaving School.

Bovril

Invaluable as a Strengthening and Invigorating Beverage.

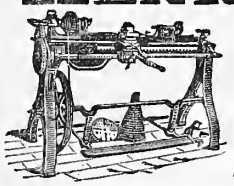
Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

HENRY MILNES,



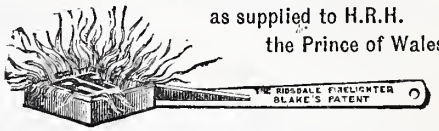
MANUFACTURER OF
HIGH-CLASS LATHES
FOR
SCREW-CUTTING & ORNAMENTAL TURNING
TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.
Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. ESTABLISHED 1858.

Monthly, 4d.

Cassell's Time Tables.

THE "RIDSDALE" FIRELIGHTER



as supplied to H.R.H. the Prince of Wales.

Twelve fires for 1d.

Indestructible—No Danger—Free from Smell.

Retail price, 1s. each, and one will last for years.

Praised by "Work," and all papers. Post free, 1s. 3d.

"RIDSDALE" FIRELIGHTER CO., Crewkerne.

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application.

FRANCIS RAVENSCROFT, Manager.

A. T. TALLACK
Engineer & Patent Agent.
28 HATTON GARDEN, E.C.

English, Colonial, and Foreign Patents at Reasonable Charges

SPÉCIALITÉ.

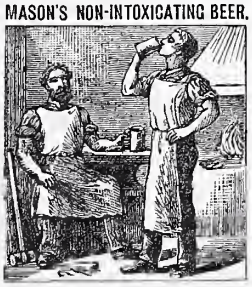
The Patenting, Working out of Inventions, and making Practical Models, Special Tools, Drawings, Engravings, &c.

If you have a novel idea which has merit, provisionally protect it at small cost, and you can make money out of it.

PARTICULARS FREE.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER. MASON'S WINE ESSENCES.



These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. One Tablespoonful of Mason's Extract of Herbs makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON,
Nottingham.

CASSELL'S CLASSIFIED CATALOGUE, containing particulars of upwards of One Thousand Volumes published by Messrs. CASSELL & COMPANY, ranging in price from *Threepence to Fifty Guineas*, will be sent on request post free to any address.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

80th Thousand, price 1s.

Cassell's Shilling Cookery.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill**, with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design SENT GRATIS with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Marvellous Purifier—Matchless Preserver—Pure Antiseptic.

"CALIFORNIAN"

"The Household Treasure" Borax,

Specially Prepared for Personal, Domestic, and Sanitary Uses.

Packets, 6d., 3d., and 1d. each.

Sold by all Grocers and at Stores.

TRADE MARK.

REGISTERED.

PATENT BORAX CO., *Sole Makers. Works: BIRMINGHAM.*

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,
TOOL MAKERS,
DUBLIN.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6D OR FOR 7 STAMPS
BIRMINGHAM.

[33

London Warehouse: **124, NEWGATE ST.**

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

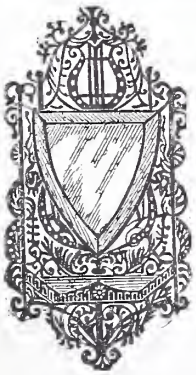
LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the **MANAGER, SALT REGAL WORKS, LIVERPOOL.**

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

CARVING AND FRET SAWING FOR PLEASURE OR PROFIT.

Highest Award Gold Medal for Fretwork and Carving Tools and Designs.



The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION. Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS, at 1/3, 2/6, 3/6, & 5/6 each, *post free.*

Parcels of Assorted Fretwork, 10 feet	***4s.*** free.
12 Finely Lithographed full-sized Patterns	***1s.*** ,,
Sets of 12 Carving Tools...	***10s.*** ,,

None should buy elsewhere before seeing our **New Catalogue** of all Requisites, with instructions. Acknowledged the **Most Complete and Cheapest List** of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

JUST PUBLISHED—THE "FORTH BRIDGE BRACKET."

HARGER BROS., Settle, Yorks.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 99.] SATURDAY, FEBRUARY 7, 1891. [PRICE ONE PENNY.

A DRESSING CHEST, WITH JEWEL DRAWERS AND GLASS ATTACHED.

BY A. TISCHLER.

FOR a small bedroom it would be difficult to name a more useful or economical piece of furniture than that known as a dressing chest. It unites in itself all the advantages of an ordinary dressing table and of a small chest of drawers, without occupying more floor space than either of them separately. In regard to cost, also, though more expensive than one or the other, it is less than the two of them. Fig. 1 represents a dressing chest of a good plain style—just such a thing, in fact, as a house furnisher would consider useful stock, and therefore commendable to those readers who are cabinet-makers by trade. By amateurs the design will no doubt be appreciated for its simplicity, as anyone who can make a drawer will experience no great difficulty in making this piece of furniture. The wood of which it is to be made must, of course, depend on the choice of the customer or the maker, as the case may be, as any of the ordinary furniture timbers are equally appropriate.

Those of our readers who contemplate making it for stock may be reminded that ash, American walnut, and mahogany are the woods most in vogue for bedroom furniture, so that, if made of any of these, it will be better stock than if some more unusual wood were selected. If made for any particular room, of course the furniture in it will determine the choice.

Now, bearing in mind that the chest is to serve as a dressing table, it will not do to make it of the same height as an ordinary large-sized chest of drawers, for such a height would be inconvenient to most people. If made ordinary table height, it will be much better, and this may be taken as 2 ft. 6 in., or rather more.

The width across the front may be taken as 3 ft. 6 in., though nothing definite can be said about this, as there is, naturally, much latitude allowable. It may, however, not be amiss to say that anything over 4 ft. would be unusually large. It must be understood, therefore, that any measurements of jewel boxes and glass to be given subsequently apply only to a 3 ft. 6 in. chest, and may be modified according to circumstances.

Fig. 1.—A Plain Dressing Chest, with Jewel Drawers and Glass attached.

For any size under 3 ft., jewel boxes are hardly desirable, as either they or the glass would have to be made inconveniently small. If something in the nature of a jewel drawer be required, one drawer immediately under the glass, as represented in Fig. 2, is a very suitable arrangement. Of course, if preferred, the top of the chest may be left plain, without either boxes or glass attached. In such a case it should have a small slip of wood along the back of the top to serve as a guard to prevent things slipping off.

The depth of the top from back to front may be taken as 1 ft. 9 in., so that if it overhangs about an inch at both back and front, the widest or upper portions of the ends will be about 1 ft. 7 in. It should be observed that the overhang of the top should be the same at the ends as in front, and that it should be rather under than over 1 in. At the back the overhang may be anything in reason.

The narrower part of the ends may be from 2 in. to 3 in. less than the wider. The extra width is got by simply jointing on pieces of the necessary size to the main portions of the ends. As many readers are no doubt aware, dressing chests are often made without the projecting upper drawers, or, in other words, the ends are of the same width throughout. There is no reason why they should not be by those who wish to economise their labour, but in the opinion of most, the improved appearance gained by having the widened top will more than compensate for the trifling additional amount of labour involved.

The following measurements may be taken for the jewel boxes: Width across front, on top, 11 in.; back to front, 8 in.; and height, 5 in.

These measurements will allow of a silvered plate measuring about 2 ft. 2 in. by 1 ft. 4 in. sight size.

Very little need be said about the actual details of construction, but a few hints to those who might otherwise find themselves "all at sea" may not be amiss. The articles entitled "Lessons from an Old Bureau" in Vol. I. of Work will give novices nearly all the information they require, and, if they have not already done so, they will do well to study them.

In making the dressing chest, the ends may be of ¾ in. or 1 in. stuff, and the top the same. The fronts of the ends are shown thickened up with pilasters to about 2 in. The ends and top of the jewel boxes need be scarcely so thick as the corresponding parts of the lower portion. It is, it may be presumed, understood that the jewel boxes are made independently, and are screwed through their bottom boards to the top of the chest.

The length of the turned columns (which are shown on a larger scale than in Fig. 1 by Fig. 3) must, of course, depend on the length of the glass, which is attached to them by means of the ordinary "glass movements." These should be fitted so that the part of the glass below them is heavier than that above them. The movements are fastened to the square portion of the columns, and to the corresponding parts of the glass frame. Let it here be said that common, low-priced movements are a nuisance, as they are so liable to get quickly out of order. Nothing so surely detracts from the appearance of even the best cabinet work as inferior brass fittings, unless it be bad polishing.

A few suggestions for modification and alterations from the original design may now be given:—

The tops, instead of being plain chamfered, may have the edges moulded and lined up, as shown in Fig. 4. If this finish be adopted, the upper edge of the plinth should be treated in the same manner, to keep up the uniformity of the design.

The fronts of the drawers, instead of being plain-beaded across, may have sunk bevels at the edges, as represented by Fig. 5. As the difference between a sunk bevel and a plain one, which would not look well, may not be known by all, they are shown in section in Figs. 6 and 7 respectively.

A rich appearance may be given to the drawer fronts by planting mouldings round their edges, as suggested by Fig. 8. The moulded drawer fronts should be set back further than they otherwise would be, so that the moulding is flush with, or only a trifle within, the bearers.

The edges of the bearers themselves may have moulded edges, as represented in Fig. 9, in which case the drawers must be set still further back. Beads may be run across the drawers just as if they were without mouldings, but, of course, before the mouldings are put on. The edges of the glass frame may also be moulded to correspond. By the way, if the slight extra cost be not objected to, the glass should have bevelled edges. A ¾ in. bevel will be quite sufficient for such a small plate. When measuring the size of the glass, be careful to take sight size, and not the full within the rabbet. If, when ordering the plate, sight size be clearly expressed, the glass merchant will understand that it must be a little larger, and will probably allow ⅜ in. in each direction. This is the usual way, and, of course, the purchaser may order it plate size if he prefers.

Instead of the narrow guard which is shown in Fig. 1 at the back of the jewel drawers, a more ornamental appearance may be given by means of a row of spindles, as shown in Fig 10. The spindles should not fit directly into the tops of the boxes, but into a rail placed on them; and in character they should be similar to the larger columns. Being so much smaller, no attempt should be made to have the same number of members.

Instead of being hung on columns, the glass may be placed on brackets, for which suggestions are given in Figs. 11 to 13. If brackets are used, they should be firmly secured to the jewel boxes, otherwise the weight of the glass is apt to work them loose. The carving shown on Fig. 13 is very slight, and may be omitted if preferred, or something similar used in either of the others.

The top rail of the glass may appear to some as being rather too plain, and they may, perhaps correctly, think that the appearance would be improved by the addition of something. This may either be a row of spindles, as suggested for the backs of the jewel boxes, or a pediment, of which three shapes are shown in Figs. 14 to 16. Carving may be introduced into any of them, though they will look well plain. Two drawers instead of one may be in each jewel box.

It merely remains to end these few suggestions with a word of advice to both amateur and professional makers—viz., do not forget to prepare a full-sized working

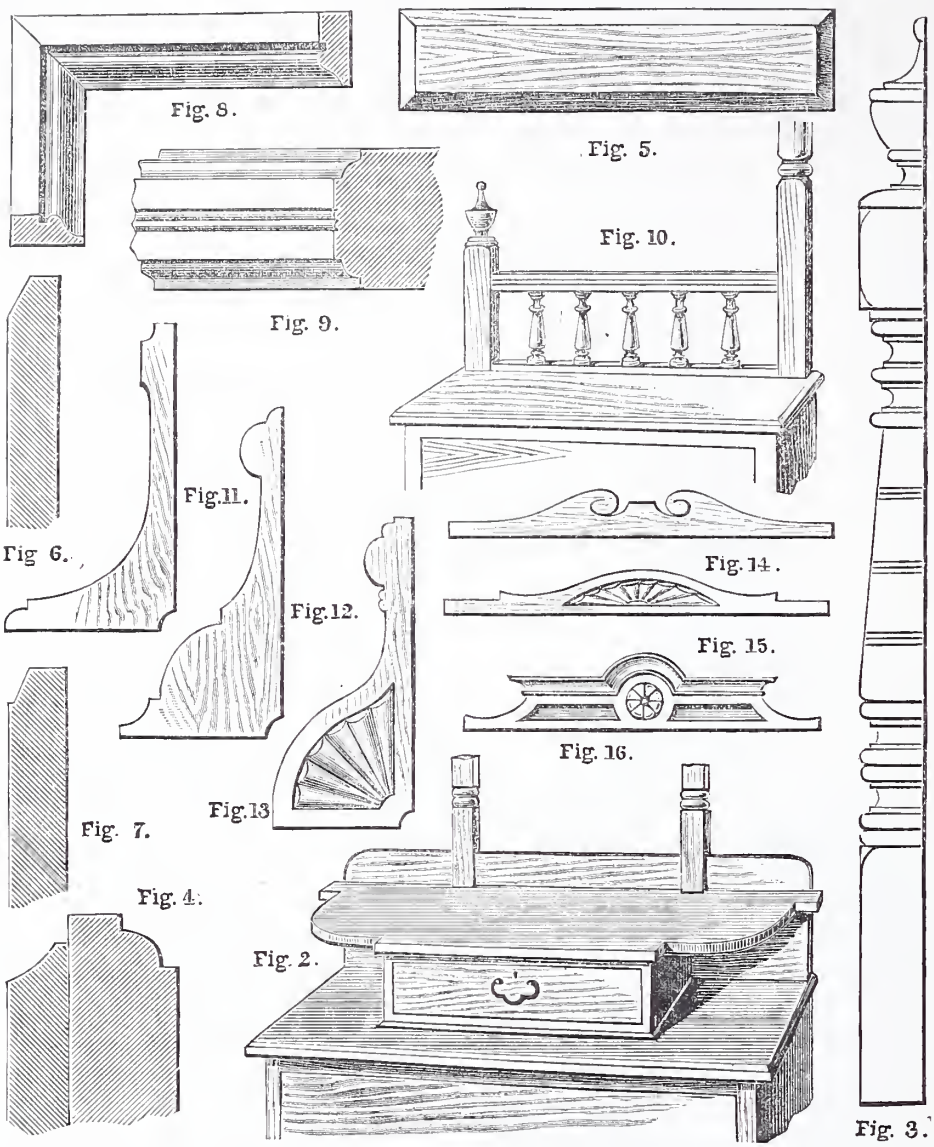


Fig. 2.—Jewel Box for Small Chest. Fig. 3.—Members of Turned Column. Fig. 4.—Moulded and Lined-up Top. Fig. 5.—Drawer with Bevelled Edges. Fig. 6.—Edge with Plain Bevel. Fig. 7.—Edge with Sunk Bevel. Fig. 8.—Moulding round Drawer Front. Fig. 9.—Alternative for Edges of Drawer Bearers. Fig. 10.—Spindle Gallery at Back of Jewel Boxes. Figs. 11, 12, 13.—Brackets for Glass Standards. Figs. 14, 15, 16.—Pediments.

drawing as the first step towards making a dressing chest, or, for that matter, any other piece of furniture.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

SUPER CLEARER, BEE TRAP, DRONE TRAPS.

THE super clearer recently invented by the celebrated expert, Mr. W. B. Webster, of Binfield, will be found a most useful piece of apparatus, and certainly deserves a description in these pages. As its name implies, it is designed to free the super, when full of honey, from the bees which lurk among the combs. It is not always an easy matter to take a super full of honey from a stock of bees. The removal of the super and substitution of a quilt is easy enough, but when the super is found to contain thousands of bees as well as their honey, the novice is sometimes rather exercised in his mind as to how to get rid of them.

If, however, Webster's super clearer is slipped between the brood nest and the super, ten or twelve hours before the latter is removed, it will generally be found that very few bees, if any, are to be met with among the sections. The crate can thus be taken off without the slightest disturbance of the bees, the capped sections removed, and new sections with foundation substituted. All this without a host of bees buzzing about the manipulator and the section crate! Surely a super clearer is a very desirable acquisition!

It is a very simple piece of work, on the same principle as the well-known mouse traps, into which the mice go through a tunnel formed of wires converging towards the inside of the trap, while exit is prevented by the points of the pieces of wire. The clearer or trap proper is fixed into the centre of a board which is made to fit between the brood nest and super.

We will first proceed to make this board. For the hives I have described in this series, the board should be 17 in. square and $\frac{1}{2}$ in. thick, of perfectly dry yellow pine, and planed true and not in winding. For other hives the thickness will be the same, but the other dimensions must vary, the object of the maker being to have it completely cover the frames, so as to prevent the escape of the bees.

Strips of wood, a bee space in thickness, viz., $\frac{5}{16}$ in., must now be tacked round the board at both sides. This will increase the thickness of the board at the edges to $1\frac{1}{8}$ in. while the centre will remain $\frac{1}{2}$ in. These strips may be about an inch in width more or less.

In the centre of the board a hole 5 in. long and 3 in. wide is cut, as seen in Fig. 1. This can easily be effected by boring holes with a centre-bit at the corners, and sawing between them with a keyhole saw. Fig. 1 shows the board at this stage, with slips round the edges and hole complete.

We now turn to the trap proper, which is not so easy to describe. It is made of stiff wire netting about twelve meshes to the inch, but I should say any stiff wire netting whose wires are not more than an eighth of an inch apart would do. A piece 4 in. long and 3 in. wide will make one trap. It should be cut to the shape shown at Fig. 2, the middle portion being partly severed from the ends or wings at each side as shown.

A tapered piece of wood, such as the handle of a small paint brush, should now be procured, and the ends of Fig. 2 doubled over it so as to make each end a kind of circular tapered tunnel. Another piece of wood, like the handle of a broom, $1\frac{3}{8}$ in. thick, should have its end cut off square. This end should then be placed in the position of the dotted line in Fig. 2, and the sides in Fig. 2 turned up against the sides of the broom-handle. The netting is thus made into a receptacle which is not unlike Fig. 3. The bees can get in underneath, which is open, and would pass along the tunnels, emerging at the points which are not more than a quarter of an inch across.

Two pieces of tin or zinc are now procured, each 6 in. by 4 in., and an inch and a half hole bored in the centre of one, and a seven-eighth hole in a similar position in the other.

These centres may be found by joining the opposite angles of the tin. The trap (Fig. 3) is now to be taken, and the lower part, which was formed over the broom-handle, can, with a little manipulating, be made to pass through the $1\frac{1}{2}$ in. hole in the tin; then the edges are turned back and the trap thus secured to the tin.

The other piece of tin can now be laid over it, and the jagged ends of the wire netting will thus be covered over and hidden. The trap and pieces of tin may now be inverted over Fig. 1, the trap passing through the hole, axially with it, and in its centre, and tacks through the edges of the tins will secure it in place. Instead of this, other strips of tin or zinc three-quarters of an inch wide may be tacked round the edges of the two tins, and will serve to keep them from moving.

A description of the complete affair, as it lies before me now, will probably help the amateur. Looking at one side, I see a board 17 in. by 17 in. with a slip $\frac{5}{16}$ in. high and 1 in. wide tacked all round. In the middle there is a piece of zinc 6 in. by 4 in., held in place by other strips all round tacked to the board; there are just two dozen tacks, spaced about an inch apart.

In the centre of the zinc there is a circular hole $\frac{7}{8}$ in. across, and looking through I can see the wire netting and the tunnels leading towards each end. Looking carefully through the hole, I can see the ends of the wires of the netting turned over a second piece of zinc, the zinc at my side covering the jagged wire ends.

Turning the board over, I find strips round the edges at this side as well, a bee space high, and an inch wide. Instead of the zinc, I notice a hole like that shown in Fig. 1 in the middle of the board, the zinc of the other side acting as a bottom to this hole. In the centre stands the trap, made of wire netting like Fig. 3. The middle of the trap is an eighth of an inch lower than the surface of the board, but the tunnels slope upwards, and their points are an eighth of an inch higher; the points of the tunnels are equidistant from the ends of the hole. On a careful examination I observe that a bee could not by any possibility get from this side to the other except through the tunnels, and as the ends of the wires are unprotected and only $\frac{1}{4}$ in. apart, she would not find it comfortable, if it would be even possible, to go from this side through. In the opposite direction the passage would be easy enough.

It is scarcely necessary for me to add, as I am sure it is evident to the intelligent bee keeper, that the clearer should be placed on the hive with the trap side down, and the zinc side up towards the section rack, thus affording all opportunity to the bees of leaving the super, but none of returning. It would be wise to write "this side up" on the zinc side of the clearer.

If one of these super clearers is not used, it would be well to make a bee trap for the express purpose of ridding the supers of bees after they are taken from the hives. A box should be made of half inch wood large enough to hold the crates and a little over. As our crates are 17 in. by 17 in., a box 18 in. square and 6 in. high inside measurements would be enough. This should be well made—as nearly as possible light tight. The top should have a flange all round to fit over the body and break the joint.

Towards the upper edges of the sides a number of $\frac{1}{4}$ in. holes should be cleanly bored with a centre-bit, and through these the bees can escape. To prevent entrance, however, some precaution must be taken, but this can be done very easily by utilising the old five-pin bee trap.

Draw with a fine pencil a line horizontally across each hole, passing through its centre as at Fig. 6, then drive four pins into the sides of the box, two above and two below this line, and sloping upwards at a small angle; then lay another pin between them across the hole, which it will serve to bar. The bees from the inside can easily push the pin forward out of their way, but it will drop back as soon as the pressure is removed, and effectually prevent entrance to the box. When in use, the box should be placed so that the sun can shine through the holes, which will cause the imprisoned bees to make for the light.

A drawback to this plan is that when the bees find themselves separated from their companions they are tempted to gorge themselves with honey to prepare for emergencies, and with that object in view they pierce the cappings of the sections, which take away considerably both from their value and from their keeping qualities. The super clearer, however, is not open to this objection, the bees not being separated from the hive, or otherwise disturbed to any extent.

Drone traps next demand our attention, of which I will describe two. The simplest (Fig. 7) consists of a piece of excluder zinc bent in such a way as to completely cover the entrance to the hive. One could be made of a piece of excluder 1 ft. long and 4 in. wide as follows:—Call one long side the front; from two of the front corners cut out pieces 2 in. long and 1 in. wide; then turn down the piece in front, which is 8 in. long and 1 in. wide, between the pieces which have been cut out; turn down also the ends, which will be 2 in. long; and then turn out 1 in. at each end. It will then be like Fig. 7, and complete. If it is placed at the door of the hive in the middle of a fine day, when the drones are flying freely, it will entirely prevent their entrance; and a crusade might be made against them late in the evening. Of course, care should be taken that the trap fits closely against the front of the hive, so that there is nowhere a larger space for the entrance of the bees than the perforations in the zinc; otherwise the trap might be set in vain.

This is at the best a negative kind of trap: it does not quite catch the drones, but simply prevents them from entering their home.

Fig. 8 is the section of a drone trap which catches and retains the drones until the bee

keeper has leisure to get rid of them. The part to the left of the engraving is placed against the hive entrance in the morning, and the drones on going out for their airing follow the direction of the arrow. The bent part (E) is made of the excluder zinc, so they cannot gain exit through that. They then crawl up along the sides D, D, through the narrow space on top, only to find excluder zinc above them and in front. They have not wit enough to regain the hive through the narrow entrance between D, D, and so remain buzzing in the top space until the bee keeper puts them out of their misery. The worker bees make easy exit through the excluder zinc, which forms the top, front, and arched bottom of the trap.

To make this trap, we will require a piece of nice straight-grained yellow pine, 3 ft. long, 9 in. wide, and ½ in. thick; also excluder zinc 12 in. by 13 in., and common perforated zinc 7 in. by 11 in.

First cut two sides to the dimensions given at Fig. 9, and then cut out the piece A, which is 4½ in. wide and 11 in. long; put it between the sides in the place indicated, and put four nails through each side into A; then nail the piece B (Fig. 8), which is 12 in. by 3½ in., on to the sides, the nails passing through C into the sides. The sides ought now to be parallel, and 11 in. apart.

Two pieces of wood like Fig. 10 are now to be made out of ½ in. stuff, and pieces of plain perforated zinc—11 in. by 3½ in.—are to be nailed along the sloping sides so that the wood ends and perforated zinc sides make a sort of elongated rectangular funnel, the space at the top being ⅜ in. wide and 10 in. long.

The sides of this funnel should now be found to fit exactly between the previously made sides of the trap. If anything, they should fit rather loosely, so that when they are secured together the perforated zinc will be drawn taut.

The funnel may now be put into the trap, having one edge of the perforated zinc against the side A, to which it may be fastened with a couple of tacks, and the other edge will be flush with the front of the trap. The trap and funnel may be secured together either with nails or screws passing through the ends of both.

The excluder zinc may now be taken in hand. It is 12 in. by 13 in. Turn up 4½ in. of one end, and bend it back sharply—almost flat—against the other part. This is to make the bridge (E). To make it fit between the sides of the trap, ½ in. must be cut off from each edge. This would of course be done more easily before the bending.

Form the bridge now by bending the excluder zinc to shape, taking care that its back edge will touch the bottom with a slight pressure when the latter shall have been put on.

If the sharply bent part be now hooked against the perforated zinc already in place, we can see how things look. The excluder zinc can be tacked against the front of the trap by means of the projecting portions, while the bridge fits easily between the sides. The bottom—12 in. by 9 in.—may now be put on; and care should be taken that there is a space, not varying much from ⅜ in., in front to give access to the bridge excluder. The zinc will be bent at a right angle at the top front edge, so that the bent-over portion will cover the top, which it will be found to do almost exactly. Two tacks must be driven downwards into the sides towards the front edge, but it will be necessary to have the back part secured with a couple of little buttons, so that it can be raised up to allow the trap to be cleared of drones.

This is, as I said, a positive trap, catching the drones rather than excluding them; but it owes its efficacy to the stupidity of the bees in not getting back to the hive by the same road as they came out. I ought to mention that the back part of the bridge-shaped excluder can be raised with a piece of wood thrust in from the front, so as to allow of free ingress and egress to the hive when desired. Nothing now, I think, remains to be said on this subject.

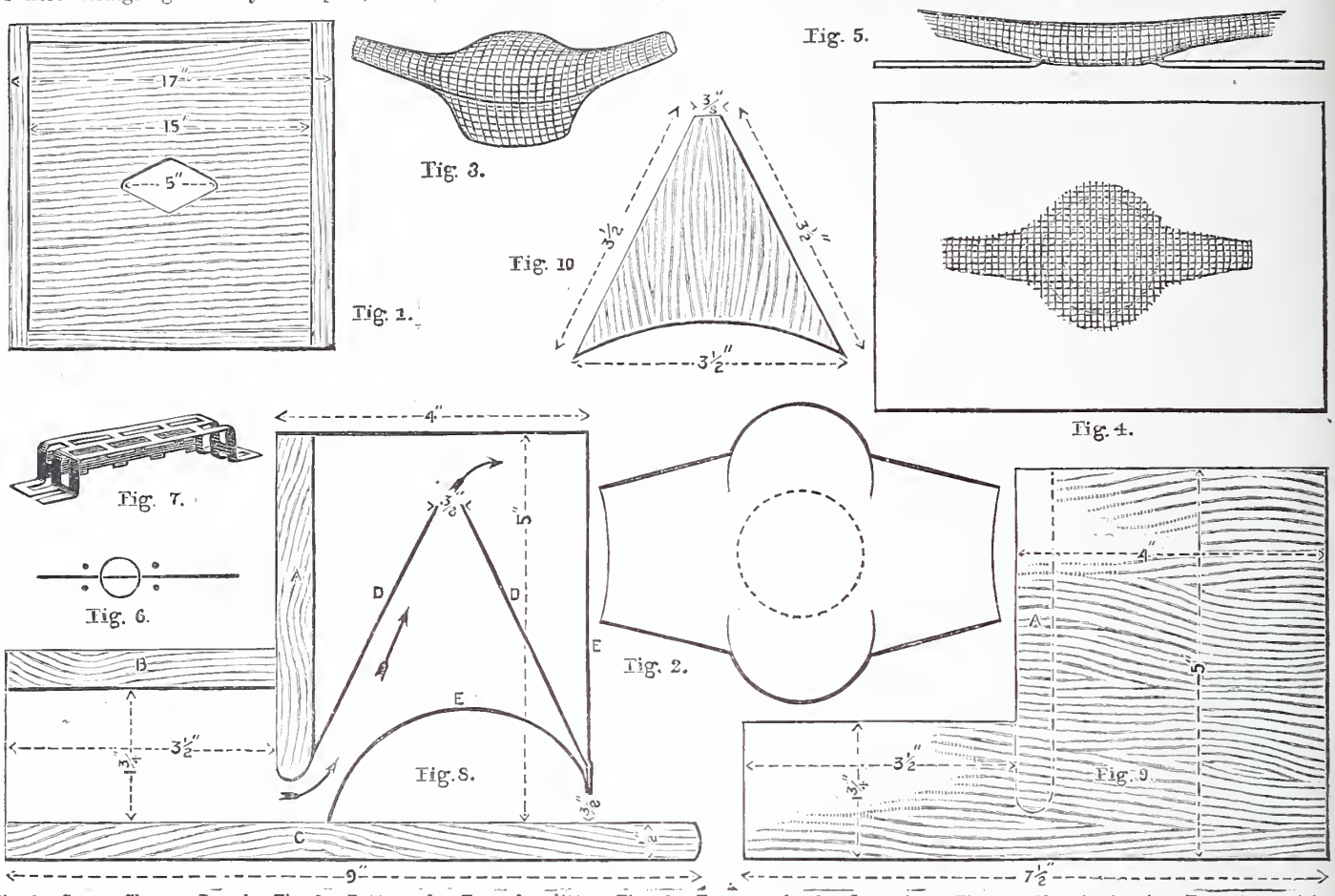


Fig. 1.—Super Clearer Board. Fig. 2.—Pattern for Trap for ditto. Fig. 3.—Trap ready for Insertion. Fig. 4.—Sketch showing Trap in Position. Fig. 5.—Side View of Fig. 4. Fig. 6.—Five-Pin Bee Trap. Fig. 7.—Simple Drone Trap. Fig. 8.—Section of Drone Trap. Fig. 9.—End ditto. Fig. 10.—End for Funnel for ditto.

MODEL ELECTRIC LIGHTS.

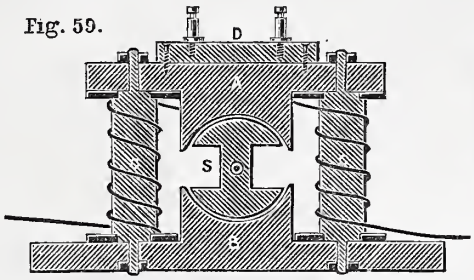
BY GEORGE EDWINSON BONNEY.

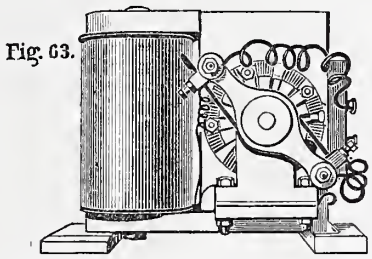
The Manchester and Simplex Dynamo Machines.

The Manchester dynamo shown at Fig. 58 (invented by Messrs. Mather and Platt, of Salford, near Manchester) now claims our attention. In point of simplicity in construction, and in usefulness, it bears the palm over both Siemens and Gramme machines. The carcase of a Manchester dynamo is made up of four malleable iron castings. These consist of the bed-plate and bottom pole piece in one casting, the two cores, and the top pole piece and yoke also in one casting. The whole arrangement is shown in section at Fig. 59, where A represents the top pole piece, B the lower pole piece, and C, C, the two cores. From

this sketch it will be seen that the four horns of the pole pieces form a tunnel in which the armature works, and the two field magnet cores on each side form pillars to support the upper pole piece and yoke. These cores have wrought-iron screw-threaded pins cast in each end. These pass through holes drilled in the top yoke and the bottom bed-plate, and the cores are securely bolted to those parts by means of nuts made to fit the screwed pins. Just a few words about those cores. That they should be made of the best malleable iron and well annealed goes without saying, as this is now conceded to be a common necessity to cores and pole pieces of all dynamos. But it is not so generally recognised as it should be that the cores of these dynamos should be fitted with wrought-iron flanged ends, and that the outsides of these ends, together with a corresponding round area on the yoke and bed-plate, should be turned bright and closely fitted together. If this is done before the cores are wound with wire, the following improvements will be observed: It will be much easier to wind the cores when thus made up in the form of bobbins; the wire will be protected from injury whilst bolting the parts of the machine together, and the magnetic connection between the cores and pole pieces will be improved. When cores are not thus flanged, it frequently happens that the iron of the upper pole piece or yoke is forced into connection with some of the coils of wire whilst bolting the parts together, and this alone is the cause of some failures with this class of machine. The difference in magnetic efficiency and intensity of the field is most marked when cores are thus flanged, and the flanges brought into close, bright connection with the pole pieces. As the efficiency of the machine depends upon the magnetic changes in its field magnets, this point should not be neglected. At Figs. 60, 61, and 62, I show how the flanges may be put on. Fig. 60 shows the core as in general use. Fig. 61 shows the same core with a light cut, taken in a lathe, on each end. This must be made to fit the hole in a wrought-iron collar or washer when the collar has been made warm. Fig. 62 shows the collars shrunk on the core and turned up bright. The field magnet cores are wound with wire in the same manner as those of the Gramme machine already described—*i.e.*, wound to make the top a N. pole and the bottom a S. pole. The method of connecting the ends has also been shown.

The Armature.—The Manchester field may be easily adapted to either the ring or the H girder forms of armature, either solid or laminated. In the small machines Pacinotti cogged armatures are employed. In some others the Gramme ring has been employed. When large, coarse wire is necessary on the armature, the H girder form will be found most convenient, and will be most efficient when built up of laminated plates, as shown at Fig. 23 in the fourth article on this subject (page 644). When armatures of the Gramme or Pacinotti type are used, it will be necessary to build up the commutator as described in the last article as for a Gramme machine, because we must have a commutator with several sections to receive the ends of the several coils. But, when the H girder form of armature is chosen, we must also select the two-part commutator used in the Siemens machine, and illustrated at Figs. 26, 27, and 28 (page 644).





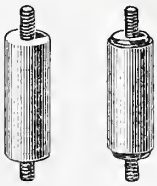


Fig. 59.—Section of Manchester Dynamo, showing how to wind the Field Magnet Cores—A, Upper Pole Piece; B, Lower Pole Piece and Bed Plate of Machine; C, C, Cores of Field Magnets; D, Wooden Platform for Binding Posts; S, Section of Siemens H Girder Armature. Fig. 60.—Usual Form of Field Magnet. Fig. 61.—Core with Ends turned down to receive Flanges. Fig. 62.—Core fitted with Iron Flanges. Fig. 63.—The Simplex Dynamo Machine.

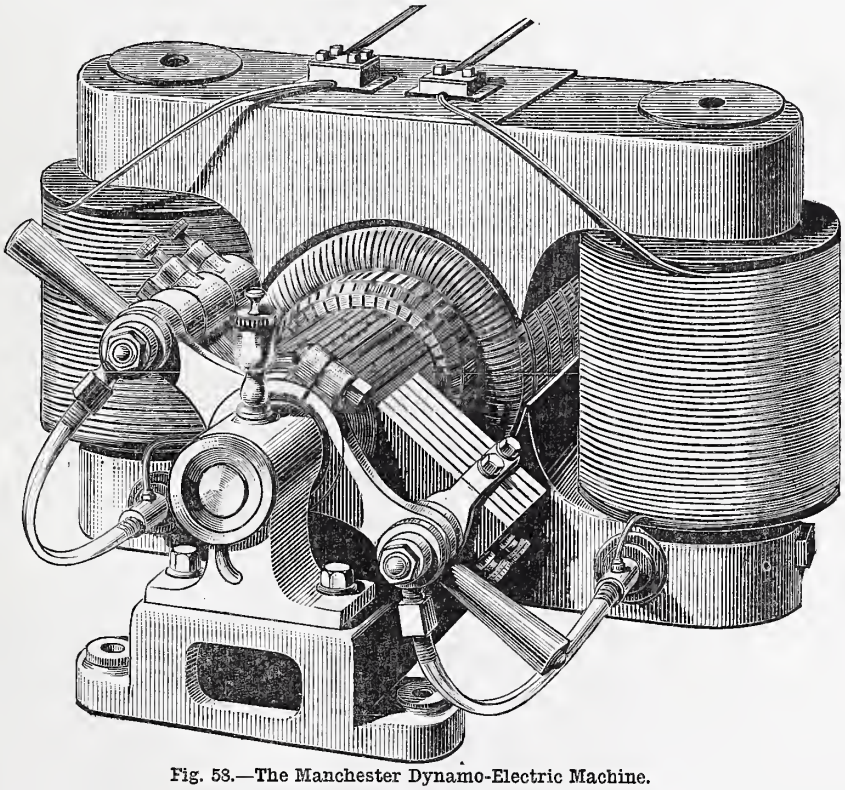


Fig. 58.—The Manchester Dynamo-Electric Machine.

Brushes and Brush Holders.—As the bed-plate of the machine is massive and broad, it carries journals for the bearings on each side of the pole pieces, and these are set wide enough apart to admit a long armature spindle. We have therefore room enough for a rocker arrangement and adjustable brush holders such as those shown at Figs. 53, 54, and 55 (page 725). The rocker works on a gun-metal sleeve fixed to the inside of one of the journals. The brushes are best made of copper wire gauze soldered to thin strips of sheet copper. Connections between them and the wires must be made as directed for the Gramme machine. Those of my readers who may wish to make up a machine of the Manchester type, will find instructions on winding the armature and all other necessary particulars in preceding articles on the Siemens and Gramme machines, the directions for one being applicable to all. The specifications on page 758 for four useful sizes of Manchester type dynamos have been kindly placed at my disposal by Mr. S. R. Bottone, electrician, Carshalton, Surrey, who will also supply the castings and all other requisites to amateurs making up these machines.

No. 1 is furnished with a solid Pacinotti cogged armature. All the others are intended for laminated armatures of the same type. The armature of No. 4 is to be wound with two strands of No. 16 wire run side by side, and wound on together. This is found more convenient for winding than a coarser wire, and the effects obtained are equally good. After winding on two strands in this way, the ends should be bared, twisted together, and soldered, before fastening them to the commutator bars. The large machine shown at Fig. 58 is furnished with a Gramme armature, wound with forty coils of wire. The small machines, coming within the scope of an amateur's abilities, have a less number of coils on their armatures. This large machine had also compound wound field magnets—that is, the cores were wound with two sizes of wire, the smaller being connected in shunt with the armature. In the small machines above described, the main coils of the field magnet cores are connected in shunt with the armature. In making arrangements for connecting the machine with the line wires of the outer circuit, it will be advisable to mount a slab of polished mahogany or other hard wood on the top of the dynamo, as shown in section at D, Fig. 59, and insert the binding posts in the wooden slab as shown.

The Simplex Dynamo.—The machine shown at Fig. 63 is thus named because of the simplicity of its parts. If we take a Manchester dynamo and cut right down through the machine, so as to lop off one core and the ends of the pole pieces which it supports, the remainder of the machine will represent a Simplex dynamo having only one core. All the other parts of the machine are constructed exactly the same as the Manchester dynamo. The armature may be a Gramme ring, a Pacinotti cogged ring, or a Siemens H girder, but I should advise the Pacinotti as being the most convenient, and this is the form arranged for in the following specifications :—

List of Dynamo-Electric Machines—Manchester Type.

No.	Size of Cores.			Armature.			Wire on F.M.'s.	Wire on Armature.	Power developed.			Speed.
	in.		in.	in.		in.	All d.c.c.	All d.c.c.	Volts.	Amps.	C.P.	Revs. per min.
1	$1\frac{1}{2}$	×	4	$3\frac{1}{2}$	×	2	6 lbs. No. 22	$1\frac{1}{2}$ lbs No. 22	25	5	50	2,500
2	$2\frac{1}{2}$	×	$6\frac{1}{2}$	$4\frac{7}{8}$	×	$2\frac{1}{2}$	10 lbs. No. 22	4 lbs. No. 20	50	5	100	2,000
3	3	×	$7\frac{1}{2}$	6	×	6	20 lbs. No. 20	4 lbs. No. 16	55	10	200	1,500
4	4	×	10	7	×	7	90 lbs. No. 16	12 lbs. No. 16	50	30	600	1,200

List of Dynamo-Electric Machines—Simplex Type.

No.	Size of Cores.			Armature.			Wire on F.M.'s.	Wire on Armature.	Power developed.			Speed.
	in.		in.	in.		in.	All d.c.c.	All d.c.c.	Volts.	Amps.	C.P.	Revs. per min.
1	$2\frac{1}{2}$	×	5	$3\frac{1}{2}$	×	2	6 lbs. No. 22	$1\frac{1}{2}$ lbs. No. 22	25	5	50	2,500
2	$3\frac{1}{2}$	×	7	$4\frac{7}{8}$	×	$2\frac{1}{2}$	10 lbs. No. 22	4 lbs. No. 20	50	5	100	2,000
3	$4\frac{1}{2}$	×	8	6	×	6	20 lbs. No. 20	4 lbs. No. 16	55	10	200	1,500
4	6	×	10	7	×	7	90 lbs. No. 16	12 lbs. No. 16	55	30	600	1,200

No. 1 has a solid Pacinotti cogged armature. All the others are arranged for laminated armatures. In winding the armature of No. 4 machine, two strands of No. 16 wire are to be used, as in the No. 4 Manchester machine. The armature is connected in shunt with the field magnet coil. Stability is ensured by bridging the two pole pieces with a plate of brass or of gun-metal. The binding posts may be mounted on this bridge, or on top of the machine, as shown in the Manchester dynamo already described. A high efficiency is claimed for this machine in working. It is also easily put together, and all its working parts can be readily adjusted. All the remarks made respecting the Manchester dynamo are equally applicable to this, so it will not be necessary to repeat them.

Designing Dynamos.—I should strongly advise the amateur not to attempt designing dynamos with a view to making his own patterns and castings, and thus reduce the cost. Unless he is well versed in the laws which govern the proper construction of these machines, he will find himself landed in a hopeless muddle, with castings too large, too small, or so ill-proportioned as to be almost useless. Then, too, the efficiency of the machine so largely depends upon the quality and condition of the iron used in the castings, as to need an amount of skill not always obtainable in country foundries, where the men do not know the requirements for a dynamo machine. Before winding the cores of the field magnets or the armature of a machine designed by an amateur, he will have to take into consideration the work desired to be done by the machine, and the resistance offered by all this work, and then calculate the size and length of wire necessary. It is almost useless to think of a dynamo as of a galvanic battery giving an E.M.F. of so many volts at the poles, since the E.M.F. developed in a machine is so largely dependent upon the character of work being done by it, the E.M.F. of the current being increased or decreased by the strength of the magnetic field, and this must vary with the varying strength of the current passing through the field magnet coils. In planning the winding of a shunt dynamo, the resistance of the outer circuit—*i.e.*, work to be done—must first be ascertained, then the resistance of the armature coils must be calculated not to exceed one-twentieth the resistance of the outer circuit, and the resistance of the coils on the field magnets must be twenty times the resistance of the outer circuit. I cannot go fully into this part of the subject here. Perhaps a more able pen than mine may go more deeply into the subject of dynamo designing, and publish the results in a future number of Work. Those of my readers who may wish to study up the subject for themselves, will find some plain directions in the books already named, and in "Electrical Instrument Making for Amateurs," pp. 108-116. The subject is also treated in a more advanced style in Walker's "Practical Dynamo Building for Amateurs," pp. 18-28; in Esson's "Dynamo-Electric Machines," pp. 140-181; and in Thomson's "Dynamo-Electric Machinery," throughout the appendix.

Working Dynamo-Electric Machines.—Before concluding this part of my subject, I will give a few hints on working the machines, and hope they may prove acceptable to my readers. A machine may be worked from any source of power, be this horse traction, foot motion (as in a lathe), by winch handle, windmill, water motor, hot-air motor, gas engine, or steam engine. Uniform speed is greatly to be desired in the motor, and this is best obtained from a steam engine fitted with a sensitive governor. Small gas engines do not run steady. There is a tendency to race, and the impulses given to the piston are observable in flickering of the lamps. This fault is less observable when the engine is working with a heavy load, and is taking in gas at every stroke of the piston. Water motors give good results when the head or pressure is constant, and the load is also constant. This is probably the cheapest source of power. Windmills are very inconstant motors, and altogether unsuitable for driving dynamos engaged in direct electric lighting. They may be used (under certain conditions) to drive dynamos for charging secondary batteries employed in electric lighting. Animal motors as a source of power are costly, and the work is very hard. Treading a foot-lathe to light up a 10 candle-power lamp is pleasurable excitement for a few minutes whilst the novelty lasts, but the necessity for a uniform high speed makes the work very tiring to the leg muscles. I need scarcely mention the work of driving a machine by turning a winch handle attached to multiplying gear, as it so nearly resembles grindstone drudgery. One thing must be impressed on the reader's mind :—To ensure a steady, bright, uniform light in the lamp or lamps, the *speed of the dynamo must be uniform*, since any variation in speed will vary the E.M.F. of the current and consequent brightness of the lights. If the speed given in the last column of the specifications above mentioned is greatly exceeded, the lamps will brighten up, and have a merry life, but a short one. On the other hand, if the machine is not driven up to speed, the lamps will not be fully lighted. When the filament is glowing white, with just a suspicion of sparkle in it, the E.M.F. of the current is quite high enough. A dull red or creamy yellow about the filament shows that the speed of the machine may be increased with advantage.

The dynamos described in the foregoing pages are all shunt-wound, and are constructed to furnish current for a certain number of incandescent lamps arranged in parallel. If a larger number of lamps are put on than the machine can furnish with sufficient current, the brightness of the lights will fall, because the resistance of the circuit will then be much less than that of the coils on the field magnets, and the magnetic intensity of the fields will fall as a consequence. If the machine fails to give out its proper quota of current when driven at the right speed, we may suspect a wrong adjustment of the brushes, and should then alter the lead of these until the best effect has been obtained. This we can easily do if the brushes are fixed on a rocker and controlled by a swivel and spring arrangement such as that described for the Gramme machine. Speaking from a theoretical point of view, we should adjust the brushes to cut off the armature current just as its coils have passed the most intense part of the magnetic field into the neutral gap between the pole pieces; but it is found in practice that the armature retains some residual magnetism after its coils have passed the point above-mentioned, and the influence of the field is carried beyond that point by the speed of the armature. We shall, therefore, very likely find the best position for the brushes to be forward beyond the neutral point, and this position may be affected by the speed at which we are driving the machine. The brushes should not press too heavily on the commutator, since too much pressure on the bars causes excessive wear. They should rest on a bar and a half of the commutator, and cover the whole width, so as to prevent excessive sparking, since the electric sparks burn away the brushes and the commutator. A little oil applied to the bars after cleaning, and then wiped off again, will be found quite enough lubrication; but the bars and brushes should always be well cleaned after a run of a few hours, and before starting again. Some machine minders prefer using blacklead as a lubricant, but this must be put on sparingly, since it is apt to choke up the spaces between the commutator bars and short-circuit them.

After the cores of the field magnets have been once magnetised, they should retain some residual magnetism, and this is generally found sufficient to start the machine. But it sometimes happens that the cores of small dynamos lose their residual magnetism, or they do not so readily become magnetised as larger ones. In this case the remedy is, of course, to send a current from a battery through the coils, as in the first instance, and thus re-magnetise them. When doing this be sure to send the current in the right direction, or the poles will be reversed, and then all the connections will have to be altered. For a similar reason, never play with the dynamo as a motor.

Dynamos for Lighting Arc Lamps.—The

carcase of a Manchester dynamo may be easily wound with wire to make it suitable for lighting arc lamps. For instance, to render a Manchester, having cores 3 in. in diameter by 7¼ in. in length, and an armature 6 in. in diameter by 6 in. in depth, suitable for lighting an arc lamp of 1,000 candle-power, we have only to strip off the wire put on for incandescent lighting and wind the machine afresh. The cores of the field magnets must then be wound with 8 lb. of No. 14 double cotton-covered copper wire on each core, and the armature wound with 4 lb. of the same kind and gauge of wire. The two inner ends of both field magnet coils must then be connected to one of the brushes, and the two outer ends to one of the binding posts. The coils will then be connected in parallel. A wire goes from the binding post to the lamp, and from this back to the other binding post, which is in turn connected to the other brush. Thus the whole (coils, lamp, and armature) are connected in series, and this is found best for arc lamps. The machine will supply a current of 12 ampères at a pressure of 50 volts, when driven at a rate of 900 revolutions per minute, or will give twice this amount of current if driven at a rate of 1,800 revolutions per minute. A larger machine, having cores 4 in. by 10 in., and an armature 7 in. by 7 in., should have 10 lb. of No. 10 wire on each limb, and 12 lb. of No. 12 on the armature. This will give a current of 15 ampères at a pressure of 55 volts when driven at the rate of 900 revolutions per minute, or double this output at 1,800 revolutions per minute.

An arc lamp suitable to this machine will be described and illustrated further on, after we have considered the desirability of storing surplus electric energy in accumulators, and lighting incandescent lamps from these secondary batteries.

PARAFFIN LAMPS.

BY THOMASO.

ARM OF RESERVOIR—SUSPENDING WIRES—CHAIN.

ACCORDING to promise, I am now going to describe the method of drawing a design for one of the arms that hold the reservoir and support the shade, half full size.

Draw a perpendicular line. On it describe a circle the size of the reservoir—in this case 5½ in. Draw a line across this circle to represent the join in it. About $\frac{3}{16}$ in. below it—that is, allowing for the protuberant part of the join—draw two lines across ½ in. apart to represent the ring supporting the reservoir. The length of these lines is, of course, the extreme diameter of the ring. From the join in the reservoir measure the distance to the top of the burner, and mark it on the paper. This gives the height (a convenient one) of the lowest edge of the brass rim supporting the shade. Draw lines across to represent this rim ½ in. apart. Their length is about ½ in. more than the extreme diameter of the edge of the shade, it being necessary to make the brass rim rather larger than the shade.

Now comes the critical part. The arm has to be drawn in the position it is to occupy. A man handy with the pencil would put it in, trusting to eye alone. To simplify matters for those who are not good at freehand drawing, I have squared the engraving, and made it just half size. All that it is necessary to do is to draw the same number of squares twice the size, in ink, on a piece of paper, and then draw the figure—the squares serving as a guide. When finished, cut away the superfluous paper, and put the drawing in position on the other drawing.

As drawn, Fig 23 would support a 12 in. shade holder at a distance above the ring of about 6¼ in. If you intend using a larger or smaller shade, the middle of the figure, where indicated by the arrow, can be lengthened or shortened as required by cutting the drawing, and separating or lapping the two parts as may be required, touching it up afterwards with the pencil in order to get an unbroken curve. A view of A and B from the top is given, and the position of the rivet-holes indicated. It is best to have them cast of the shape shown, and afterwards file them up to fit the curve, as shown by the dotted line. C is intended for a foot to support the lamp when stood on a flat surface (an arrangement few hanging lamps possess), and D is to take the supporting chain.

Having got the drawing right, prepare the wood for the pattern by gluing two pieces of ¼ in. fretwood together, with the grains running in opposite directions. Leave them to dry under pressure, and then plane down to $\frac{5}{16}$ in. each side equally. Make a tracing of the drawing, paste it on the wood, and cut out the pattern. Let all the curves be free of sudden bends, and remember that any inequalities in the pattern will have to be smoothed down in three castings. Observe that the pattern tapers at the ends, and is round in section. The lugs are glued on after the other part is finished. Sand-paper smooth, and varnish, smoothing each coat of varnish down with sand-paper.

I have been thus particular in describing this pattern, because the method is applicable to fragile patterns in general.

File up the castings, using a half-round file and emery-cloth, and then burnish them. Drill the holes for the chains, and then temporarily solder them to the ring supporting the reservoir. This soldering is only done to enable you presently to drill the holes for the rivets in their proper places. Make the shade holder of ½ in. by ⅛ in. flat wire; join in the same manner as in Fig. 22 (page 696), and solder it lightly in place. Observe that the arms are upright, and that when the shade is put into place the chimney projects through the middle of the opening. If it does not do so, it is a sure sign that the inner faces of the lugs have not been filed at the proper angle. This part wants a little fitting to get it right, and the soldering facilitates matters.

When all is correct, drill the holes (only just large enough for the rivets, by the way), and then rivet. Do not smash the ends of the rivets. One blow with a light hammer will be enough if the rivet fits the hole, and if finished off with a hollow punch or rivet set, they have an ornamental appearance.

Now as to the length of the suspending wires, both for Fig. 16 and Fig. 17 (page 696). The right length is found when, on being pushed up as far as it will go, the lamp permits people to walk under it without raising bumps on their craniums.

Although this is very desirable for the reason given, it is objectionable in another way. Take the average height of ordinary rooms as being between nine and ten feet—we will say nine feet, for the sake of illustration. If you have the lamp high enough to allow six feet to walk under it, the bottom of the lamp will only be about three feet from the ceiling, and therefore, only a very short length of chain can be used—too short, in fact, to be of any use. Besides, the distance of the burner from the table would be about four feet—too far away to allow anyone to read or work in comfort.

Fig. 16 cannot be put high enough to clear passing heads, in consequence of the space taken up by the remains of the chandelier.

If the lamp is intended for a hall, or any room where reading or other "eye-work" is not intended to be indulged in, the idea of weights and chains had better be abandoned, and the lamp simply suspended by the three wires or chains.

I think the majority of people have a table in the middle of the room, from which position it is rarely moved, except for cleaning operations. If the lamp is suspended over this table (a position hard to improve on), the table would prevent people knocking their heads.

That contingency having been thus provided against, there is no reason why longer suspending wires should not be used. I think, that for a room nine feet in height, a length of 3½ feet should be allowed to them. This allows a drop of about 18 in.—quite sufficient, considering the length of the wires, and the ease with which (in the case of Fig. 17) a short length of strong chain can be interposed between the hook from which the lamp is suspended and the casting to which the wires are fastened at the top. In the case of Fig. 16, if you should at any time want it to come down lower than you originally made it, you can easily accomplish it by adding a piece of chain to each side; and inasmuch as with the lengthened chain there would be great danger of the weights smashing the shade if the lamp happened to be pushed up quickly, it is necessary to put a ring (or something that will answer the same purpose) through both chains, at a distance from the ends which are hooked to the casting equal to half the length of the chain added. These rings prevent more than the proper amount of chain passing over the wheels, thereby keeping the weights from the shade. In Figs. 16 and 17 the wires are shown much shorter than they would be in the actual lamp.

It is simply a question of obtaining the greatest length of chain possible without allowing the weight to come down low enough to either put the lamp out or smash the shade and chimney. Of course, it is easy to get a good length of chain; but we are in this position: the greater the quantity of spare chain we allow, the less need we have of it.

The 3½ feet I have mentioned above is a very convenient length for the wires. If it is desired to retain this position of the lamp, and the room is more or less than nine feet in height, all that it is necessary to do is—add to the length of the wires (or subtract, as the case may be) the difference between nine feet and the height of your room.

Although I have said "wires," there is no objection to using chain; but the wire is cheapest, and is capable of being cleaned. If you use chain for Fig. 17, you must fix something on it (a ring, for instance) to act as a stop, preventing more than a certain amount of the chain passing over the wheels; otherwise the weight will drop on the shade when the lamp is pushed up.

The size of the wire should not be less than No. 9, which is about ⅛ in. Make the loops as shown in Fig. 13 (page 696). Do not make more than three links, if you have links at all, as the multiplying of the links renders it more difficult to get all three wires of the same length, which is essential.

The wire might be all in one piece, provided it was made nice and straight; but the three links has an advantage over both

single wires and chain in this way :—Most people have festive gatherings at some time or other; for it is a poor heart that never rejoices. On such occasions it is often desired to clear the centre of the room, either to hunt the nimble slipper, or for some other purpose necessitating brisk locomotion on the part of the assembled guests. Now, if the lamp is kept at its old level, it will not be long before it is flying in all directions, making the social party anything but a festive one to those who come into collision with it.

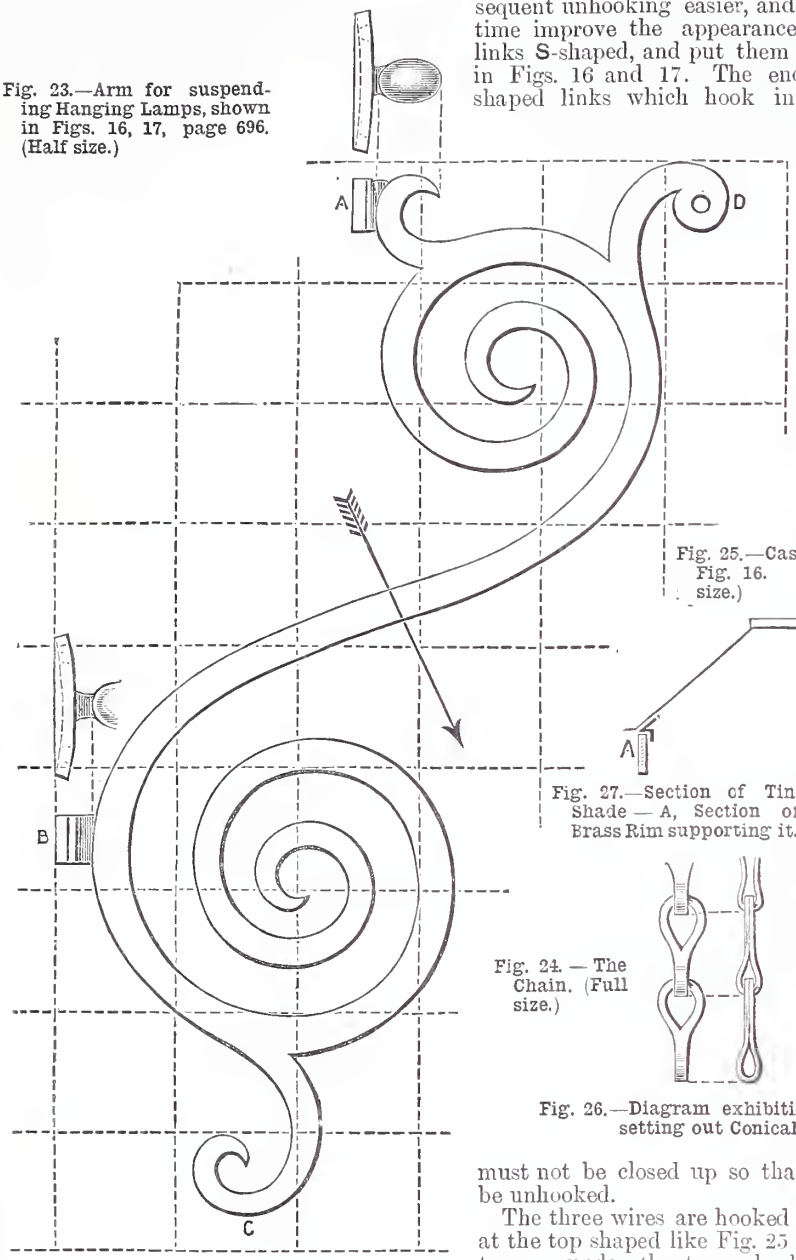


Fig. 23.—Arm for suspending Hanging Lamps, shown in Figs. 16, 17, page 696. (Half size.)

The remedy is simple. Take off one link from each wire, and hook on the weight higher up the chains. I may here remark that it is never necessary, either in taking down these lamps or a gas chandelier, to take down the weights as well. Simply catch the disengaged end of the chain into that on the other side of the wheel.

I have made frequent mention of "chain." That shown in Fig. 24 is the most suitable, as, from its construction, it cannot pull apart under any strain short of that required to break the metal. It has its drawback, however, in the difficulty, or rather impossibility, of joining two pieces or lengthening the chain, except by adding one link at the time.

To proceed with the making of the wires as illustrated. Having straightened the wire with a mallet, cut the pieces to form the links of such a length that when three are placed end to end they measure the required length. Thus : if the finished length is to be 42 in., cut each link 14 in. Now make the loops on the ends, and you will find on temporarily linking three of them together that they are collectively about 6 in. too short. To make up this loss, render subsequent unhooking easier, and at the same time improve the appearance, make short links S-shaped, and put them where shown in Figs. 16 and 17. The ends of the S-shaped links which hook into the arms must not be closed up so that they cannot be unhooked.

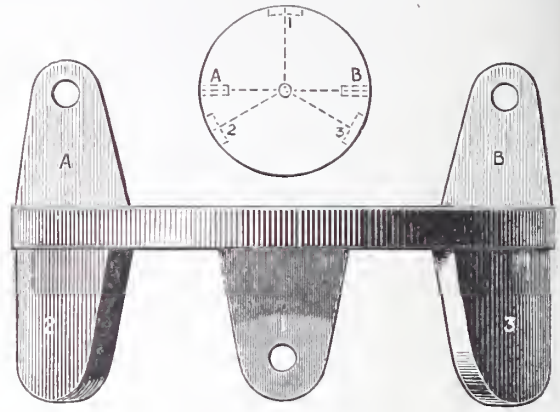


Fig. 25.—Casting at Top of Fig. 16. (Approximate size.)

Fig. 27.—Section of Tin Shade — A, Section of Brass Rim supporting it.

Fig. 24. — The Chain. (Full size.)

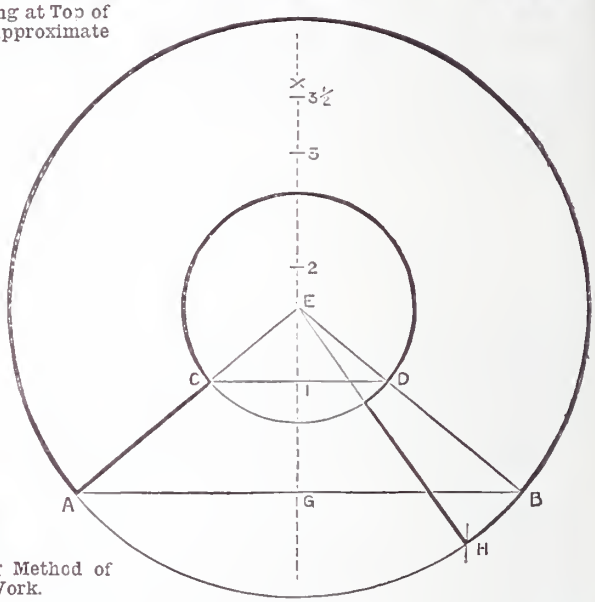


Fig. 26.—Diagram exhibiting Method of setting out Conical Work.

The three wires are hooked into a casting at the top shaped like Fig. 25 ; A and B are to come under the two wheels fixed at the top of the gas chandelier, as shown in Fig. 16. The size of the rest of the casting does not matter particularly. It is conveniently made of ¼ in. walnut fretwood. The small sketch above Fig. 25 is a plan of that figure, and shows the position of the different lugs. This is important in this lamp, in order to prevent the two weights (or one, at any rate) catching in the suspending wires. A hole is drilled through the middle of the casting, as shown in the small figure, to suspend a smoke consumer from.

You may, perhaps, be able to hammer up a 3 in. circle of brass, saucer-shaped, to serve this purpose. If not, the pattern shown can be obtained of Messrs. Stanton aforesaid. A mica one fastened to the top of the chimney would do better, and be cheaper, but does not look so well.

As to the weights, they can either be bought second-hand, if those belonging to your chandelier are too light, or you can make them as described further on.

All the brass-work should be polished and burnished. If you like, you can polish and lacquer the shade holder and Fig. 23 in the way mentioned for the reading lamp; but it is as well not to have too much lacquered work about suspended lamps, because, from their position, they form an excellent resting-place for the flies, and as a result get very dirty. If this occurs to lacquered work, you may be able to wash the dirt off for a time or two without fetching off the lacquer, but it will not last long with such treatment. It is best to polish and burnish, and when it gets dirty or tarnished, use one of the soaps sold especially for cleaning metal, such as Brooke's.

Some fringe hung round the shade, as shown in Fig. 17, adds to the appearance. Red looks very well. Glue or sew it on to a narrow strip of card to which small wire hooks have been previously fastened, and hook it on inside the shade holder. Now, if you have made the latter the ⅛ in. larger all round that I recommended, the shade will fit in nicely without shake.

If preferred, the common green and white card gas shades or a tin one of the same shape can be used. The latter is a useful shade, as it can be painted white inside and

green outside with one of the numerous enamel paints. It looks well by daylight, and throws down the light well when the lamp is alight.

If you intend having a tin shade, make up your mind first as to whether or not you are going to wire the edge; then proceed as follows:—On a sheet of stiff paper draw a horizontal line equal to the external diameter of the shade holder, or gallery. If the edge of the shade is going to be wired, add $1\frac{1}{2}$ in. to the length of the line; otherwise, add only $\frac{3}{4}$ in., to allow for turning out as in Fig. 27. This line is shown at A B, Fig. 26. Determine the height of the shade (a quarter the length of A B is a good measurement), and draw the line C D at that height, not less than $4\frac{1}{2}$ in. long. Join A C and B D, prolonging the lines until they meet at E. From E as centre, with the radius A E describe a circle, and from the same centre describe another circle with the radius C E. A wedge-shaped piece is now to be cut out, and the edge wired (if so intended). To get the size of this wedge-shaped portion, cut from the outer circle to the centre (H to E) and round the two circles, and then lap the two ends until you get the right size. Then cut out in tin, and bring the two straight edges together, lap, and solder. Observe that it does not "wobble" when stood on a flat surface, and do not have any unsightly lumps of solder about the join. Turn the outer edge outwards, and the inner edge upwards, as shown in Fig. 27. Solder three pieces of wire inside, bent as in the same figure, to keep the shade in place, and then paint.

The above method of getting the shape of the tin for the shade is the easiest of many. If you cannot get the large sheets of tin, or sheets large enough, you must make the shade of two pieces.

It must not be forgotten, if the shade is changed at any time, that the weights will also want adjusting.

HOW TO UTILISE WASTE DRY PLATE BOXES.

A PAPER FOR PHOTOGRAPHERS.

BY DEVOIR.

When I look around my dark room and view the many empty plate boxes, a sad feeling is apt to come over me when I think of the good plates—many of which, alas! are spoiled—once ensconced safely within; and also to think that such good and true boxes should have meted out to them such ill-deserved fate as being burnt, or to be consigned to that place where many of their contents have gone before—namely, the dust-hole. Also I can see so many small things laying about, that I have felt it imperative to consider some scheme to utilise the first-named, and provide a resting-place for the latter. The result of my deliberations I will now relate.

The forms of boxes are various: some, indeed, are useless for our present purpose, but the majority of the boxes used in the better-known systems of packing are well adapted for use. Take as example the three principal kinds: firstly, those made on the system used by Messrs. Thomas & Co. for their Pall Mall plates; secondly, those similar to the Ilford style; and, lastly, those by Messrs. Edwards, who pack in boxes with wood grooves.

Let us deal with the first-named. These will be found to consist of three parts: the inner rough case actually containing the plates, the case into which this is slipped, and, finally, the outer covering, into which the second in its turn is placed. We shall at once discard the inner box, it being quite useless. The outer cases we must fix together in tiers, as shown by Fig. 1. I have taken, as an example, a nest of one dozen drawers or boxes, but, of course, there is no limit either way. The space between each tier is occupied by a thin slip of pine or mahogany, as shown, half full size, by Fig. 2. These slips are placed at both front and back of boxes, and are fixed thereto by glue, and a few brads or nails as indicated. Let the nails, or whatever is used, have big flat heads. If it is anticipated that the nest will be shifted about much, it will be well to put two slips on top of boxes, and put sides to the whole—that is to say, a piece of stuff the same width as the length of the boxes, and in height the total thickness of boxes, plus so many slips. Having got so far, place aside to dry, and then proceed to deal with the inner cases in the following manner—

Fit to the open end of each a piece of mahogany or pine, $\frac{5}{8}$ in. thick, and glue in, but do not glue one of the long edges for reasons hereafter to be seen; a pin or two, placed judiciously, will add strength; a half size view of what is intended is given at Fig. 3. When dry, a sharp penknife must be passed round the three top edges, the fourth edge being the wooden one not glued, this allowing the top to be removed, and thus form a kind of drawer with wooden front, in which can be fixed either a small mahogany or bone knob, obtainable at an ironmonger's, or a round-headed screw would answer the purpose.

When all are completed, if stained and varnished, we shall have quite a fancy nest of useful drawers for a very small expenditure.

I have been dealing with boxes made for half plates as being a most convenient size for illustration, but the principle is readily adapted to suit any size.

Now let us look at boxes made on the Ilford principle, and on how they can be made useful. The system is two boxes, one a trifle larger than the other, and forming a lid, both being similar in depth. These will not give nearly such good results as the former variety, for obvious reasons; but we must do the best we can, and I think the result well worth the trouble.

We must first make a box without top or bottom, the size being the depth of so many boxes, plus $\frac{1}{8}$ in. between each. A nest for a dozen boxes is shown at Fig. 4. In the case shown we have the boxes in two tiers, and, therefore, a centre division is essential. In the inner face of the two outside pieces, and in each face of the inner division, must be cut $\frac{3}{8}$ in. deep saw kerfs, to take a slip of zinc $\frac{7}{8}$ in. wide, and the length of the box for the other dimension. These zinc slips must be cut from fairly stout zinc. A portion of one side is shown at Fig. 5, which sketch will render my meaning clear, I think.

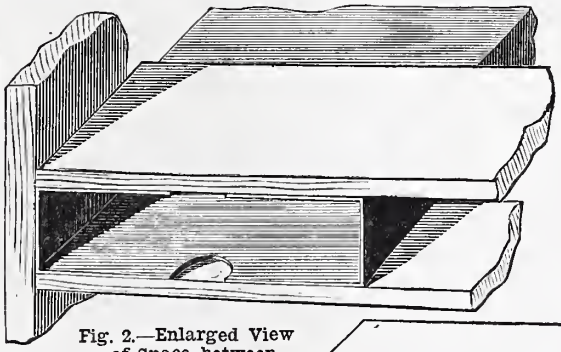


Fig. 2.—Enlarged View of Space between each Tier.

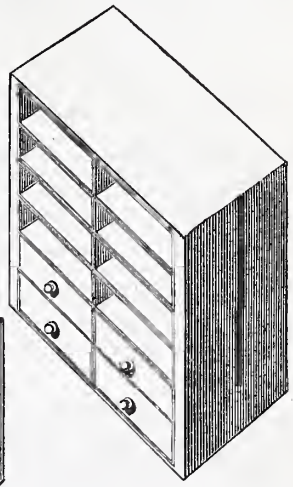


Fig. 1.—Outer Cases fixed together in Tiers.

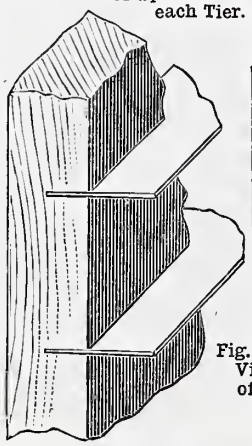


Fig. 5.—Enlarged View of Side of Nest.

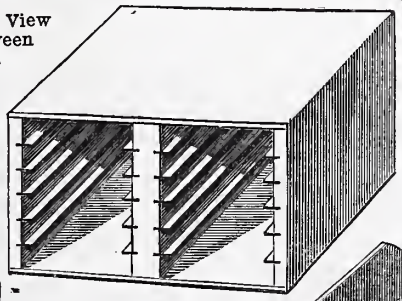


Fig. 4.—Nest of a Dozen Boxes.

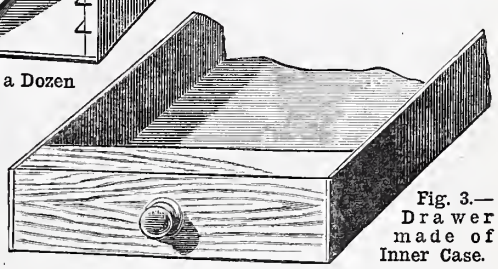


Fig. 3.—Drawer made of Inner Case.

The boxes have now to be dealt with. We can, if so cared for, dispense with the lid entirely, and use only the bottom; but the great objection to this is that dust can enter, whereas, if the following method is adopted, it will be found to be practically dust-tight.

Proceed in this way: place the lid on as usual, and glue round the intended back end a piece of black twill or calico about 3 in. wide—about an inch to be glued to top, the same to end, and remainder to bottom. When dry, cut with a keen knife the angles at back of top box only; this will allow the top to be thrown back. For additional strength, a piece of $\frac{1}{4}$ in. pine should be glued inside the bottom box at each end. The front piece will take the knob, should one be used. Fix the knob near the bottom edge, as a piece will require to be removed from lid to allow passage of knob. Now slip the box into position, label the front, setting forth contents, and our job is completed.

I scarcely need have referred to the third class under consideration, as the utilisation of these is a very simple matter—in fact, the idea of supplying the plates packed in such form is to provide a place for storage when the negative stage is reached. They simply want mounting between two pieces of board to form capital negative boxes. They are certainly not adapted for use as nests of drawers.

Doubtless this will be considered a rather peculiar paper upon a peculiar subject, but I trust that my photographic readers will find the hints contained therein useful to them, and be the means of promoting tidiness in many ways about the dark room. The varied uses to which such nests of drawers can be put, I will not venture to mention. One thing is certain: that once made and placed in position, the drawers will speedily prove of service—in fact, my only objection is that so many things get hoarded that might well be dispensed with; but still, that is no excuse for having an untidy dark room.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

120.—Electric Light Installations.

This book—"Electric Light Installations and the Management of Accumulators"—has already arrived at the position of an acknowledged authority on the subject of which it treats. There is no occasion, therefore, to say more than that it is the sixth edition of a practical handbook on electric lighting and all that pertains to it by Sir David Salomons, Bart., M.A., Associate of the Institution of Civil Engineers, and Vice-President of the Institution of Electrical Engineers. In its present form it will be found to have been revised and considerably enlarged. Its price is 6s. It forms the first volume of Whittaker's Library of Arts, Sciences, Manufactures, and Industries, and is published by Messrs. Whittaker and Co., White Hart Street, London, E.C.

121.—Photography for Architects.

In "Photography for Architects," Mr. F. W. Mills, Member of the Camera Club and the Huddersfield Photographic Society, and author of "The Art and Practice of Interior Photography," has produced a most useful book, showing in detail the practice of photography from the architect's point of view and the advantages which would accrue to members of the profession from an elementary knowledge of the art. Everything that is absolutely necessary, including processes for copying tracings, is touched on briefly, but sufficiently for all practical purposes. The illustrations are good and to the point, as an inspection of two views of the south front of York Minster—one giving the result when the swing-back was not used, and the other when the swing-back was perpendicular—will clearly show. The book, which is well and tastefully got up, is published at 2s. 6d. by Messrs. Iliffe & Son, 3, Bride Street, London, E.C.

122.—The Cabinet-Worker's Handybook.

This is the latest volume of "Lockwood's Series of Handybooks for Handicrafts," written by Mr. Paul N. Hasluck, and published by Messrs. Crosby Lockwood & Son, 7, Stationer's Hall Court, Ludgate Hill, London, E.C., at 2s. It is, as stated, a practical manual, embracing information on the tools, materials, appliances, and processes employed in cabinet work. Mr. Hasluck gives, in his description of a portable bookcase, an excellent contrivance for a folding receptacle for books, which will pack into a small compass. The idea—which, I think, first saw light in an American contemporary—has been elaborated and extended by Mr. G. H. Blagrove in his paper on "A Portable Folding Bookcase" in Vol. II., page 217, of WORK.

123.—Calvert's Mechanics' Almanack.

This excellent "workshop companion," which, in the present issue for 1891, has reached its eighteenth year of publication, should be in the hands of every artisan, whether professional or amateur. The price is not stated on it, but, if I remember rightly, it is 4d. This, however, readers can ascertain for themselves by writing to the publisher, Mr. John Calvert, 99, Great Jackson Street, Manchester. In addition to the usual almanack matter, it contains much practical, technical, and industrial information, hints, recipes, etc., valuable to all artisans and handicraftsmen, but particularly to those connected with the building trades and engineering.

124.—"The Young Fretworker."

Messrs. Henry Zilles & Co., publishers of "The Amateur," and dealers in every kind of tool, appliance, and material required for fretsawing, carving, and other kinds of ornamental wood-working, have sent me from their house of business, 24 and 26, Wilson Street, Finsbury, London, E.C., their Supplementary List No. 42 for Catalogue No. 39 (cancelling Lists Nos. 40 and 41), with reproductions in miniature of several of their newest fretwork designs, and a new book, "The Young Fretworker," published at 2s., and containing twenty-four easy, but very pretty and tasteful, designs for beginners. The patterns—which embrace a wide variety of subjects, including photo-frames, silk-winders, brackets, baskets, key-boards, pen-racks, thermometer-backs, mats, easels, watch-stands, book-slides, pen-boxes, album-covers, cabinets, etc.—are noteworthy for the careful way in which they are drawn and coloured. They are just the thing to put into a boy's hands who has just acquired his first fretsaw or fret-machine.

125.—Catalogues, Serial Publications, etc.

Charles Nurse & Co.'s Price List.—Messrs. Charles Nurse & Co., 182, Walworth Road, London, S.E., send their "Enlarged Illustrated Price List of Tools" of all kinds made or sold by them. It has the advantage of being alphabetically arranged, so that any particular kind of tool can be looked up at once without the trouble of hunting for it from beginning to end of the catalogue.

"**The Machinery Market and Importer,**" published at 181, Queen Victoria Street, London, E.C., will be found useful as a source of information and advertising medium by all who use or are interested in machinery. THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

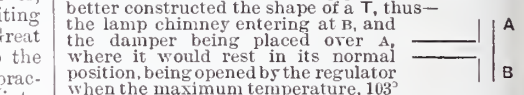
**** In consequence of the great pressure upon the "Shop" columns of WORK, contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.

I.—Letters from Correspondents.

Questions and Answers in "Shop."—J. F. (*Ahoghill*) writes:—"I do not altogether like the way the questions are answered in 'Shop.' If questions were answered in such a way as to render information to all readers interested in the subject, the value of WORK would be greatly increased." [Our correspondents and authorities are again requested to note this, and to frame the question and answer so as to be intelligible to others beyond the original querist.—ED.]

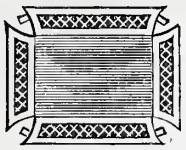
Incubator with Self-Acting Regulator.—LEGHORN writes:—"As one who has had some experience in making and working incubators, perhaps I may be allowed to criticise the article on this subject which appeared in No. 89. The machine described is a very old-fashioned arrangement, dating back, I should say, to the construction of its original in 1882. It may work, but according to my experience it is weak in its vital points. The regulator is very crude, and I very much doubt its capacity to keep the machine at anything like an uniform temperature. A regulator should control the heat in the egg chamber, and not in the tank, as various agencies might be at work to cause the heat in the former to vary, which would not affect the latter at all. The flue-pipe would be much better constructed the shape of a T, thus—



the lamp chimney entering at B, and the damper being placed over A, where it would rest in its normal position, being opened by the regulator when the maximum temperature, 103° to 106°, is reached, the surplus heat then passing straight away. The lamp-box is quite unnecessary, care being taken to place the lamp under the centre of flue-pipe. The damping arrangement is next to useless. The writer says, 'place cold water in the tray.' Now, as the heated air will not descend, it follows that the water will never get hot enough to moisten the air—in fact, if boiling water were placed in the tray it would be cold in less than two hours, and the eggs would want constant sprinkling, and towards the end of the period of incubation a good soaking each day in water heated to about 100° Fahrenheit, to get any result at all, except spoiled eggs. Now with regard to tank. Writer says, 'use copper or tinplate (zinc is unsuitable).' As to copper I have not a word to say, it being by far the best material; but let me warn anyone against using tinplate. It will be sure to rust and leak in a very short time, and is likely to give endless trouble. If copper is too expensive, by all means use zinc. I would advise a lamp to be used to supply the heat, as although gas gives less trouble, you cannot be certain that it will not be turned off for repairs to mains, etc., in which case, if not noticed, it would be all U P with the batch; therefore my advice is, use oil. As to Mr. Walker's concluding remark (I presume he is referring to his own machine), I can well imagine he speaks feelingly, but from the fact that there are machines on the market which can and do hatch 90 to 95 per cent. of fertile eggs placed in them, I can (speaking from my own experience) confidently say that incubation by machines can be made to pay well. I have floundered through the experiences of hot-water machines, and have now given them up in favour of those on the hot-air principle. By the Editor's permission, I may, at some future time, describe a simple atmospheric machine, if sufficiently interesting to our readers. A useful rule for finding the egg capacity of any box or drawer may not be out of place. Square its size in inches and divide by four; thus, say a box 12 in. by 12 in.: $12 \times 12 = 144 \div 4 = 36$ eggs."—[Thank you for your able criticism. In WORK it is sought to go upward from tolerable to good, from good to better, and from better to best. The difficulty generally is to make a beginning on any subject, and to find a writer who can and will write on it. As soon as the beginning is made by someone who knows something, criticism is drawn out from someone who knows more on the subject, and thus, by its ventilation, the readers of WORK are put into possession of information which, in all probability, would never have been theirs had not the inferior appliance been described first.—ED.]

Toy Balloons.—F. S. (*Normanton*) writes:—"On looking through No. 90, Vol. II. of WORK, page 618, I saw that E B. (*Liverpool*) wanted information on how to make the above. I think I could give him some information on how to make same. The balloon should be made of silk or taffeta—of course, shaped like a pear; in fact, the best model would be to take one and divide it into about sixteen slips, one of which will serve as a guide for cutting out the material for the balloon. When you have cut all the slips you must sew them very neatly together, leaving the last one open. When this has been done, soak the whole in drying oil. When you have done this, you must place a piece of brown paper over each seam on the inside of the balloon, so that there will be no holes left for the escape of gas; pass a hot iron over them several times, which will make them stick firmly to the oiled silk. When you have done this, you must give the balloon a coat of varnish, which you can make in the following manner:—Take a pound of bird-lime and half a pint of drying oil, put them into an iron saucepan over a slow fire, and let them boil for about three-quarters of an hour; when the bird-lime ceases to crackle, put in some more drying oil, enough for the size of your balloon, and and let it boil an hour longer, stirring with an iron spoon. Mind you do not let it boil over, and have some wet rags handy, in case it should take fire, to clap over the saucepan and extinguish it. When the varnish separates into threads when rubbed between two knives, it is

ready for use; take it off the fire and add a little turpentine to it. let it cool till lukewarm and then apply it to your balloon with a brush. The balloon should be stretched out to do it properly. It will take about twenty hours before it is quite dry. You can make a net to cover the whole of your balloon, which must terminate in a cord going round its lower portion, and from thence cords must hang to suspend a light hoop, which must hang a little below the balloon; and from this hoop other cords must hang to support a car, which can be made in the following way:—From a sheet of stout cardboard or millboard (if your balloon is large) bend the four divisions back, put some glue on the little tongues and stick them all together, and paint any colour you like, and then suspend it from the hoop previously hung on the balloon. To fill the balloon with gas, which must be made in the following manner, put into a large bottle or jar a pound of iron filings and two quarts of water; to this add little by little one pint of sulphuric acid. Stop the bottle with a cork, insert a glass tube into the bottle, making a hole in the cork, and place the other end in the neck of the balloon. You will soon find that the gas which has been generated in the bottle from the decomposition of the water will soon fill the balloon. When this is done withdraw the tube, and tie the balloon neck very tight, and then set it free. The cost will be according to the size."



Toy Balloon Car Plan.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Picture-Frame Making.—M. E. M. (*Heywood*).—An article on this subject appeared in Vol. I., page 71, of this Magazine, and if you consult the Index, which you can obtain of any bookseller or newsagent for one penny, you will find that frequent references have been made to it in "Shop." Another article on picture-frame making is in my hands, and will appear in Vol. III.—ED.

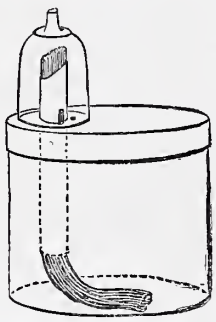
Improved Method of Lighting Fires.—H. G. (*Dewsbury*) has hit on an improved method of fire-lighting, and asks advice as to whether it would be desirable to patent it. To speak candidly, we do not think that it would. Many persons may like his plan, and adopt it; yet (assuming that the Patent Office allows his idea to be so far original as to grant him protection) it is hard to see how he would be able to defend his rights from infringement. There is no special apparatus to be manufactured on which he might levy his profit; and if people think proper to use his plan in their houses without his permission, he can scarcely enter private dwellings to enforce the payment of a royalty. If (as is decidedly the case) we do not recommend a patent, H. G. gives permission for his plan to be made known to the readers of WORK. For this he has our thanks. His method is only applicable to houses where the gas is laid on. He has a rubber pipe, so long as to reach from his gas-burner to his grate, and at the end of this he has a copper tube, 2 ft. long. He puts the end of his tube into the grate, covers with coal and coke, turns on the gas, and lights it, and in from ten to fifteen minutes is *certain* of having a good fire. He has tried closing the end of his tube and punching it with holes, but finds that the open pipe answers best. He claims for his method that it is more cleanly, more expeditious, and that it involves less trouble than any other.—C. C. C.

Bird Cages.—TOM LIVINGSTONE.—I am glad you are pleased with the article, "Bird Cages, and How to Make Them." With the permission of the Editor, I should be delighted to give instructions for making the cages you have stated in your letter (linnet, goldfinch, canary, lark, blackbird, etc.). But at the same time, as you can procure them ready made so cheap, I think it would not be worth while, unless you intend to make them for sale. The traps I would rather not describe, as I love to see the wild bird free, and would not cage them in small cages. I am preparing a paper on "How to Make an Out-door Aviary," which I hope will appear in an early number of WORK.—F. H.

Elliptic Arch.—D. M. (*Inverness*).—Whether carpenters have a rule which they follow to obtain an ellipse or an elliptic arch, I am unable to say. I doubt whether they have; it is seldom that workmen of any kind will follow any particular rule to attain a certain result. If such were the case, we should not now be surrounded by so many improvements in various branches of trade and art. A fixed rule may be taught to the apprentice, as to the schoolboy, but if he is at all aspiring, he soon finds a way of doing things in an original manner. A most handy method of striking an elliptic arch is to follow the instructions given by G. R. in No. 41 of WORK, Vol. I., page 652, for striking an oval. Of course, half the oval, lengthways, will give you the arch. Another method, and one which is simpler even than this and many others, and more preferable if you require to strike many elliptic arches, is described by me in No. 59 of WORK, Vol. II., page 106. It is, as some of our friends would say, "my own idea," but it is probable the same idea has occurred to others: this does sometimes happen, and seems to be a special penalty of Providence to counterbalance the conceit we are always liable to indulge in when possessed of "a new idea." The *circular* board (card or wood) should be mounted lengthways; and, as I there state, can be so regulated when placed between a light and the object to be drawn upon, to throw a shadow upon the latter of any size or proportioned oval; the top half of which will give you what you require. Of course, this process requires a tolerably steady hand, and unless you possess this, try first the method mentioned by G. R.—J. S.

Wood for Furniture and Designs in WORK.—OXIDE.—It always gives us pleasure when our efforts are recognised in a complimentary manner. All the designs I have contributed to WORK are original, and the readers of WORK are the first who see them, excepting, of course, if I am bound to speak strictly logically, the Editor, myself, engravers, and a few private acquaintances who may happen to come into close contact with me. None of the articles are thus, naturally, made previous to their appearance in WORK. I am in the habit of making small rough working models of the things, and these, in addition to practical experience in mixing among professional workmen in different branches of cabinet work, enable me to give our readers something of a combined or folding character which will be workable, useful, and sometimes ornamental. If you wish to have a "combined work-table and escritoire," and a "novel coal and coke box" (appearing in Nos. 56 and 58 respectively), and you will allow me to correspond with you privately, I will put you in communication with one or more skilled *professional* workmen, who, I have no doubt, would turn out two good jobs. Of course, you could take the designs to a first, second, or third-class furnishing establishment, but as the goods would have to be specially made, the sums they would charge you (more so in the last of the three cases, contrary to supposition) would be exorbitant. Believe me, I do not wholly appreciate the disestablishment of the middleman, but the percentage some firms charge upon the actual maker's return for his labour, is such as to lead one to think that cabinet makers can earn excellent wages. This is not the place to discuss such a question; but I may say that I have seen poor, but skilled, master workmen filling the pockets of men whose only recommendation was that of a connection with the "upper ten." Of course, this does not apply to all firms; and I may be regarded as making a rather innocent accusation by intimating that it applies more so to second and third-class firms, because *every* firm considers itself *first-class*. Some of our amateur friends may see this, and believe there is an opportunity open for them to make a bargain. But let me say that I should only recommend first-rate work; and anyone who thinks there may be a chance for him, can communicate with me through the Editor, with his permission.—J. S.

Jewellers' Soldering Lamp, Forges, and Furnaces.—K. W. (*Mildmay Park, N.*).—It appears to me that a wrong article is asked for, but in case it really is a forge that is desired, I think it best to mention that the leading makers are Thos. Fletcher and Co., of Warrington. London address, 77, Queen Victoria Street, E.C. If it is a soldering lamp that is required, a good one, which gives quite enough flame for ordinary mouth blowpipe work, can be obtained from Calipe & Co., 19, Poland Street, W., for 3s. 6d. This new one is called the "Hydrostatic Soldering Lamp," and they have some small bills describing and illustrating it, which can be obtained on application by post or otherwise. It appears, though, as if R. W. wishes to make something himself, so I will describe the simplest way I know to make an effective soldering lamp, methylated spirit being the material that supplies the heat. The sketch gives the appearance of the article, and it is made up in this way: A sound tin canister with well-fitting lid is obtained (one of Van Houten's cocoa tins holding 1 lb. will do, if lowered to half its height); then through the lid a piece of ½ in. brass tube should be pewter-soldered in the position shown in sketch—this is, of course, to hold the wick, and to regulate the height of that, it would be well to cut a slot in the tube, large enough to work a pin up or down, as the wick is desired to be either raised or lowered. In the lid also, about ½ in. from the tube, an air-hole should be made. The lid is not to be fixed, as it will have to be removed when the lamp is being filled. Over the burner and the air-hole there should go a cap, which is to act as an extinguisher, and to prevent the evaporation of the spirit. If one can be made to fit over a bezel, or be screwed on, so much the better, but a footless wine-glass will answer pretty well. As to the use of charcoal, use it by all means as a support for your work while soldering, but do not make a fire with it, and try to solder with that; if you do, there will be trouble in store for you, for the reason that the heat from it is not sufficiently under control. In soldering jewellery, where solders are used that are nearly the same quality as the article to be soldered, it is necessary that one should be able to stop the supply of heat, or to vary its quantity and direction instantaneously. From this you will gather that it is only in exceptional cases such a furnace or forge would be used for making jewellery. I find that I have not mentioned the wick to be used. It should be "loose" wick, but nearly any sort will do, providing it does not fit too tight.—H. S. G.



Home-Made Spirit Lamp for Soldering.

Rubber Stamp Accessories.—BUYER.—I cannot give you the names of the actual makers of the accessories required, as they are for the most part made abroad, and consigned to the wholesale dealers in this country for distribution. H. Savage, 33, Cheapside, London, E.C., and M. Lindner, 170, Fleet Street, London, E.C., are two of the largest dealers, and either of them would probably supply you as cheaply as the actual makers.—QUI VIVE.

Silvering.—A REGULAR READER.—If the pier glass is a valuable one, I would strongly advise you not to attempt to resilver the places yourself. It is extremely difficult for an amateur at any time, but more so in this case, as it would naturally get dirty where it has worn off; and before it is resilvered it must be made perfectly clean, or it will show only too plainly when finished. If you will take my advice you will show it to a professional, and he guided by his advice. I do not like to say the least thing to discourage an amateur in anything he wishes to do, but I should not like you to spoil your glass. If, however, you are still determined to have a try yourself, kindly refer to my answers to C. H. G. in "Shop," No. 83; also other answers in back numbers. You can then easily adapt the information to your own case, the materials used being the same in both cases.—W. E. D., JR.

Electric Gas-Lighter.—J. N. (*York*).—I can only guess that you have a small battery and coil, of which the battery is out of order, and needs recharging. The carbon-plate may be renewed with one of ordinary carbon. You may charge the cells with sal-ammoniac dissolved in water, as much of this as the water will take up, then add ½ oz. of chlorate of potash to each pint of sal-ammoniac solution.—G. E. B.

Voltmeter.—W. M. (*Hereford*).—Mr. Bottone is quite right. To measure the voltage of the current, it is necessary to keep back by high resistance the volume of the current. These resistances may be included in the fine wire wound on the voltmeter coil, or added outside the instrument. The resistance does not act on the needle, as you suppose, but it acts on the current to pull down its volume. If you look again at my reply to CYMRO DEWI, on p. 633, Vol. II., you will see that the bridge of wire must be of "fine brass or German-silver wire." This in itself offers a high resistance, and pulls down the current volume. To the words "any number of volts," please add "up to five," as the range of this "makeshift" is small.—G. E. B.

Electric Clock.—ELECTRIC.—The secondary clock is simply a dial with two hands in front, and a ratchet movement worked by an electro-magnet behind the dial. The ratchet is so constructed as to move the long hand one half minute, or one minute forward, for each cog of the ratchet-wheel released or engaged. The armature of the electro-magnet forms part of the ratchet pawl, and is attracted to the magnet every time contact is made by the mechanism on the driving-clock. I regret that I cannot now make the drawings to show you the various parts. Perhaps some other contributor, better acquainted with clock mechanism, will oblige with drawings of electric clock works.—G. E. B.

Polishing.—H. S. (*North Kensington*).—Do not be too much discouraged by your partial failure in getting good results with polishing. The cause, probably, lies more in your want of practice than in not having a good filling—at least, if you have used the one which I have several times recommended in "Shop" columns. If you read these regularly, you will get many hints which will be valuable to you. To help you more specifically, however, and endeavour to remove the difficulties you suggest in your letter: (1) I presume you object to the end grain of the dovetails showing up when polished, but I do not see why you should. Of course, a mitred joint would have looked better, but having made a plain dovetail you need not be ashamed of it showing. Any attempt to hide it by painting would probably spoil the work. Yes, certainly a lot can be done by varnishing and rubbing down with pumice powder, but then that kind of work is not French polishing, as if you want this you will not do right by adopting the easier method. Otherwise, when well done, it is quite as effective as badly done French polishing. I do not see where your difficulty about polishing stained wood comes in. If you rub down with glass-paper, you will not spoil the stain if you use fine enough paper, and do not rub too much. (2) Your question, "How to tell when the oil and polish have lost quality?" is not an easy one to answer, for they may be spoiled in so many different ways. I should say your best plan when you suspect anything wrong is to show the materials to a competent French polisher or oilman. (3) There is no difficulty in getting a fretwork pattern to adhere sufficiently for all practical purposes to polished wood. You can wash the paper off afterwards. Don't you think you might have tried this on your own account, instead of making imaginary difficulties? Instead of sticking the pattern on the wood, trace it with a hard point. This will mark the polish sufficiently for you to saw to. (4) No; the spirit rubber should be tolerably dry. If you have it too wet, you will simply wash off the "bodying-in" or polish instead of just glossing it. (5) No, you should have no oil on the spirit-rubber. (6) Of course, it is practicable to either varnish or polish your chest. (7) For the small hinges you want try any of the fretwork dealers.

If you cannot get the exact size you want, you will have no difficulty in getting something near it.—D. D.

Emery Wheels.—MOTO.—You cannot make your "emery dust" into "oil-stones," but you might be able to utilise it by making small emery wheels or "slips" by amalgamating it with shellac. This operation is generally supposed to be beyond the reach of amateurs, but I have been rather successful, and have many home-made wheels which I find most useful, and I have given the result of my experience in a short article in this Magazine which you will find at page 370, No. 24, Vol. I., and to which, on account of the pressure on our "Shop" columns, I must now refer you.—OPIFEX.

Incubators.—J. H. (*Liverpool*).—You appear to have mixed up two different plans of incubator. J. T. R.'s directions are very clear, and on the point you raise as to the position of the ventilating tubes, he says (page 651): "Four ventilating tubes (¾ in. lead pipe does very well) should be placed, one at each corner, to be bent under tank, and project ½ in. above top of casing." I cannot improve on the clearness of this, but would advise you to work entirely by J. T. R.'s plan, or else work entirely to some other plan. You must remember that there are two systems, one in which the lamp is expected to do all the work, the other in which, as J. T. R. says, "the heat" is "kept up by periodical fillings of hot water."—B. A. B.

Iron Houses.—CONSTANT READER.—Write to Humphreys, Knightsbridge, London, S.W.—D. D.

Lathe.—ECONOMY.—I fancy you will be able to do all you want in the way of grinding with an emery wheel. Write to the Britannia Company, Colchester, for sizes and prices, and then see which will suit you best.—D. A.

Fret Saw.—E. J. H. (*Stoke Newington*).—If the machine you refer to is too complicated for you, I really cannot advise you to undertake the construction of any other kind, as I do not think it would be possible to devise anything simpler. Why not be satisfied with the ordinary hand frame? It is far better than any but a first-class machine, which it would cost you less to buy ready made than to make yourself.—D. A.

Inlay Table.—A. C. (*Ladykirk*).—As the piece of veneer you require is so small, it is not worth your while dyeing a piece. Your best plan will be to inlay with some white wood and match it up in the polishing. Very often, small bits which have to be inlaid when repairing, can be tinted better by painting with ordinary water-colours than by any other means. Try the effect on a bit of waste veneer first, so that you may not spoil any that is inlaid. To give precise directions as to colours to be used is, of course, impossible without seeing the work to be painted up to.—D. A.

Watering-Can Paint.—TINMAN.—If the paint looks too dull when dry, varnish it. Surely you could get the oil and colourman who supplies you with paint to mix you something which will not dry dead. I suppose the enamel paints so much used are too costly for your purpose, so I do not recommend them; but if I am wrong in my supposition, you will find the Foo Chow enamel the very thing. It dries in a few minutes with a glossy surface.—D. A.

Window Mist.—W. Q. (*Liverpool*).—When gas is burnt, water in the form of invisible vapour is formed. This, if it meets some cold surface, condenses into water. In small or ill-ventilated shops, which are generally warm, this vapour condenses on and runs down the windows, which are kept cold by the outside atmosphere. In large and better ventilated shops, the temperature on either side of the windows is not much different, and there is no reason why the vapour should condense there more than anywhere else; so it remains suspended in the air. There is no real cure for your case, but the following is often beneficial:—Clean the windows as usual, and then wash them over with a solution of carbonate of soda (about 1 oz. in a gallon of water). Allow this to dry on the glass, and, when quite dry, polish with a dry cloth.—F. B. C.

Alloy.—W. J. (*Newcastle-on-Tyne*).—I do not know of any alloy with the properties you mention. Those of mercury are very soft, some even liquid, but melt at a lower temperature than boiling water. Speaking generally, an alloy melts at a lower temperature than any of its constituents, thus:—Common solder, an alloy of equal weights of lead and tin, melts at 385° (Fahr.), whilst the melting-point of tin is 442° (Fahr.), and that of lead is 620°. Calin, the alloy used by the Chinese for lining tea-chests, is but little harder than lead; its composition is:—Lead, 126 parts; tin, 17·5; copper, 1·25; and a trace of zinc.—F. B. C.

Silver-Plating Chains, Lockets, etc.—SEQUAH.—Three articles giving full instructions on this subject are in hand.—G. E. B.

Electric Night-Light.—H. B. C. (*Sunderland*).—The small box battery described and illustrated on p. 592, Vol. II. of WORK, will supply current to a small electric lamp to be used as a night-light. You would find the battery recommended for photographic dark rooms more suitable for the purpose. Five or six cells of the patent Gassner dry battery are most suitable for lighting small 2½ c.p. 6 to 8 volt lamps used as night-lights in a bedroom, as there are no liquids to spill, nor any fumes given off in working the battery. Carbons for batteries are sold at a cheap rate; it will never repay you to make them yourself.—G. E. B.

Camera Bellows.—TOM.—It will be well to make a pattern in paper, so that when the more expensive material is being used, it may be worked up without hesitation, and the folding and unfolding that would inevitably damage it. Procure sufficient black lining and leather (morocco is best) for the size of the bellows you contemplate making. We will suppose you have cut out a rectangular piece of lining that, when folded, will be of the right dimensions. Upon this attach, with strong bookbinders' paste, the leather, which has been previously rendered limp by damping. Wherever it is necessary for the leather to overlap, it should be shaved sufficiently thin with a sharp knife to make the two thicknesses equal to the rest. Before this gets quite dry, proceed to fold it fan-fashion, each fold to be 1 in. in depth, as in Fig. 1. Then keep pressed together until dry. I omitted to say that before creasing, the position of the folds should be marked with a chalk pencil, as in Fig. 2, as it will save some trouble afterwards. When the material is nearly dry, fold it the contrary way—four sharp creases, as the lines B, B, B, B, to form the corners of the bellows. Now open it out and securely push together the two ends of the strip in

FIG. 1.

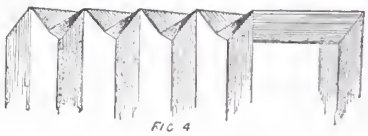


FIG 4

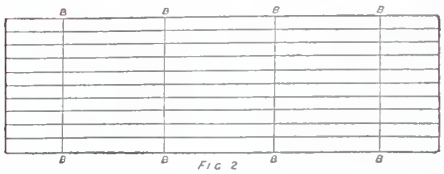


FIG 2

Camera Bellows Parts.

the centre of one side in preference to making the join at one corner. There will now be formed a cylinder, as in Fig. 3, consisting of leather outside and lining in. There remains nothing to be done but pressing the cylinder into shape with the fingers and thumb. The corners will be the only part likely to give much trouble, and must be pinched up, as in Fig. 4. All the corners being finished in this manner, press together and let them remain till absolutely dry to make the folds retain their form. When dry, work the bellows backwards and forwards to get pliability, and the thing is complete and ready for attachment to the camera frame. It must be borne in mind that the space inside must be equal to the size of the plate to be used, which, if the folds are 1 in. in depth, will necessitate an outside measurement of an inch larger each way, so that the fold will not cut off the light from the plate when in use, and only slightly extended. Half an inch or so must be left for joining up.—D.

Charging Porous Cells of Leclanché Battery.—W. G. (*Erith*).—If the cells are clean, and have never been used, you may utilise them as porous cells for a Leclanché battery, by charging them to within ½ in. of their tops with a mixture of equal parts granulated carbon and granulated binoxide of manganese broken to the size of peas, and sifted free from dust. The carbon plates should have lead heads cast on them, each head holding a binding screw embedded in the lead. The heads, and a narrow line below them, should be painted with Brunswick black whilst still hot. Pack the mixture closely around the carbon strips and shake down well, then seal the tops with a mixture of pitch, to which has been added one-third part of beeswax melted together. The small bits of glass tube are merely ventilators to the cells, and can be thrust a little way down into the charge of the cells before pouring in the hot sealing mixture. Paint ½ in. of the tops with Brunswick black when the cells are charged and sealed. If the cells have been used for other purposes, they are useless for this purpose.—G. E. B.

Model Electric Light Battery.—CRUDE ELECTRO.—The tang of the brass screw cast into the zinc plate passes up through the cover of the battery box, and is secured on the upper side by a brass nut. This also grips a copper strip as shown at Fig. 5, page 593, Vol. II. of WORK. The copper strip thus connected to the zinc of one cell is also connected to the carbon plates of the next cell by a brass screw passing through the copper strip and the wood cover into the lead collar in which the carbons are embedded (as shown at Fig. 1). This forms a connection between the two cells instead of a wire. The screw should not touch the carbon plates. The copper strip is not continuous; this is clearly shown in the drawing at Figs. 5 and 7. Of course, you cannot see all the parts in one figure, but must understand that they are parts of one whole cover, seen above, below, and through in section. The collar of hard wood, ebonite, or gutta-percha, fits on the screwed tang of the zinc plate (as shown at Fig. 8) to insulate this from the lead ring holding the carbon plates. I think I stated clearly that the chromic acid solution was strongest and fumeless. Kindly read the article again carefully.—G. E. B.

Onion Net.—J. B. (*Belfast*).—Turn up No. 79 of WORK, and read the article on "How to Net a Garden Hammock." If the net is intended to hold very small onions or shallots, the meshes should be only ½ in. across, and you will want a small needle and small mesh stick. But, if the onions are large, the meshes may be made as large as hammock meshes, and with the tools described in the above-mentioned article. Three-fold twine, a little smaller than whip-cord, will serve for the material. First, net a ring of meshes large enough to form the mouth of the bag, and net the two ends together to form a ring. Put a piece of stout string through this, and loop it over some support, then proceed to net the remainder of the bag by making meshes round and round in ever-increasing rings, until the required depth has been obtained. If you wish to increase the diameter of the bag from the mouth downward, as shown in your sketch, it will be necessary to put two meshes in one opening here and there as you go on, and thus enlarge the diameter of each ring of meshes. To decrease the diameter, you must take in two or three meshes in a ring. As the bottom of the net is neared, decrease the diameter more rapidly by taking in every alternate mesh. Run the needle through the last few meshes, and draw them all together, then take a few half hitches around the twine, and pull them tight to finish off the net.—G. E. B.

Incubator.—SWANSEA.—If you refer to the illustration again (see page 589, No. 89), you will see that the well-hole does not reach to the bottom of the tank—a space being left to allow the water of tank to freely enter and return. The float is simply an air-tight vessel, with a central wire working in a guide; the size of this is immaterial, as its rise and fall is not according to its size, but to the level of water in the well. A convenient distance would be about half an inch clear of the well sides.—C. M. W.

Mechanical Help in Making an Invention.—A. B. (*Manchester*) is not very explicit as to the exact nature of the help he requires, but it would appear to be in cutting slots in metal plates to admit the pennies in his new spirometer. Surely in Manchester he might find some working machinist who would do this under his own eye, and without involving cost of carriage? We should advise him to look there for such a person. The workers whom we should recommend as the best we know for carrying out *novelties in metal*, are in the Midland manufacturing districts. He might apply to Mr. H. J. Cook, "Proved" Works, Crabb's Cross, Redditch; or to his brother, Mr. Wm. Cook, steel tool-maker and improver, Headless Cross, Redditch. We have every reason to believe that he will find them to be practical, clever, and trustworthy men.—C. C. C.

Dulcimer.—H. J. C. (*London, N.*).—Yes, the lowest note is brass, the next steel, and so on, exactly as you say; but it is the lowest steel note that is tuned to on the piano, not the lowest brass, which is tuned an octave lower, viz.:—

—R. F.

Crystoleum Painting.—W. A. H. (*Stockport*).—The advantage of two glasses is apparent when together with that having one. In painting a portrait, for example, the light tints are put on the photograph, and solid colour on the back glass, such as a dab of vermilion for the cheeks, deep colour of dress, etc., etc., and when seen through the thin photograph gives it a silky, soft, transparent effect; whereas, if the colour is dabbed on the photo., a dead colour is produced, and looks to me as though the portraits had rubbed their cheeks in Nature with black cherries, lips and face all run into one; all the soft shadows of the photo. seem to give way to the colour. That is the secret of those seen by you in the shops; the photograph is carefully sand-papered away, so that a very thin film remains, and the colour of the back glass reflecting through, gives the silky soft colour.—G. R.

Patent *versus* Registration.—L. G. (*Bradford*) will find registration sufficient; the smaller fee required for that purpose will be as much as he will be justified in spending. Being in wood, his invention will come under Class 3.—C. C. C.

Fret Machine.—F. G. S. (*Richmond Hill*).—The most likely machine to suit your requirements is the Empire Scroll Saw. It can be used for either light or heavy work, and will cut up to 3 in. thick; it has a swing of 24 in., and the usual table and drill, and judging from the cut, I should say that it was a good substantial tool. The list price is £5 5s. If you write

to Messrs. Chas. Churchill & Co., 21, Cross Street, Finsbury, E.C., I have no doubt they will be pleased to furnish you with full particulars.—W. R. S.

Fret Machine Saw.—HOMERTON.—The saw you mention is not fastened to the wheel; neither has it an exactly vertical stroke. The arms are riveted to the framework (A). About an inch from the centre of the wheel (B) a small pin is fixed, which works in a slot of the arm (C). There is a small grooved wheel fixed under the table (D) to steady the saw when running; perhaps that is where you have got your idea that the saw is fastened to a wheel.—W. R. S.

Marking Patented Articles.—F. C. (*Bolton*).—Upon patented articles it is usual to put the word "Patent" and the No.; a patentee would not in any way forfeit his right to monopoly by neglecting to do this, but should he, under these circumstances, institute a prosecution, it is probable that a jury would award him no more than nominal damages.—C. C. C.

Wood Panels.—J. W. B. (*Lockwood*).—If you will purchase the Index to Vol. I. of WORK, you will find that much in the way of carving in wood has already appeared. In due time you will get more, but other subjects besides wood require to be treated. That part of your letter referring to coinage has been forwarded to the editor of the *Popular Educator*.

Self-Acting Fountain.—R.N.B. (*Teignmouth*).—That your fountain jet does not rise so high as it should is probably due to some restriction in the passage of the tap. A small hole in the plug of the latter, opening into the larger nozzle at top, reduces the velocity of the water. If you cannot overcome this, use what is called an "oil-can nozzle," to be obtained at most ironmongers. This has a conical way inside, and will produce the best effect, but, of course, it cannot be turned on or off.—C. M. W.

Aquarium Cement.—J. P. (*Manchester*).—If you have glazed your aquarium with Portland cement, you will have some difficulty in getting it sound at all; but leaks are not always due to the cement, but from improper construction.—C. M. W.

Fret Designs.—COALY TYNE.—You may obtain the designs you inquire about in this country by applying to Messrs. Churchill, Cross Street, Finsbury, E.C., as they keep the largest stock of American designs. If you cannot get them there, write to the John Wilkinson Co., 77, State Street, Chicago, U.S.A. The series you name is not the best.—D. A.

Varnishing.—NOVICE AT WORK.—You have omitted to give the kind of wood. If mahogany or any of the darker woods, the best finish is French polish; next to this varnish. Oiling will do very well, particularly for oak. If you leave the work in the white, or, as you call it, bare, it will have an unfinished appearance, unless you have used white holly-wood, which will certainly not be improved by either oiling, polishing, or varnishing.—D. D.

Violin.—G. A. (*Liverpool*).—The most celebrated name is undoubtedly Antonius Stradivarius. You should consult some standard work on the subject; there are plenty of them. "Old Violins," by J. M. Fleming, is an interesting book, and contains some useful information.—B.

Vertical Boiler.—J. D. (*Grimsby*).—You should advertise your boiler in our "Sale and Exchange" column.

Book on Wire Working.—PANEL.—I am not acquainted with any good book on wire working that would be of use to you as a professional. I have, however, in my hands a series of excellent papers on the subject, well illustrated, which I think will just meet your requirements.—ED.

Outside Sitting- or Smoking-Room.—J. W. (*No Address*).—The sketch and particulars are not sufficiently explicit. Send the size you wish the room to be, and the amount of money you are prepared to spend on it, also what you think of covering it with, both inside and out, and the size of garden, with the position you want the room to occupy, bearing in mind that if you have a "next door neighbour" he may object. Say if it is to lean against any wall, or stand independent; also, do you propose warming and ventilating it, and how?—E. D.

Cleaning Terra-Cotta Bust.—F. W. E. (*Woolwich*).—Make a tolerably strong solution of American potash, and mix sawdust with it so as to form a kind of poultice. With this cover up the bust for a night, and it will probably be found that all paint, grease, dirt, etc., will then wash off with cold water; if, however, the incrustation should be obdurate at any part, the process must be repeated.—M. M.

Wooden Tricycle.—E. McM. (*Armagh*).—Your correspondent wishes to construct a wooden tricycle. I should hardly advise him to do so. There is no good reason why a home-made tricycle should not be made of wood, so far as concerns the framework, but I should never advise making wooden wheels. This would be going back to the old bone-shaker, with its iron-shod tires; besides, the wooden wheels are more difficult to make than wire spoke ones. I should advise E. McM. to go in for making his tricycle all iron and steel in the usual manner, even if it entails calling in the help of a mechanic. If, however, he insists upon having a wooden-framed tricycle, he must state the kind of machine he means; whether front or rear steerer, whether side or bar handles. I will be happy to furnish him with a sketch of a simply made machine free of cost if he sends his address. Mine is with the Editor of WORK.—A. S. P.

Fret Machine.—ECONOMY, W., AND OTHERS (*Inverness*).—Particulars for converting a sewing machine into a fret machine appeared in No. 56, Vol. II., page 57; and No. 60, Vol. II., page 128.—W. R. S.

Electric Light Installation.—INSTALLATION.—As you have omitted to give dimensions of your rooms, I cannot advise you respecting the number of lamps needed to light them. I think you will not get enough light from three 5 candle-power lamps in each room. These will absorb a little over ⅓ horse-power to keep them alight. If you have three 8 candle-power lamps in each room, you will need a little over ¾ horse-power. Steady lights are not obtainable from small gas-engines. Every explosion of the gas causes a flicker in the lamps. To get steady lights from gas-engines, these must be greatly in excess of the power required, and should be furnished with two fly-wheels. If you think of passing the current through an accumulator, this will mean an extra expense for plant and power, as you will have to provide power to charge the accumulator in addition to that required for the lamps. If you had a gas-engine and wished to utilise it in lighting your house at night with the electric light, I should advise you to proceed with your plans, but I cannot recommend you to attempt such a small private installation with the means at your disposal.—G. E. B.

Winding Voltmeter Coil.—HENRICUS NARPHENUS.—Wind on one ounce of No. 34 silk-covered German-silver wire, or three ounces of No. 36 silk-covered copper wire. If the inside needle is so pivoted as to enter the coil when current is passed through the instrument, make the needle of soft iron; but if the needle is so pivoted as to hang vertically in the coil when at rest, then make it of hard magnetised steel.—G. E. B.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Dynamo.—F. S. (*Normanton*) writes:—"Will any reader of WORK please tell me in 'Shop' how to make a small dynamo for two or three lights which I can drive with a motor I have made?"

Turbine.—J. L. (*Nelson*) writes:—"Will any reader furnish me with diagrams and instructions how to make a turbine of about one-man power and also the cost?"

Band-Saw Machine.—J. H. (*Sheffield*) writes:—"I am in want of a small powerful band-saw machine to work by treadle, carrying ¼ in. broad saw, and capable of cutting 1½ in. thick beech. Will any reader inform me whether there is such a machine, who are the makers, and about what is the price? The real work for which the above is required is the cutting out of saw-handles."

Cane for Chairs.—CANE asks for the address of a shop about Hackney or Shoreditch where he could buy sufficient split cane to re-seat half a dozen small chairs.

Bamboos.—A CONSTANT SUBSCRIBER writes:—"Will any reader of WORK kindly let me know how bamboos can be bent?"

Musical Skipping Rope.—R. H. (*Glasgow*) writes:—"I should take it as a great favour if any reader would kindly inform me if there is such a plaything as a musical skipping-rope; also where such a thing could be obtained, and also if patented?"

Gun Barrel.—C. D. (*Bury*) writes:—"I have a double-barrelled gun which I wish to re-brown. Can anyone inform me how to do it?"

Electricity Classes.—APPRENTICE asks:—"Will any reader inform me where I can join a class for instruction in electricity—one that I could afford? I am an apprentice only."

Black Enamel for Metal.—F. A. E. (*Tufnell Park, London, N.*) writes:—"Can any reader of WORK give me the name of the enamel that the patent pen, No. 11,328, 1887, is coated with, and if it is used hot or cold, and the process?"

Artists' Canvas.—A READER asks:—"Can anyone inform me how raw canvas is prepared so as to produce a dull and very smooth surface for artists' use?"

Primary Batteries.—ELECTRIO wishes the co-operation of a gentleman amateur electrician to experiment with a discovery in lighting from primary batteries.

Screen.—A CONSTANT READER writes:—"I have made a draught screen for an invalid lady, and covered it with calico—height, 5 ft. 3 in., length, 5 ft. I think there must be a paper printed with a Japanese design that I could paste on. Any reader telling me where I can procure such, or suggesting anything suitable, will oblige. It must be cheap."

Engraving.—C. P. (*Wanstead*) writes:—"I should be glad if any reader will tell me of any easy way to engrave names on dog collars. I am sure it would benefit many of our readers just now, as the new Act is passed. It is rather expensive to put it in an engraver's hands to do."

Imitation Icicles.—F. H. S. (*Dover*) writes:—"Would any reader be kind enough to furnish me with details as to how I could make imitation icicles, not the ordinary cotton-wool ones, but transparent and lasting."

Newspaper Cart.—L. M. N. (*Liverpool*) asks:—"Will some reader kindly give sketch and particulars of little cart to carry newspapers, size about 2 ft. by 1½ ft. by 1½ ft. deep. Must be light and strong, to run on mail-cart wheels; also where to buy materials, wheels, etc., for it? Neighbourhood, Liverpool."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Oval Drawing and the Ellipse.—F. C. (*Leytonstone*), in reply to J. B. (*Wallington*) (see No. 89, page 599):—"I was quite serious in my letter in No. 84, and if J. B. will get the other numbers in which I reply to J. W. H. on the subject, and give the matter a little careful consideration, trying a few experiments, he will be convinced of the fact that for the past twenty years he has been 'working radically wrong.' I am much obliged for the few notes he sends, but I think he will find, on referring to back numbers, that Notes 1 and 4 have appeared before. I am afraid that Notes 2 and 3 (if correct) are not much to the point: *e.g.*, Note 2, 'The circumference of an ellipse is continually altering in its direction.' Now, suppose I take two sticks, and push them in the ground at A and B, Fig. 1. I then loop a piece of string round them loosely, forming a triangle, A, B, C. At C I tie a little dog, who at once proceeds to run round, keeping the string tight. A glance at the figure will show that the path of our little dog is an ellipse. Now, may I ask is he continually altering his direction? After a while he manages to get the stick at B out of the ground, and runs round (still keeping the string tight) in a circle, having A as centre. In the former case he was running round governed by two points, the *foci* of an ellipse, in the latter case by one. Now, I think you will admit that if his direction was continually altering in the first case, it was also in the second. If that is so, Note 2 applies to a circle as

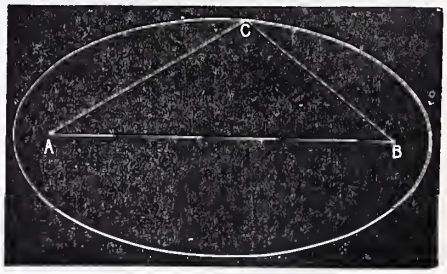


Fig. 1.—Ellipse and Triangle.

well as an ellipse—in fact, to any other curve; therefore it would be just as lucid to substitute for Note 2, 'an ellipse is not a straight line.' Now we will take Note 3. 'The *focii* (is that Latin or Greek?)—suppose we call it focus of an ellipse—is the exact geometrical proportion between the two circles, which may be struck on the transverse and conjugate diameters of an ellipse.' We use the term *foci* because there are two of them: focus is the singular, foci the plural. Each focus is a point illustrated by the sticks in Fig. 1, and as a point simply denotes a position, and has neither length, breadth, or depth. How is it possible for a focus to be the exact geometrical proportion between two circles? What two circles? Any two may be struck on the axes of an ellipse! It seems to me that Note 3 is about as clear as Note 2. In WORK, No. 78, I demonstrated that two elliptic curves when struck by the pin and string method were not parallel, and I will now try to make it clear why they are not, when struck with the trammel. In Fig. 2 por-

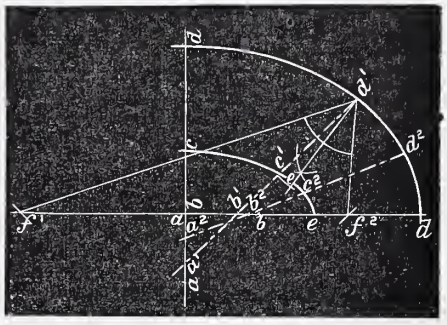


Fig. 2.—Diagram showing that two Ellipses are not parallel when struck by the Trammel.

tions of two curves are given, struck by the trammel *a*, *b*, *c*, *d*, which is shown in four positions, *a*1, *b*1, *c*1, *d*1, etc. When the trammel is at *a*, *b*, *c*, *d*, on the major or minor axis, the line *c d* is normal to both curves, but when it is at *a*1, *b*1, *c*1, *d*1, and *a*2, *b*2, *c*2, *d*2, it is not so; therefore the curves are not parallel, for if they were parallel, a normal to one curve would be normal to the other one, and all normals connecting the two curves would be equal. A normal to the outer curve is drawn at *d*1. If the curves were parallel, *d*1—*e* would equal *c d*, but a reference to the figure will show that it does not. In reply to J. W. H. (WORK, No. 91), 'I have no means of answering his question properly, as I have no elliptic chuck, but I know from works on geometry by well-known authors, and by practical trials, that if an ellipse is an oblique section of a right cylinder or cone, two ellipses cannot be parallel. I have proved practically to my own

satisfaction by cutting a section of one of the above solids, finding the major and minor axis, then testing the curve by five of the methods used in plane geometry, such as the pin and string, trammel, two circles and points, rectangle and points, etc., that in all cases the curve is the same, and that the definition given in 'Practical, Plane and Solid Geometry' (Angel) is correct, viz.:—'That if a point moves in such a manner that its distance from a fixed point is in constant ratio to its perpendicular distance from a fixed straight line (being nearer to the point than to the line), the curve traced by the moving point is an ellipse.' If we admit this to be correct, an ellipse is a true ellipse or no ellipse at all, just the same as a straight line is a true straight line. J. W. H. will readily see by my diagram, No. 2 in the above letter, that a trammel cannot strike two parallel curves if one of them is an ellipse. If J. W. H. will turn a brass plate in the manner he describes in his letter, and send me a tracing of the four curves, it will be an easy matter to tell which (if either) is the ellipse."

Bruises in Plate.—H. S. G. writes, in reply to APPRENTICE (see page 618, Vol. II.):—"The way to remove bruises from articles of plate with narrow necks is as follows:—First for the tool: it is a simple one, and is called a snarling tool; it varies in shape and thickness, but Fig. 1 is the usual form, and as to the thickness of the iron rod it is made from, well, that will hardly be less than ¼ in., and it may well be very much thicker. For cream-jugs and such-like articles, round rod of ¼ in. to ⅜ in. should be stout enough. It is fixed in a vice, as shown in Fig. 2. The hammer is also sketched, to show about the

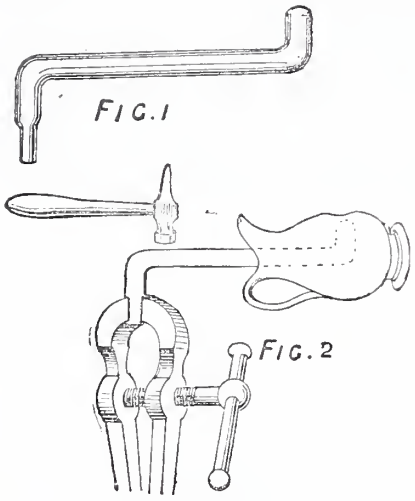


Plate-Repairing Tools.

place it should strike; it is not for the purpose of giving a direct blow, nor is the snarling tool intended to resist direct blows; but, on the contrary, it is merely the means of conveying a succession of small jars or taps to the desired spot, where a hammer or punch cannot be used. That is all I think that need be written. Practice, combined with care and observation, will enable APPRENTICE to get up dents in the most awkward places. Of course, the end of the tool that comes in contact with the work should be smooth and somewhat rounding."

Belts.—TURNER writes:—"On page 519, 'Shop,' Vol. II. of WORK, A. R. (*Scorrier*) writes on the merits of cotton and leather belts. Let me say that if A. R. will go to the slight trouble of covering the pulley of his saw-bench with leather well saturated with castor-oil, he will not have much trouble with his belt slipping."

Painting on Terra-Cotta.—C. W. B. (*London, E.C.*) writes, in reply to J. E. H. (*Southampton*) (see page 650, Vol. II.):—"J. E. H. will find no difficulty in painting flowers upon plates if he is capable of painting upon card or canvas; the same oil-tube colours are used, and the medium I find the cheapest and best instead of using megilp, which is used for canvas, is a mixture of turps, a very small quantity of gold-size, and a preponderance of best copal varnish; of course, this is only for painting when the plate is not to be afterwards fired. If water-colours are used, procure moist colours, which can be obtained of any artist's colourman, and a little gum arabic, which makes them shine, can be put in the water."

Glass Cement.—C. W. B. writes, in reply to O. H. O. (*East Dulwich*) (see page 650, Vol. II.):—"O. H. O., who requires a cement for joining metal to glass, may find the following recipe of value. A solution of 8 oz. strong glue and ¾ oz. Venice turpentine, which boil together, and stir till thoroughly mixed."

Violin Mute.—MIEUX QUE ÇA writes, in reply to VIOLIN MUTE (see page 650, Vol. II.):—"If he requires a mute for his own use, why try to make one when he can get one with an A and C pitch from any music dealer for 6d. If VIOLIN MUTE is a little boy, and cannot coax a sixpence from his father, he must do as I had to do once—get the key of the front door and place it between the third and second strings on the bridge, with that open place that we notice in almost all common door-keys pushed tightly on to the bridge. The eye of the key will sit right over tail-piece. This forms a capital mute."

Silvering Dials Dead White.—B. E. W. (*No Address*) (see page 669, Vol. II.) writes:—"ALBO may re-silver his aneroid dial by the following process:—Rub all the old lacquer and silver off with powdered bath brick. If a circular dial, care should be taken to keep a circular motion, or the work will have a scratchy appearance when finished. When clean and free from grease it is ready for silvering. Get 1 dwt. of nitric of silver, a couple of handfuls of salt, and 1 oz. of cream of tartar. Proceed as follows:—Dissolve the nitric of silver in 1 oz. of water. Keep in a bottle, as it will do for several dials; pour a small quantity in a saucer, and have the salt and cream of tartar near at hand, also a vessel with some clean water in; dip a piece of rag into the clean water and salt. Rub dial well, and use salt plentifully; dip into nitric solution and rub until required colour is produced, adding cream of tartar. The action of the salt gives the dial the affinity for the silver, and cream of tartar whitens or bleaches it. With care you can get either a blue tint or dead white. Some people use the nitric of silver crushed dry, and dip alternately into salt silver tartar, but if you are not careful, you get the silver on streaky and black; the other is far the best and easiest way. Should any of the figures be cracked, they can be filled before starting to silver with shoemaker's heelball. To finish the dial, wash and dry with clean (soft) cloth, and warm gently, either in the oven or over a Bunsen burner; care must be taken not to get it hot, or the filling in figures will smear when lacquering. You can get colourless lacquer at any oil merchant's. I get mine from Gedge, St. John's Wood, London."

Window Cleaning.—CHEMICAL writes, in reply to C. T. (*Ashton-under-Lyne*) (see page 634, Vol. II.), who asks, "What is the composition of a window-cleaning liquid?":—"It is dilute hydrochloric acid. The cleaner mixes a little of the strong acid with water in a pail, rubs it on the windows, and quickly washes it off again; if left on the windows it quickly etches them—*i.e.*, renders them dull and opaque; it cannot be kept in a glass bottle as it dissolves glass, but is sold in gutta-percha bottles. It must be carefully used, as it causes very bad sores if spilt on the hands; it rapidly clears away grease and dirt from factory windows, and that is what it is used for. I believe there is a Window-Cleaning Company in Leeds who hold a patent for the use of it for that purpose, but I may be mistaken."—H. B. B.

Vaporiser—Steamy Windows.—M. (*Bishop Auckland*) writes, in reply to J. B. (*Colchester*) (see page 670, Vol. II.):—"Carry a pipe from the top of the window to the outside, and fix on the top an extracting ventilator, such as are made by Boyle and Son, London, or Gibbs & Son, Liverpool. This will carry off the heated air, and prevent it being condensed by the cold glass."

Glass Cement.—BERTIE writes, in reply to O. H. O. (*East Dulwich*) (see page 650, Vol. II.):—"Cement for mending kerosene oil-lamps is made as follows:—Three parts of resin, one of caustic soda, and five of water. This composition is mixed with half its weight of plaster of Paris. It sets firmly in three-quarters of an hour. It is of great adhesive power, not permeable to kerosene, a low conductor of heat, and but superficially attacked by hot water."

Steamy Windows.—A. G. S. (*Edinburgh*) writes, in reply to J. B. (*Colchester*) (see page 670, Vol. II.):—"I have heard glycerine recommended. Clean the windows perfectly dry, and then rub with a clean cloth on which a few drops of glycerine have been placed. The only effectual remedy, however, is to have the windows thoroughly ventilated. Have three or four holes, ¾ in. or so, bored in top and bottom of frames of the windows. That, however, means a cold and draughty place, and I would recommend J. B. to tolerate the 'terrible scourge,' the remedy being worse than the disease to my idea."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. W. (*Caverton*); AMICUS; RING MANDRILL; A READER; A. R. (*Somerton*); I. R.; NIL DESPERANDUM; PHONO; DRY PLATE; E. R. (*Chelmsford*); W. P. B. (*Colnbrook*); H. S. (*Milnsbridge*); APPRENTICE; J. G. (*Rochdale*); T. R. B. (*Blaydon-on-Tyne*); OLD BRUIN; E. H. H. (*Chatham*); CARTER; T. S. (*Poplar, E.*); E. G. P. (*Kingsland, N.E.*); W. P. (*Lonsdale*); J. S. (*Londonderry*); SIFTER; J. R. (*Helmshore*); J. D. (*Glasgow*); J. H. (*Wigan*); T. C. (*Manchester*); L. G. (*Middleton*); J. R. (*Middlesbrough*); J. S. (*Huddersfield*); S. P. (*South Wales*); J. G. (*Nottingham*); S. C. (*Ashton-under-Lyne*); J. S. (*Nelson*); CONSTANT READER; J. B. (*Durham*); J. W. B. (*Birkdale, near Southport*); E. K. (*London, N.*) LEARNER; X. Z. (*Leeds*); A YOUNG BEGINNER; G. F. (*London, E.*); RENFREW; J. S. H. (*Dublin*); A. O. (*Manchester*); J. H. (*Hexham*); W. J. E.; D. G. T. (*Alminster*); H. C. S. (*Ipswich*); GLASS PAINTER; GRAPHO; F. G. (*London, N.*); P. T. (*Kilmarnock*); CHEST; SOWERBY; A. READER; D. S. M. (*Glasgow*); E. W. C. (*New Wandsworth*). PENYBRYN; A. H. W. (*London, W.*); R. W. M. (*Kildare*); MIEUX QUE ÇA; SAW MILL; T. B. (*Morpeth*); J. W. H. A. (*Weybridge*); CYCLOS; A BLACKSMITH; B. F. (*Liverpool*); YOUNG ASPIRANT; H. B. T. (*Hendon*); A. R. (*Scorrier*); DISTANCEPHONE; A. A. B. (*Brighton*); H. B. (*Dudley*); W. A. F. S. (*London, S.W.*); W. A. (*Chatham*); T. L. (*Gainsboro'*); CYMRO; OIL PAPER; W. R. (*Cheshire*); H. S. (*London, N.W.*); T. G. S. (*High Wycombe*); OLD NORWICH; W. N. (*Tottington*); R. N. (*Grays*); F. C. (*Leytonstone*); READER; F. T. D. (*Stoke Newington*); OMAR; T. H. B. (*Ardwick*); G. F. (*Liverpool*); E. W. (*Worcester*); A SUBSCRIBER TO "WORK"; G. F. R. (*Woolwich*); CORREX; G. P. (*Elgin*); W. J. P. (*Wimbledon*); D. J. (*London*); W. C. (*Peckham, S.E.*); A. B. X. (*Guildford*); BUSYBODY; W. N. (*Cheshire*).

"WORK" EXHIBITION.

PRIZE DISTRIBUTION.

NOTICE.

THE Manufacture of the Medals and other arrangements in connection with the Prize Distribution are now in a forward condition, and the Editor hopes to announce in an early number the date and place at which the Distribution will take place.

JURORS' AWARDS.

The Editor hopes to publish a full list of the Jurors' Awards in No. 101.

Price **3d.**; post free, **4d.** The

Special Exhibition Number of

"WORK"

(*Separate from the Weekly or Monthly Issue*).

Containing an **Illustrated Descriptive Account** of the most remarkable Exhibits.

Among its contents are:—

Working Model of Steam Fire Engine.
The Story of the "Work" Exhibition.
Protected Exhibits under Certificate of Board of Trade.
The Value of Art Training to the Professional Workman. By C. R. ASHBEE.
Sir John Lubbock, Bart., M.P.: His Services to Science and Labour.
Fifty Years of Recreation Work. By the Rev. C. C. ELLISON.
Our Exhibits and Exhibitors.
Work and the "Work" Exhibition. By the SECRETARY.
My Ideas about Hobbies. By OPIFEX.
Special Gift Books to Exhibitors.
The Story of the Prize Certificate and Medal Competition.
Certificate Granted to Prize Winners.
"Work": Its Utility and Importance to all Workmen, Professional and Amateur—
I. From the Professional's Point of View.
II. From the Amateur's Point of View.
Statistics of the "Work" Exhibition.
"In Memoriam."
The Polytechnic Institute.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

SALE AND EXCHANGE.

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [11 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

2,000 Lots of Second-hand Lathes, Drilling Machines, Gas and Steam Engines, and miscellaneous items. Call at 100, Houndsditch, London, or send 4 stamps for Register.—BRITANNIA Co. Tool Factory, Colchester. [12 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E.

Ormonde Cushion Tyre Safety.—Splendid bicycle, ball bearings, usual parts beautifully plated; brand new and faultless. Only £8 8s.; honestly worth double. Rare bargain; sure to give satisfaction.—T. E. W., 6, Tower Street, Ipswich. [1 S

Electro-Plating Solutions.—Amateurs supplied with every requisite. Dynamos, motors, and castings; repairs.—BONNEY & Co., 19, Avenue Rd., Lewisham. [2 S

Lettering and Sign-Writing made Easy.—Also diagrams for marking out eight alphabets, only 1s.—F. COULTHARD, Terrace Road, Bournemouth.

Fret, Carving, and Repoussé Patterns.—100 of either, full-size, 1s.; 300 Turning designs, 1s.; 400 small Stencils, 1s.; 500 Shields, &c., 1s., postage free.—F. COULTHARD, Terrace Road, Bournemouth. [3 S

Picture Moulds.—15 to 25 per cent. saved. Send for wholesale list, one stamp.—DENT'S, Importers, Tamworth. [13 R

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.

SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

THE POLYTECHNIC SERIES.

Consisting of practical Illustrated Manuals specially prepared for Students of the Polytechnic Institute, Regent Street, London, and suitable for the Use of all Students.

Forty Lessons in Carpentry Workshop Practice. Cloth gilt, 1s.
Practical Plane and Solid Geometry, including Graphic Arithmetic. Vol. I. ELEMENTARY STAGE. Cloth gilt, 3s.
Forty Lessons in Engineering Workshop Practice. 1s. 6d.
Technical Scales. In set of Ten in cloth case, 1s. per set.
Elementary Chemistry for Science Schools and Classes. Crown 8vo, 1s. 6d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

TOOLS MOSELEY & SON

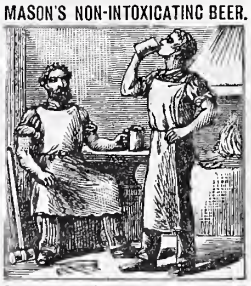
323 HIGH HOLBORN LONDON.W.C.

200 PAGE CATALOGUE

700 ILLUSTRATIONS
PER POST 6^D.
ORDERS OF 10/- CARRIAGE PAID

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER. MASON'S WINE ESSENCES.



These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. **One Tablespoonful of Mason's Extract of Herbs** makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON,
Nottingham.

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

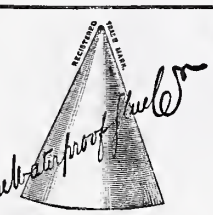
HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application.

FRANCIS RAVENSCROFT, Manager.

FLUID WATER RESISTING **GLUE** (*Patent*) PATENT TINS.

Invaluable for all Out and Indoor Repairs.



FLUID WATER RESISTING **GLUE** (*Patent*) PATENT TINS.

No Brush—No Boiling—Will securely join Wood, Glass, China, Metals, &c.

By Post, 8d. and 1s. 3d. per tin. Through Ironmongers, Chemists, Chandlers, &c., 6d. and 1s. per tin.

Manufactured only by THE WATERPROOF GLUE CO., 62, Dale St., LIVERPOOL.

CASSELL'S CLASSIFIED CATALOGUE, containing particulars of upwards of One Thousand Volumes published by Messrs. CASSELL & COMPANY, ranging in price from

THREEPENCE TO FIFTY GUINEAS,

will be sent on request post free to any address.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

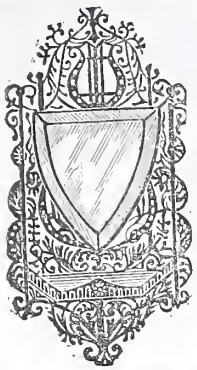
These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

CARVING AND FRET SAWING FOR PLEASURE OR PROFIT.

Highest Award Gold Medal for Fretwork and Carving Tools and Designs.



The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION. Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS, at 1/3, 2/6, 3/6, & 5/6 each, *post free.*

Parcels of Assorted Fretwork, 10 feet ... ... *4s.* free.
12 Finely Lithographed full-sized Patterns ... ... *1s.* ,,
Sets of 12 Carving Tools... ... ... *10s.* ,,

None should buy elsewhere before seeing our **New Catalogue** of all Requisites, with instructions. Acknowledged the **Most Complete and Cheapest List** of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

JUST PUBLISHED—THE "FORTH BRIDGE BRACKET."

HARGER BROS., Settle, Yorks.

MELLIN'S FOOD

For INFANTS and INVALIDS.

MASTER MILLAR. Aged 12 Months.

"31, Harewood Sq., N.W.

"Mrs. MILLAR's little boy—taken the day he was a year old—brought up on MELLIN's FOOD till then."

MELLIN'S FOOD BISCUITS.

PALATABLE, DIGESTIVE, NOURISHING, SUSTAINING.

Price 2s. and 3s. 6d. per Tin.

SHAKESPEARIAN WISDOM ON THE FEEDING AND REARING OF INFANTS.

A Pamphlet of quotations from Shakespeare and portraits of beautiful children, together with testimonials, which are of the highest interest to all mothers. To be had, with samples, free by post, on application to

G. MELLIN,

Marlboro' Works, PECKHAM, S.E.

SALT REGAL.

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY**, imparting **NEW LIFE** and **VIGOUR**. Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION**, and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET**, eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE**, and giving tone to the entire system.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill**, with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 1s. 6d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design **SENT GRATIS** with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

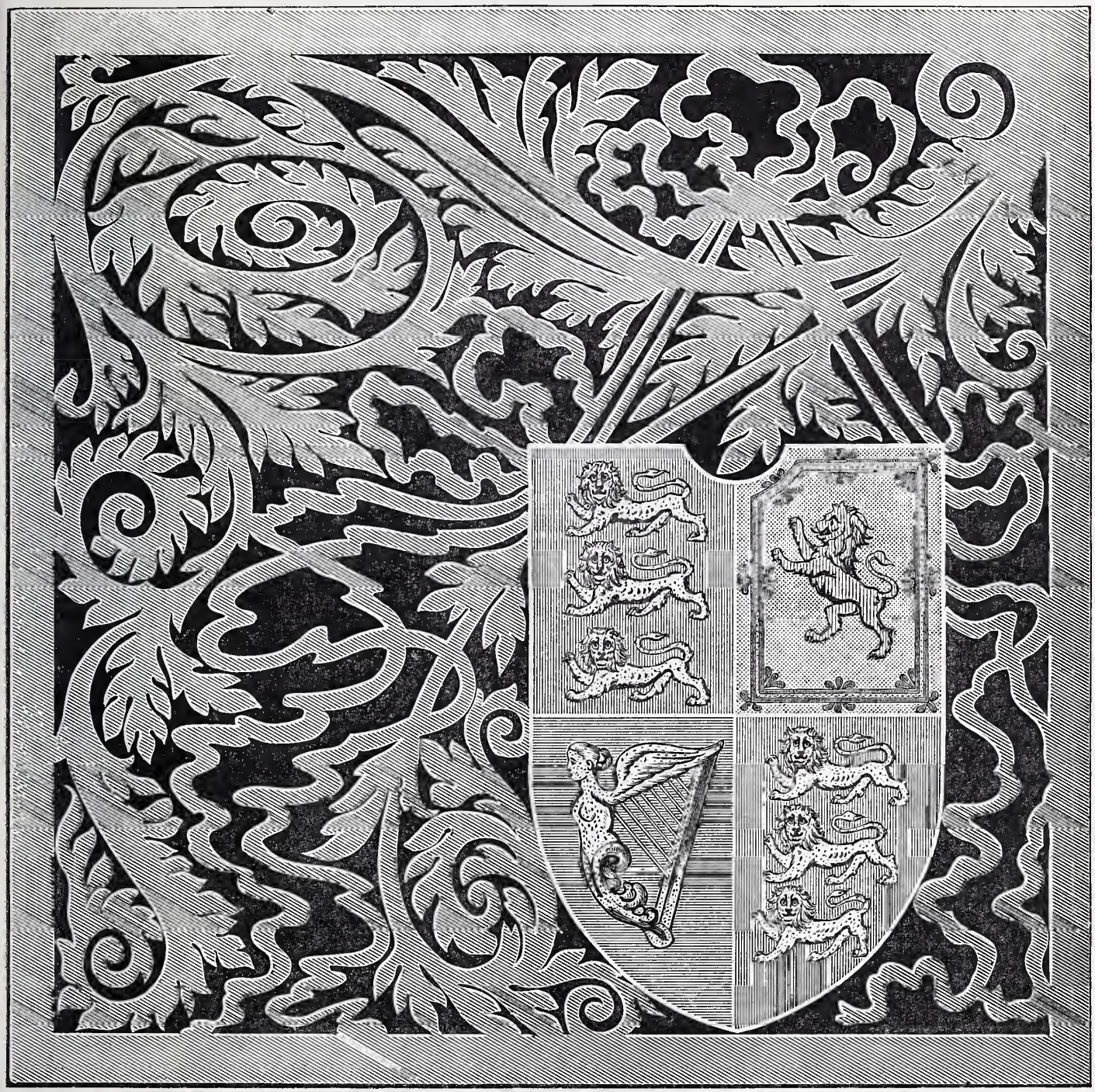
WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 100.] SATURDAY, FEBRUARY 14, 1891. [PRICE ONE PENNY.



A SMALL HANGING CUPBOARD WITH FRETWORK DOORS AND ENRICHMENTS — FULL-SIZE WORKING DRAWING FOR LEFT-HAND DOOR. By E. BONNEY STEYNE.

For Sketch of Cupboard complete and Full-Size Working Drawing of Enrichments in the form of Borders to the Various Parts, see next page. The Shields in the Doors are to be decorated with Coats-of-Arms in Heraldic Colours, Crest, or Monogram according to liking. As the left-hand Door is shown in the Drawing above given, it will be understood that for the Door to the right hand the Design must be reversed.

A SMALL HANGING CUPBOARD WITH FRETWORK DOORS AND ENRICHMENTS.

BY E. BONNEY STEYNE.

THE love of human nature for handy receptacles in which to store accumulated oddments—treasures, perhaps, to their possessors if lumber to all others—is no doubt as old as the love of collecting such things. Whether the virtue of tidiness is equally old is another question. As we delve into early history we are surprised at the antiquity of vices. From the comparatively harmless pun to the most tragic crimes that set a continent aghast with horror, we find, alas, that our ancestors knew them all. Of some virtues we may almost trace the first example, and tidiness, we fancy (if it be, indeed, a virtue, and not a deplorable vice, which delicate point may be left to the casuists among our readers), at least in its modern sense, is an artificial product, caused by the more artificial conditions under which we now exist. Tidiness is, we know, a very domestic virtue, if not exclusively feminine, yet one that is specially inculcated by the rulers of home, where the Salic law is so rarely in operation. Consequently, if the powers that be object to "more useless ornaments," when the amateur craftsman presents his thirteenth bracket, his twenty-fifth pipe-rack, or his fiftieth photo-frame, let him take warning; and that his hobby may not become a curse to his household, let him try a few useful articles to propitiate the offended goddess, whether she be wife, aunt, sister, or "a nearer one yet and a dearer one still," as the poet has sung with unconscious satire.

Of all articles makeable by an amateur joiner, a set of two or three shelves with the lower space enclosed by two plain doors is surely among the easiest. By plain doors I mean the use of just a solid piece of wood in place of framed and panelled ones, which are, of course, preferable, if the skill of the worker is able to achieve it.

The form of this little structure is so commonplace that it hardly needs explaining by diagrams, for if any piece of furniture in the whole range of such is easily seen and studied from the actual example it is surely this. In one near me as I write, the shelves are just screwed into through the uprights; in one I noticed ten minutes ago in passing a shop the shelves were boldly tenoned through the end pieces and secured by pegs. Another has them grooved into the uprights and fastened by nails. A backing of wood serves the double purpose of enclosing the cupboard and keeping the framework taut, with no lateral play of the joints. It is best in all such work to fit the doors before sawing, then, by simply unscrewing the hinges, they are ready to receive the design.

But whatever may be the way in which the parts are put together, the appearance of the finished cupboard as shown in Fig. 3 will be much the same. In Figs. 1 and 2 are shown full size the fretwork doors and bands. The pattern of the band may be repeated from end to end, or broken by a medallion, as shown by dotted lines in Fig. 2, and the design reversed.

The shields are intended to bear a painted heraldic device, a crest, or to be decorated with a monogram cut in very thin wood and glued on. To end in cookery book phrases — stain, polish, or otherwise finish to taste; time (uncertain in season at any time), sufficient for the needs of one person.

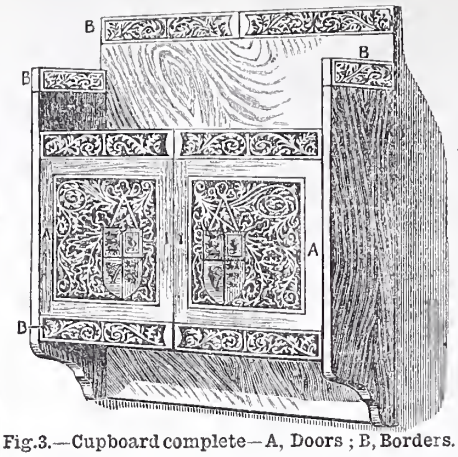


Fig. 3.—Cupboard complete—A, Doors; B, Borders.

Fig. 2.—Full-Size Working Drawing of Border.

AN ARMCHAIR: HOW TO MAKE THE FRAME AND UPHOLSTER IT.

BY DAVID ADAMSON.

SEATS OF CHAIRS—MATERIALS FOR UPHOLSTERY—WEBBING—CANVAS—STUFFING—WADDING—COVERINGS—MOROCCOS—ROANS—LEATHER CLOTH—VELVETS—SADDLE-BAGS—TRIMMINGS—UPHOLSTERER'S TOOLS—STRETCHING AND FIXING WEBS—LAYING CANVAS.

As is well known, seats may be either spring-stuffed or hard, buttoned or plain. We will consider this one as being without either springs or buttons, as this arrangement presents fewer difficulties to the novice, besides being perhaps rather more in keeping with the general character of the chair. Besides being simpler to make, a plain unbuttoned seat allows of a greater range in choice of covering materials; but without giving reasons in full for the selection of this kind of upholstery, it will suffice to give instructions for stuffing and covering seat and back in a proper manner.

The materials proper for the work are webbing; thin canvas; scrim, which is a very loosely woven canvas; calico; some stuffing material, of which curled hair as prepared for upholstery purposes is the best; wadding; tacks; twine; outer covering; and several minor odds and ends, which will all be considered in due course.

Perhaps a few remarks on the principal materials may not be amiss before beginning work. All of them may be got from any upholsterer in quantities which may be suitable. Wholesale dealers and manufacturers, as a rule, will not supply in retail quantity, so that the novice, at any rate, will do well to purchase what he requires from some local furniture shop where upholstery work is done.

The webbing is a banding of about a couple of inches in width. It is of the utmost importance that it should be of good quality and properly stretched, as it supports the greater part of the stuffing. If the webbing gives way, the seat is bound to follow.

For the canvas, scrim and calico are generally used, though almost any fairly strong fabric may be used, and the qualities required will be easily perceived as the description proceeds. For the tacks, a suitable size will be ⅝ in.

Almost any fine strong twine will do, but that used by upholsterers (a kind of whipcord) is the best for the purpose. The quality of the stuffing material is very important, for not only the comfort, but the appearance and durability of the chair largely depend on it.

As has been said, curled horsehair is the best material when it is of good quality; but let me caution all against the use of old hair—that is, hair which has been taken out of old work, especially that from bedding—unless its source is known. What may be called second-hand hair is offered at very low prices by marine store dealers, low-class brokers, etc., but it should be always looked on with suspicion. It is certainly hair, but it is not to be compared with good new stuff in any way, while there are obvious risks attending its use, unless it has been thoroughly re-made; in which case, for all practical purposes, it may be regarded as new material. It may not be generally known that curled hair cannot be simply washed unless it is also thoroughly redressed. I say this, as not very long ago I saw in a popular magazine some instructions purporting to tell how to renovate old

hair, and among other details, it was stated that it should be washed. Now, washing would get rid of dirt, of course, and to that extent might be of benefit; but if merely dried afterwards, as was directed in the article referred to, the hair would have lost all the principal qualities which render it valuable as a stuffing material. It would be dead and limp, without the springiness which is one of the essential features of a good stuffing. The proper preparation of curled hair is rather an elaborate one, which it is needless to enter upon here in detail. It will suffice to say that the hair is first made into tight ropes, which are subsequently baked or heated, after having been soaked in water, and then untwisted. When sufficiently loosened, it is ready for use; and I should advise readers to buy it towsed instead of in the rope. It will cost very little more, and the labour of unpicking the rope is very uninteresting, and not at all remunerative to the man who can employ his time otherwise. Good hair is obtainable at from 1s. to 1s. 6d. per pound. It is to be had at much lower prices, but the commoner qualities are generally largely adulterated with inferior materials.

Besides hair, various other materials may be used for stuffing purposes. Among the most general are *Crin vegetal*, or vegetable hair, cotton flock, and alva. The former is a preparation of the fibres of a plant, and is chiefly brought to this country from the northern coast of Africa. Flock is too well known to require any explanation. Alva is a seaweed, of which there are at least two kinds used—viz., the German and the French. The former is inferior to the latter, which is crisper and with more spring in it. None of the vegetable fibres are, however, to be compared with hair, as they do not present the same amount of elasticity. Let the novice take a handful of each material and compress it. Good hair will expand again on pressure being removed, while the others will do so only to a very limited extent. In use, seats stuffed with them become hard and lumpy very soon, while hair retains its spring for a considerable time, though, of course, it too eventually becomes matted.

The wadding is what is often known as "cotton-wool," being a finely worked cotton, sold in loosely fitted sheets sized over on both sides. The size, drying, forms a kind of skin. I think it is to be had from drapery as well as upholstery shops. It is prepared either grey or white, and is sold by the yard. To use, it is split open, dividing its thickness; and its object is principally to soften the harshness of the stuffing to the sitter. It is sometimes omitted.

About the covering a good deal might be said, but I can only glance at a few of the materials, leaving the worker to make his own selection. There are leathers of various kinds, and these may be taken first.

Moroccos are deservedly popular, but they are hardly suitable for a beginner to work with. They wear well, and can be had in almost any shade or colour. They are goat-skins, and must not be confounded with roans or sheep-skins. The two are remarkably alike in general appearance, but there is much less wear in the latter, which are often substituted for the others by unscrupulous dealers, on account of their lower price.

For the outsides of backs, where there is little or no wear, roans do very well instead of the more costly and durable moroccos. Hog-skins, specially prepared for upholstery, have come much into favour within the last few years. They are both durable and handsome, the principal manufacturers stamping them with various good patterns. They are, however, like moroccos, not the easiest materials to use.

Very closely resembling the real thing are some of the imitations, or leather cloths. The better qualities wear remarkably well — far better than some real leathers. Crockett's leather cloth is of world-wide fame, and, apart from its durability, is preferable to some of the newer introductions. I need only remind those who think of using an imitation of leather that some of the leather cloths are very inferior, and that as the best is very inexpensive, it is scarcely worth while to use anything else.

Velvets and various woven fabrics are much in use now, and have to a great extent supplanted leather, as there is no question that, for durability, some of them are superior even to the best morocco. This applies specially to velvets. Of these, the suitable kinds for such a chair as the present one are the plain Utrecht, or mohair, and the frieze. The former are generally plain, but may be had stamped. The latter have a pattern woven in with them, and have almost superseded the stamped Utrecht.

With these velvets may be classed the now well-known saddle-bags, which, with few exceptions, are made up only in squares, so that for coverings they are generally used along with plain Utrecht to make up the necessary sizes.

Very much resembling saddle-bags is the material called moquette, which is made up in the same style of semi-Oriental patterns and colours, and in lengths like ordinary piece-stuffs. Velvets of the ordinary kinds—Utrechts and friezes—it should be said, are only made in self-colours, but are to be had in almost an endless variety of tint.

Beyond these few, there is an immense variety of covering materials, but none of them are so suitable for the present chair, unless, perhaps, it may be some of the tapestries, and a few others, which, though not in general use, may be regarded as more or less fit for the purpose.

Various trimmings—such as gimp and studs—will also be necessary to give an adequate finish to the upholstery. They will, to a great extent, depend on the covering material, but as it is clearly impossible to define them all, it must suffice to mention one or two. With a real or imitation leather covering, the best gimp to use will be leather; the studs also may be either covered to match or plain metal. Without any banding, these may be used by driving them in close together. For velvet coverings, either a leather or velvet banding may be chosen, and the studs be as before, or velvet-covered.

Now, with some general idea of the materials to be used, let us see how to work them up. To do this, beyond a long upholsterer's needle, no special tools are absolutely necessary, though an upholsterer's hammer, a web strainer, and a regulator will be conveniences. They may, however, be dispensed with, and easy substitutes found for them. The hammer generally used has a long, thin head, with a very small face and thin claw; but for occasional use an ordinary hammer will do very fairly. The web-strainer may easily be made at home, but as I purpose at no very distant date describing its construction in detail, those who are not provided with one may make use of a straight piece of wood for the purpose of stretching the web when tacking it down. The sizes of this extemporised tool are not important, as will be seen later on. For the regulator (which is a steel rod tapering to a point at one end, and flattened out towards the other), the needle may be made to serve. All the outlay, it will thus be seen, may be confined to the actual materials used in the upholstery, which the learner is now sufficiently informed about to be able to proceed with.

First, the webbing must be fastened to the seat and back. Let us take the former for the purpose of description, premising that it is understood the pieces from back to front are interlaced—that is to say, first over and then under those extending from side to side. Four strands each way might do, but five will be better for a chair of this size, and as the webbing is inexpensive, it is better to err on the side of excess. The spaces between each should be, as nearly as possible, the same, but extreme accuracy is not requisite. Now, please follow the movements thus: Turn under the loose end of the web, and put it down on the top of the back (or any other) rail, the length of the web being towards the opposite one. Fasten the end down with, say, four tacks, not less than half an inch from the inner edge of the rail. Now get the piece of wood serving for strainer, rest one end of it against the outer edge of the rail opposite to that to which the web has been already tacked, pass the web over the other end, grasp it and the web tightly with the left hand, and depress it till the web is thoroughly taut and level with the top of the rail. Still holding tight, drive three or four tacks in. The stretcher for this strand has done all that is required of it, and may be relinquished. Cut the web off, say, an inch from the tacks, turn over the loose bit, and fasten it down with a couple more tacks. It will be seen that the improvised web-strainer acts as a lever, and all that is required is that it should be at least as wide as the web, stout enough not to break, and long enough to get sufficient pressure. If it is found impossible to hold the web and it so tightly in the hand as to prevent the web from slipping, a remedy may easily be found by passing the web along the under side of the lever, and gripping it between the end and the seat rail. The remainder of the webbing is fastened in exactly the same manner, and every precaution must be taken that it is well stretched. Sometimes, to make sure that it is stretched to the fullest extent, it is strained before use by letting it remain suspended over a beam, with heavy weights attached to the ends. However, it does not matter whether this is done, provided it is strained to the utmost before it is tacked down.

The webbing on the back is done in the same way, the tacks being driven into the front—that is, the webs lie on the inner side of the back.

Over the webs lay the canvas, or, as it is often spoken of, from the kind that is used, Hessian. As this canvas does not have the same weight to support as the web, smaller tacks will do very well for fastening it down. The best way to proceed will be to cut the canvas a trifle larger than the seat frame, to allow of the edges being turned over to the extent of 1 in. or so all round. Then put one tack through the centre at the back, and drive in other tacks at intervals of $1\frac{1}{2}$ in. to 2 in., at the same time pulling the canvas always tightly with the left hand, and driving the tacks through the turned-over margin. When the whole of the back rail has been done, continue along the right side of the frame towards the front rail, always pulling the canvas tightly

with the left hand. Proceed in a similar manner along the front and remaining side rail. Care must be taken at the legs not to cut the canvas too finely, as if this is done the hair or stuffing will very likely come through. It will be better to leave the canvas full here, so that it may be slightly turned up, and if necessary, tacked to the legs. The back also has canvas laid over the web in a similar way.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

Imitations of Inlaid Woods.

The art of *inlaying*—a word that explains itself—has been practised to some extent for many centuries. Mosaic—perhaps the most ancient—marquetry and parquetry, and the inlaying of metals, are all four different methods of working out the same idea of ornamentation. With the metals and mineral products we have here no concern, whilst the connection of these papers with marquetry work—the inlaying of furniture—and parquetry—its application to floors—can only be of a somewhat remote nature. A general *résumé* of these inlaying arts would doubtless serve as the best introduction to studying their painted imitations—since both painted mosaic and metal inlays are as practically useful in decoration as those of woods—but for the present the student must look for this in other directions. All I can attempt to do in the space of two short papers is to explain how, in connection with these lessons on graining, the technical processes of painting, graining, outlining, staining, etc., are so manipulated as to obtain the desired imitations of inlaid woodwork.

Suitable Designs for Inlaying are factors in this work upon which much of the resultant success will depend. The production of good ornamental design—that which is original—can seldom be forthcoming without the combined resources of a natural inventive faculty and a trained eye and hand. Very few grainers lay claim to being also ornamental designers, and fewer still can justify that claim. Perhaps the next best thing to being able to "create" an ornament is to know when a design is suitable for any particular purpose. This knowledge should be possessed by the imitator of woods in its application to inlaid work. Without, therefore, presuming to initiate my practical readers into mythical principles of idealistic lines and contours upon which, presumably, ornamental forms are produced, I will indicate simply how, and why so, a design for inlaying should be arranged.

The ornament, in the first place, should be of the nature termed "flat," and therefore akin to that for stencilling. The basis of the idea, that of "laying in" one wood upon another, resents any attempt at shadow or rounding, whilst the first principle of construction—viz., utility—is outraged if we attempt "light and shade" upon surfaces like table tops and the floors we walk upon, whether it be in mosaic work or parquetry. *Colour* in inlaid work has certainly some purpose and mission, but form is of chief importance, and therefore very careful and accurate drawing is required. Contrast of light against dark, and not colour-contrast—a distinction with a difference—is the means whereby the ornamental form is displayed. In the more elaborate specimens of marquetry, conventional representations of material forms and figures are, however, sometimes executed. Outlining with light wood or black is then resorted to, that the design may be properly defined; and, in such cases, the colour-stained woods are used to give a soft richness and to help make a picture. The margin between that *correct art*, which ornaments the constructive and useful, and the *bad art*, which sacrifices all sense of use and first purpose to ornamentation, is here but a very narrow boundary line. The coloured inlays of the Italian mediæval work and the costly "Buhl" work of French production are usually free from any such reproach, since in these productions we find the same excellence attained as in the best Persian painted decoration, where light and shade is *suggested* to perfection, but never directly *represented*.

In the imitation of inlays a learner's best effects are commonly obtained by graining woods in their natural colours, leaving the pyrochromatic arrangements for the perfected skill of experienced workers. His scope is by no means limited thereby, as a glance at the woods mentioned in the preceding paper will prove. Two or three well-arranged varieties, worked into a good design, give but little trouble, and amply repay the time and labour involved.

We will now interest ourselves with simple methods and treatments, chiefly in their connection with and applicability to the woodwork of buildings, leaving to the final paper the execution of more difficult and intricate panels and table tops.

The *Grounds for Imitation Inlays* should invariably be light in colour. A perfectly level surface must be maintained, and it is by this desideratum our methods are governed. It is quite apparent to anyone possessing only a slight knowledge of painting that an opaque white ornament cannot be obtained against a dark background without the former being coated so many times as to destroy the even surface. On the other hand, it is possible to cover up portions of a light ground, even to blackness, without any appreciable thickness of pigment, hence the reason for light grounds. When white, unpainted wood is the ground worked upon, for simple inlays we may prepare the surface with a coat of varnish, and thenceforward treat as a painted ground. For delicate work, however, in which we desire to stain the wood itself, a totally different plan is advisable; this we will consider later on.

Inlaid Floor Margins have occasionally provided work for the grainer for many weeks in the "good old days." Although the real parquetry is now so cheap that its imitations may seldom furnish employment for the operative, this branch may well be followed by the amateur worker. Many persons now use a margin of imitation parquet linoleum, in place of the plain staining of floor boards, but there is little doubt that a stained ornamental border would be generally preferred to either.

The two simple border-ornaments (Figs. 1 and 2) in the accompanying page of illustrations are arranged upon the scale of one inch to the foot. The width of eighteen inches is one that can be easily adapted to the size of ordinary floor boards. Fig. 1 is intended for two woods only—dark walnut upon a light oak. Fig. 2 is made more ornate and effective by the further addition of ebony wood imitation. To apply these designs we first make a full-size line drawing of the border, and from that make a tracing upon a piece of cartridge-paper. This is easily done by rubbing over the back of the outline drawing with a little dry red or black lead, then pinning the two together upon a table with drawing-pins and marking over the drawing with a fine-pointed stick or penholder. The colour is thereby pressed into the face of the cartridge-paper. We make a tracing upon cartridge-paper for each different wood used—hence two for border Fig. 2—and then cut out the parts of the design corresponding to the wood. When the design is of one colour only, one stencil is sufficient; but it may be necessary to make good the ties by hand afterwards, in which case it takes as long as working two stencils. The floor must be well cleaned, and as smooth and level as we are able to get it. It is advisable to strike two or three chalk lines, marking the centre and extremes of the border to which we work the stencil. The corners are best set out separately and put in by hand, unless of an intricate nature, when it will be quickest to use stencils. A coat of hard-drying oak varnish, stained with raw sienna in oil and a little raw umber, is first spread over the whole margin to get the oak colour and prepare the wood also. The border being set out when this is dry, we first stencil in the walnut, using burnt umber with the same varnish, and then lampblack with varnish for the ebony. The first varnish coating enables us to stencil these cleanly, and the marginal lines are put in last with a fitch and straight-edge. A coat of hard-drying varnish all over, and then rubbing with beeswax and turps, will make a good and durable finish.

Plain Panelled Dados and Wainscot are woodwork of a higher order of construction, and with such as these simple inlays may be admirably worked. For chapels or schoolrooms wherein are large quantities to be treated, our ornament must be both suitable and easily executed. The "board-rooms" of public bodies are often provided with cheap panelling, and when the wood is pitch-pine the introduction of more elaborate inlay treatments would be very appropriate. I therefore show two suggestions of design (Figs. 3 and 4), in both of which a black outline may be pencilled on with beer and lampblack after the stencils are used, or the design may be all black. The preparatory coating of varnish is here also advised, and the ornament executed upon the same plan as for the floor borders. These, I am well aware, may be but "bastard" imitation inlays. It would, however, be worse than useless to attempt the same expensive method for cheap panelling as we should use upon a table top. Stencils, if specially designed and cleanly cut and used, will bear all reasonable inspection, and if time can be spared to paint the fine black outline by hand, there will be no perceptible thickness to mitigate against the desired inlay effect.

Simple Inlay Designs for Grained Doors will now be within the scope of learners who have worked at the previous easier treatments. These samples (Figs. 5—8) are intended to be worked in two varieties of wood upon a third. Figs. 5—7 may be used upon maple-graining with mahogany or walnut ornament, and black for fine detail and lines. Figs. 6 and 8 are upon walnut ground, with ornament in maple, grey hairwood, and amboyna. Besides these complete panels, which will enable the worker to judge the effect of a finished panel, I give in Figs. 9 and 10 some very easy corner ornaments, which make up neat and pleasing panels by using them in the corners and joining with fine lines. Figs. 11 and 12 represent simple scroll borders, useful either for panels or the flat member of a door architrave.

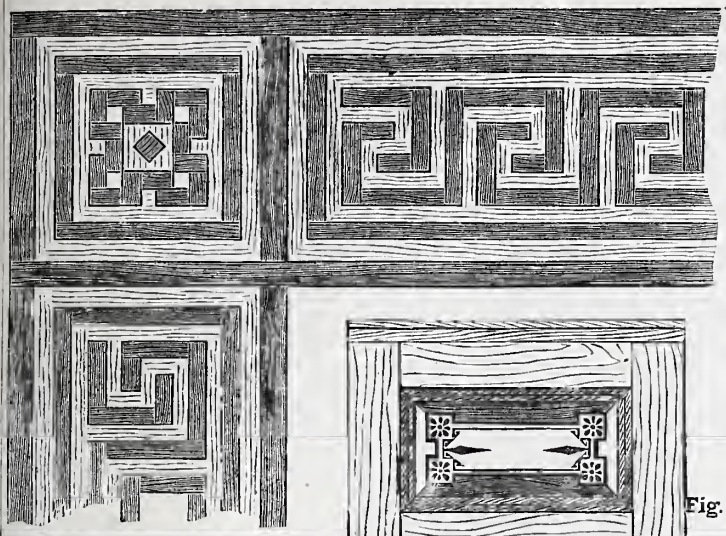


Fig. 1.

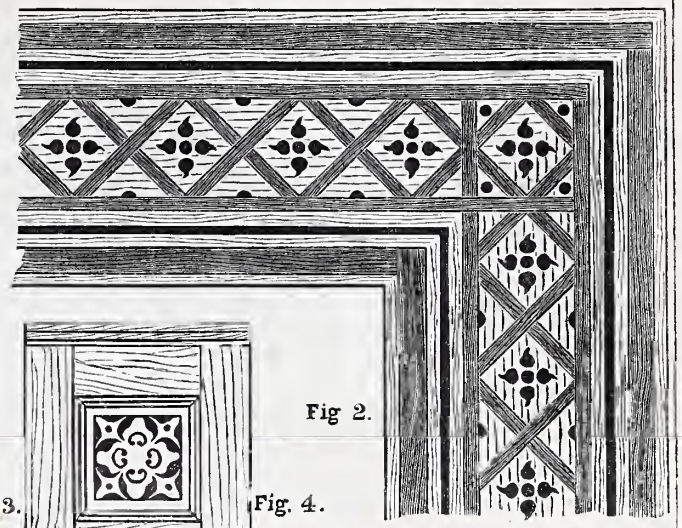


Fig 2.

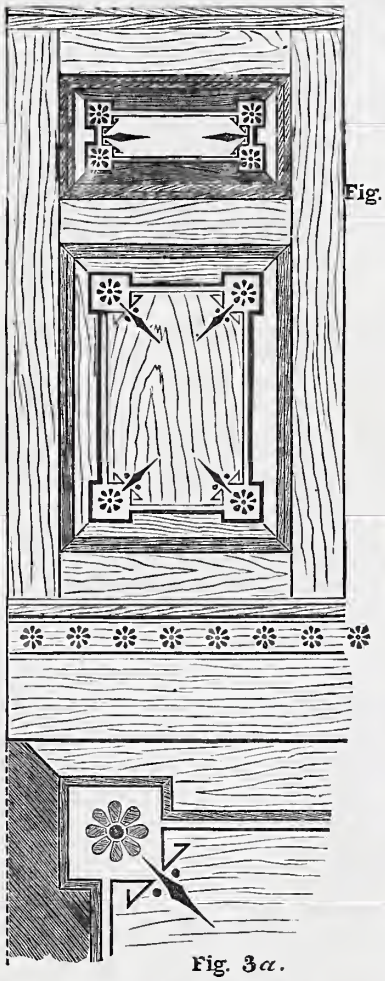


Fig. 3.

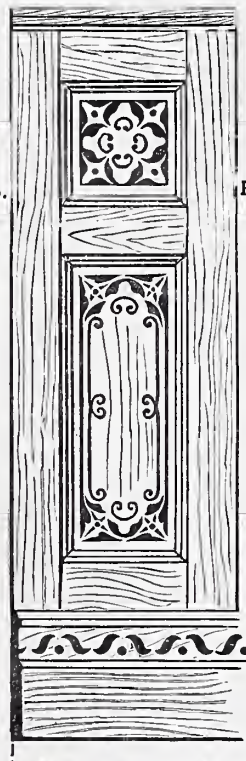


Fig. 4.

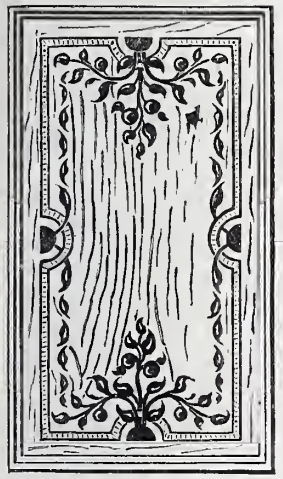


Fig. 5.

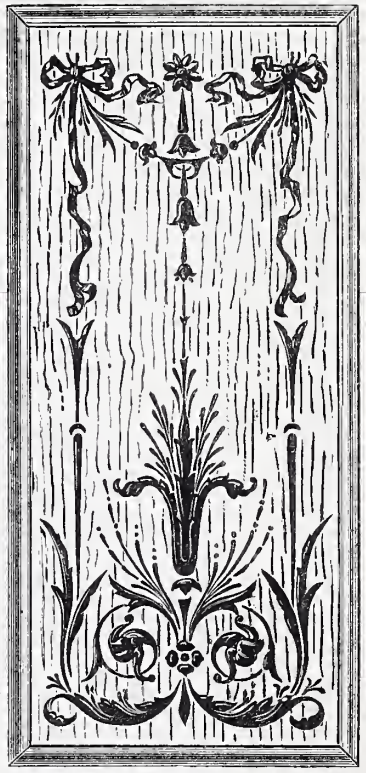


Fig. 7.

Fig. 3a.

Fig. 4a.

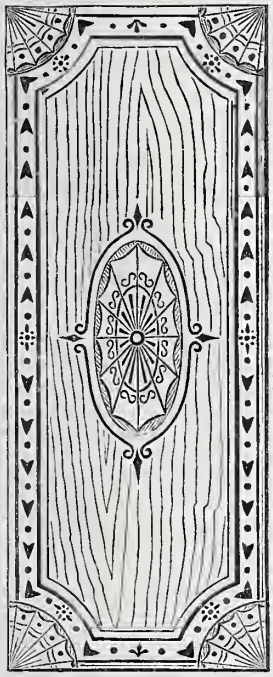


Fig.6

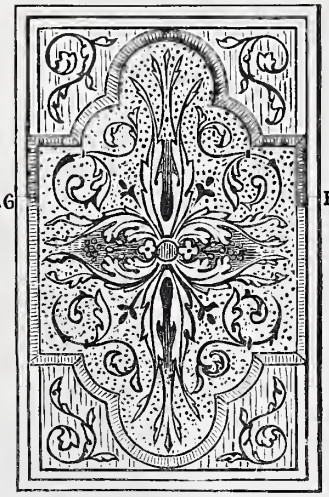


Fig 8

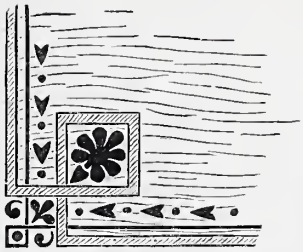


Fig. 9.

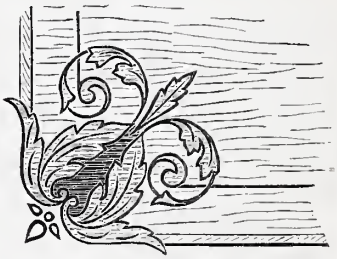


Fig 10.

Fig. 11.

Fig. 12.

Fig. 1.—Suggestion for Floor Margin in Old "Key" Pattern. Fig. 2.—Another Suggestion for Floor Margin. Figs. 3, 4.—Treatments for Panelling in Imitations of Inlaid Work. Figs. 3a, 4a.—Corners of Larger Panels in Figs. 3, 4, enlarged. Fig. 5.—Panel Treatments in Walnut and Ebony on Light Wood for Dining-Room. Fig. 7.—Ditto for Drawing-Room. Figs. 6, 8.—Fancy Panels—Light Woods on Dark. Figs. 9, 10.—Corners for Panels. Figs. 11, 12.—Simple Borders in Imitation Inlaid Work.

A zealous student with a little knowledge of drawing will very soon augment this little selection of ornaments. We are surrounded at all times, in the streets of the city and at the fireside, with different ornamental forms and expressions. A faculty for adapting lineal forms to the special requirements of our work is the essence of that which is commonly termed designing; for the beauty and perfection of an ornament is not judged solely by its lines of grace or intricacy, but rather by its fitness for the position it occupies and exigencies of the material we work in. It is, therefore, indubitably apparent that the man who executes the inlay should make a better design than the draughtsman who is ignorant of the practical work and technique.

Methods of executing Grained Inlays may now be explained. Since one general system of working will apply to all my panel illustrations, I will take Figs. 7 and 8 and show how to grain them upon painted grounds.

For both panels we "get up" the surface and "ground" them for maple imitation. Our first sample being darker woods upon maple background, we proceed to imitate the latter wood—with distemper colour as previously described—all over the panel. As we are to enrich this panel by ornament, we purposely keep the maple figure very subdued and finish it entirely before we varnish. The panel being now ready for the other woods, we have first to make a careful drawing of the ornamental outline and prick this through at very close intervals. For small work a sheet of thin note-paper answers admirably. Having now our pounced drawing, we also make a little muslin bag of cheap dry ultramarine, or any similar finely ground pigment, for conveying our design to the panel. Before this is required we take our distemper colours, vandyke brown, etc., and a little beer, and grain over the corners of the panel or wherever the walnut portions of the design come. This can be roughly judged by the eye alone, or if much walnut is wanted we grain the whole panel. We have now to secure those parts of the walnut we want for the design and to remove the superfluity. This end we attain by painting the design with a vehicle of any nature which we can afterwards remove by a solvent and brush, and such as water will not effect. For this purpose a little finest Brunswick black will answer best with painted inlays. We, therefore—the walnut being dry—now pounce the design thereon, and then carefully paint the walnut portions in with a sable pencil and the black. The latter dries quickly, and the superfluous walnut is then cleaned off the maple with a soft sponge and warm water. We have now the black, or ebony, to execute. We take a little black pigment—lampblack will do, but far preferably ivory black (see preceding paper, page 738)—and this being ground to the finest quality is rubbed upon the palette with a little beer only. We now take a soft camel-hair brush or the mottler, and brush over those parts of the panel where black is required. If the distemper black is spread carefully a very thin coating will cover. When this is dry we again pounce in the design. If we use fine drawing-paper and drawing-pins we may easily fix the pounce correctly by pinning into the first set of holes. We now cover the black parts with the Brunswick black, and when dry clean off the superfluity of distemper colour with water. All again being thoroughly dry we carefully damp over the Brunswick with clean, pure oil of turpentine, and after a little time we are enabled to remove it all with a soft camel-hair tool, leaving the walnut and ebony ornament, sharp and clean, upon the maple panel.

With panel Fig. 8, upon walnut ground, we adopt the same expedient. First we make the grey hair-wood, pounce and black it in, clean the panel, and then grain maple all over or where wanted only, just as we please, but keeping the figure very faint, since walnut will cover most of it. We paint in the maple parts with Brunswick as before, and then, without cleaning off, since amboyna is a stronger coloured variety, grain our amboyna parts. This being bound down where permanently required, we take our beer colours and overgrainers and grain the panel walnut all over. When thoroughly dry, we take the turpentine solvent and soak off and remove the Brunswick black, leaving the ornament in maple, hair-wood, and amboyna against the walnut background. The panel is now ready for two coats of copal varnish, the lightest and best quality of which is desirable.

THE TRIUNIAL OPTICAL LANTERN: HOW TO MAKE IT.

BY CHARLES A. PARKER.

CLAMPING PLATES FOR TOP LANTERN — FUNCTIONS OF CONDENSERS AND OBJECTIVES — COMPOUND PLANO-CONVEX CONDENSER — MENISCUS AND BI-CONVEX CONDENSER—SELECTION OF CONDENSERS—BAYONET FITTING FOR CONDENSER CELL — LANTERN OBJECTIVES—LONG FOCUS LENSES—FLASHERS—PREPARATION OF OXYGEN GAS—RETORT—PURIFIER—GAS-BAG—PREPARATION OF HYDROGEN GAS—GAS IN CYLINDERS—BLOW-THROUGH JET—MIXED JET—JET TRAY—LIMES—DISSOLVER—HANDLES—CURTAIN TO SCREEN LIGHT FROM JETS — LIGHTING UP — SCREEN AND SCREEN STAND.

It will now be requisite to affix a couple of screw clamping plates to the upper portion of the woodwork on either side of the second lantern, for the purpose of securing the third lantern in position. These clamping plates and screws can be obtained ready for use from any manufacturing optician, or, if preferred, the registering stops previously mentioned will be found to form capital substitutes. In this case, however, the plate of the clamp will not require bending, but should be screwed on to the upper portion of the woodwork of the second lantern with a small bush (similar to the one soldered on the plate), screwed into the woodwork at the bottom of the third lantern in a suitable position to engage the milled screw of the clamping plate, which is then screwed into the bush, thus serving to secure the top lantern in position. It will be found sufficient to cut in half the ordinary bush supplied with the clamping screw, soldering one-half on to the brass plate, and screwing the remaining half into the woodwork of the lantern body. The arrangement of the clamping plate will be readily understood by reference to Fig. 34 (page 708), which is a section of the lantern body, showing the plate screwed in position on the woodwork.

As the preceding papers have been entirely occupied by the constructive details of the lantern, it has been necessary to reserve all mention of the condensers and the objectives until this, the concluding paper of the present series; and as various matters of more or less importance still remain to be treated, it will be requisite to deal but briefly with the optical portion of the subject. The reader must understand that the condenser has nothing to do with the formation of the image upon the screen, its function being to concentrate, or condense, all the light emitted by the jet upon the small transparent slide, the front lens, or objective, as it is more properly called, serving to project the picture so illuminated in a magnified form upon a sheet or screen placed for its reception. It will thus be seen that it is the duty of the condenser to collect the rays of light emitted by the jet as much as possible, and project them forward in a parallel form through the slide. Having become acquainted with the function of the condenser, it behoves us to consider the best form suited to the requirements of the lantern. As a single condenser would not answer properly, by reason of the spherical aberration arising from the necessarily short focus required, it is usual to employ a compound condenser, which is generally formed of a couple of plano-convex lenses, mounted close together in a metal cell, with the flat sides out, as shown in Fig 35, this arrangement giving a lens of short focus and good optical qualities. Although various other combinations have been suggested from time to time, it is yet doubtful whether there is any distinct gain in their use, with the exception of the condenser introduced by Sir John Herschel some years ago, in which a bi-convex and a meniscus lens are mounted in a cell together, similar to Fig. 36, with the concave side of the latter placed next to the source of light. Condensers of this form are undoubtedly the best for use with the limelight, but unfortunately there are but few houses now supplying them. In fact, at the present moment the writer can only call to mind one firm—Messrs. J. Ottway & Son, 178, St. John Street Road, London, E.C.

Generally speaking, the best form of condensers are those which, from their short focus, permit the transmission of a wide angle of light, and distribute this over the entire field of the disc, without one part of the screen being better lighted than another. The size of the condenser, of course, depends in a great measure upon the dimensions of the slides to be exhibited; and as the standard size for the latter is now universally fixed at $3\frac{1}{4}$ inches square, 4-inch compound condensers will be found the most suitable to employ. It must be understood that it is a distinct disadvantage to use a condenser larger than is absolutely necessary, as much of the light is thereby wasted; but, on the other hand, it should not be too small, otherwise the pictures will be insufficiently illuminated. In purchasing condensers, it is advisable to see that the lens coming next to the slides is entirely free from all defects, such as air-bubbles or striæ, as they are apt to show unpleasantly on the screen with some negatives.

It is advisable to have the condensers loosely mounted in their cells, otherwise the heat of the lantern may cause them to crack, and, for the same reason, the sudden expansion of the glass should be avoided by gently warming the condenser previous to the lantern being fully lighted up. A few holes in the periphery of the cell will permit the escape of any moisture which may happen to condense on the inner faces of the lenses.

It will be found a good plan to provide the collar of each stage-plate with a bayonet slot, for the purpose of holding the condensers more securely. To do this, file an L-shaped slot in the upper edge of the collar, and then insert the condenser, and mark the position for a small cheese-headed screw, which is then screwed into a hole, drilled

and tapped for its reception, in the cell of the condenser. If the latter is now pushed into the collar, with the screw-head passing through the longer arm of the L-shaped slot, a slight turn to the right or the left will serve to secure it in position.

Although it is necessary to employ good condensers, it is of still greater importance to have first-class objectives, as the latter may truly be said to be one of the most important parts of the entire lantern, as the brilliancy of the pictures is, to a great extent, dependent upon the quality of the objective. The best form of lens for lantern use is, without doubt, the ordinary portrait combination of the photographer, which consists of a double convex and a plano-concave lens, ground in such a manner that the convex side of one lens can be fitted and cemented into the concave side of the other by means of Canada balsam, the front combination being a pair of similar lenses mounted together, with a slight air space between. A good lens of this form, while being achromatic, will possess sufficient depth of definition and flatness of field to be capable of giving very brilliant pictures on the screen.

An operator who is desirous of combining lantern with photographic work will find ordinary half-plate photographic combinations answer his purpose very well; but, on the other hand, the same person will do well to bear in mind that a lens made specially for lantern work is not always suitable for photographic use, as the visual and chemical foci are not coincident.

The better class of lantern objectives are now provided with several extra lenses of varying foci, mounted in brass cells, all of which fit into the same mount, and thus enable the operator to speedily effect a change of lenses, according to his requirements. By means of this arrangement, the exhibitor, after having erected his lantern in the most suitable position, can immediately show a six-foot or eighteen-foot disc by the aid of these interchangeable objectives, as they each have a different focus, and thus enable the operator, by a suitable selection, to obtain a larger or smaller disc, as desired, without altering the position of the lantern. It is also usual to fit the best lantern objectives with sliding shutters, or "flashers," as they are more generally called. These flashers are formed of hinged brass discs, which are permanent fixtures to the front of the lens mount, and replace the old-fashioned lens cap. By means of a rapid turn the flasher may be made to revolve, and instantaneously disclose the fresh picture, thus producing a very good effect with some slides. Fig 37 represents a lantern lens fitted with a flasher.

Briefly stated, the limelight is produced by allowing a couple of streams of oxygen and hydrogen gases (either separate or combined) to impinge upon a cylinder of unslaked lime, which is thereby rendered incandescent, and capable of emitting a most powerful white light whilst in this condition, the only requisites for the production of the light being the two gases and a cylinder of lime. The oxygen gas is made by heating a mixture composed of chlorate of potash and black oxide of manganese in a metal retort over an ordinary fire, the ingredients being mixed together in the proportion of two pounds of chlorate to half a pound of manganese. It may here be stated that the above quantity should be sufficient to produce about ten feet of gas, which will keep a blow-through jet alight for about a couple of hours. The chlorate of potash should always be of good quality, and obtained from a firm of repute, in order that it may be entirely free from all ignitable foreign matter whatsoever. The oxygen retort into which the mixture should now be put is usually made of iron or copper, in the form of a cone, as shown in Fig. 38, having a projecting pipe at the top or apex of the cone, for the purpose of carrying off the gas as generated, this pipe being connected by means of a piece of flexible tubing with a wash bottle (Woulff's bottle), containing water. This wash bottle is used for the purpose of cooling and purifying the gas, which is then conveyed, by means of tubing, from the bottle to the gas-bag. The retort, when charged with the mixture as above directed, is located over a good fire, or, better still, a Bunsen gas burner. When the gas is being given off pretty freely, it will be seen bubbling through the water in the wash bottle, and after having first allowed it to run to waste for a few minutes, the bottle should be connected with the gas-bag by means of another piece of flexible tubing. Before making the connection between the purifier and the bag, it will be necessary to flatten out the latter in all directions, in order to expel any air it may contain. Gas-bags are made of mackintosh-cloth in the form of a wedge of varying size, according to the quantity of gas they are intended to hold, and a small brass tap is fixed in the middle of the apex of the wedge, to afford an inlet and outlet for the gas. When two gas-bags are used, one for each gas, it is usual to paint a conspicuous O and H on the side of them, for the purpose of distinguishing the hydrogen from the oxygen. As oxygen does not keep well in a bag, it will be found advisable to make the gas a few hours previous to the entertainment, carefully emptying the bag afterwards.

Although pure hydrogen is always preferable to the coal-gas of the household supply (carburetted hydrogen), yet the lantern operator is generally glad to put up with the latter by the simple expedient of making a connection between the jet and the nearest gas bracket. Hydrogen gas can, however, be very readily made by the action of dilute sulphuric acid upon scrap zinc. For this purpose a large glass bottle is furnished with a good sound cork, to which is fitted a glass safety funnel and a delivery tube. The bottle is now half filled with dilute sulphuric acid and water, in the proportion of six of water to one of acid, which is poured down the safety funnel on to a quantity of clean scrap zinc cuttings lying about an inch deep at the bottom of the bottle, the latter being afterwards connected with a purifier and gas-bag, the same as before. The bags, when filled in the above manner, will be ready for immediate use, and as the gas needs to be forced through the jet under great pressure, the bag or bags should be placed between a single or double pressure board, on the top of which one or two heavy iron weights may be placed, for the purpose of obtaining the required pressure.

In using a blow-through jet and the ordinary coal-gas of the house supply, the pressure on the gas main will generally be found sufficient, and the gas may be drawn direct from the nearest gas bracket by means of a piece of flexible tubing attached to the jet; but with the mixed jet it will be advisable to fill a gas-bag from the main, and use it under pressure between double pressure boards, together with the oxygen bag, one set of weights furnishing the requisite amount of pressure for the two bags, as above stated. One hundredweight is the usual weight placed upon the bags, and although the pressure may be increased, if necessary, while the jet is burning, it is inadvisable to take off any of the weights without first turning off the jet tap, as it might cause the flame to be drawn into the bags, and thus lead to disastrous results.

Oxygen gas is now obtainable commercially at a very cheap rate, compressed into portable steel cylinders. These cylinders, when filled with gas, can be kept for any length of time, and used as required, no weights, pressure boards, or bags being needed. Although with careful use the valve or tap of a cylinder may be gently turned on and the gas used direct, this course is not to be recommended, as the gas, being under a considerable pressure, is apt to come with a sudden rush and blow out the jet. And then, again, when the bottle has been partially emptied and the pressure thereby reduced, it will be necessary to frequently open the valve more and more, otherwise the light of the jet will be found to diminish; hence the desirability of some means of regulating the outflow of the gas, and thus ensuring an even pressure until the cylinder is exhausted. This want is supplied by the use of an automatic regulator, which takes the form of a miniature bellows enclosed in a metal box, and capable of being screwed on to the delivery tube of the cylinder. Upon the valve of the cylinder being opened, it causes the bellows to fill with gas, and when filled, an archimedean screw automatically closes the orifice of the gas inlet tube until the bellows are emptied, when the inlet is again opened and the same action repeated. The regulator, in reality, performs the part of a miniature gas-bag, from which the jets of the lantern are supplied direct.

With regard to the selection of a suitable jet, it will be advisable to describe two different kinds, and leave it to the reader to select the one most suitable to his requirements. The blow-through or safety jet (which is so called on account of its being easily managed by the inexperienced beginner) is the simplest form of jet that can be used for a triple lantern. In construction, this jet consists of a couple of metal tubes, one for the oxygen and the other for the hydrogen, placed parallel to each other, with the mouth of the hydrogen tube in a vertical position, and the extremity of the oxygen tube bent over in such a manner that the gas from the latter is driven through the hydrogen flame on to the lime cylinder, supported upon an adjustable pin behind. The best make of jets are fitted with a lime turner, which takes the form of an extended handle placed parallel with the gas delivery tubes, a cog-wheel arrangement near the mouth of the jet furnishing the requisite motion for turning, raising, or lowering the lime. A cheap reliable jet, which is known to opticians as the "Optimus" blow-through jet, is shown in Fig. 39.

The general construction of the mixed jet is somewhat similar to the above, with the exception of the burner, which is provided with a single delivery tube curved in a suitable position to direct the gases full upon the lime. The two gases are conveyed by separate tubes until they arrive at a small chamber at the base of the burner, when they become mixed, and are directed upon the lime in this condition, the mixture of the gases considerably enhancing the power of the light. Fig. 40 shows a very useful form of this jet, which is interchangeable, enabling the operator to remove the single delivery tube of the burner and

substitute the double tubes shown at A, thus turning it into a safety jet.

This jet will be found very useful for exhibitors who prefer to use the blow-through jet for ordinary purposes, and may occasionally desire the more powerful light of the mixed jet.

Although it may be said that any form of jet is quite safe if carefully used, yet the blow-through is undoubtedly the best for the use of the amateur or beginner, as, besides its simplicity, it only requires the use of one bag or cylinder of gas—namely, the oxygen, as the hydrogen can be drawn direct from the nearest gas bracket. The principal danger arising from the use of the mixed jet is due to the fact that the mixed gases are of a highly explosive nature, and should the pressure upon the bags be inadvertently withdrawn for a moment, it would have the effect of drawing the flame into the bag, thus causing an explosion of a more or less serious nature.

Suitable jets having been provided, they must now be fitted to the lantern by means of a metal tray, which is furnished with an upright stem at one end, the socket of the jet being intended to fit over this stem of the tray, to which it is secured at any desired height by means of a small milled screw which grips the stem. There will be no occasion for the operator to buy these trays, as they will not be very difficult to make. Fig. 41 represents one of these trays, of which we shall require three, each one being separately fitted to slide along the grooves of one of the jet shelves of the lantern. The simplest plan to adopt in making these trays will be to cut a piece of moderately thin sheet brass to the form of Fig. 42, and then bend and hammer the metal into shape along the dotted lines, afterwards hard-soldering together the four corners of the turned-up sides. For each tray a sheet of brass, 9 in. by $7\frac{1}{2}$ in., should be cut according to the plan and measurement shown in Fig. 42. First mark out the inner rectangle, measuring 6 in. by 4 in., to form the floor of the tray, then draw lines parallel to the length of this to form the two sides, dividing each of them into three $\frac{3}{8}$ in. and two $\frac{1}{4}$ in. portions, as will be seen in the cut. The back of the tray, which is the full width of the floor, measures 1 in. in the middle, with $\frac{3}{8}$ in. on either side; and the front end, which is also the width of the floor, is to be divided along the centre into two $\frac{3}{8}$ in. portions. When cut to the required form, the metal must be sharply bent along all the dotted lines by being carefully hammered over the edge of a stake until it presents the lengthwise and cross sections of Fig. 42, after which the four corners are hard-soldered together in the usual manner. For the supporting rod of the jet a 5 in. length of $\frac{1}{4}$ in. round brass rod may be soldered into a hole punched through the raised shelf at the back of the tray, and a small handle can be readily formed by turning up a short length of brass wire into the form of a triangle, and then springing it into a $\frac{1}{2}$ in. length of tubing of suitable size, which should be soldered to the back of the tray. During construction, each tray must, of course, be occasionally tried in the grooves of its respective shelf, in order that it may be made to move quite smooth, without any jerky motion. The limes required for lantern purposes are cylindrically turned pieces of unslaked lime, each one being pierced with a hole, which enables it to be placed upon the lime-pin of the jet. As moisture or damp spoils the limes, it is necessary to keep them in a tightly corked bottle.

In use, it is requisite to occasionally turn the lime as it becomes pitted by the action of the jet, and in order to do this readily it will be found a great boon to have the jet fitted with a lime-turner, as illustrated in Figs. 39 and 40. The most reliable limes in the market appear to be the "Excelsior," as this make seems to be uniformly good.

The dissolving effect of the modern lime-light lantern is now produced by means of a specially constructed tap or dissolver, by the use of which either of the lights may be raised or lowered according to requirements, by simply turning the handle of the dissolver, this action serving to cut off the gas from one jet at the same time that it turns it on full to the other. A triple dissolver is naturally a rather expensive appliance, by reason of the complicated arrangement of tubes required, the "Optimus" triple dissolver, at 38s. (see Fig. 43), being one of the cheapest at present sold. It is by no means absolutely indispensable that a triple dissolver should be used, as very good results can be got by the employment of a six-way tap attached to the twin instrument, and a four-way tap to the top lantern.

As a triple lantern is a somewhat heavy instrument to lift, it is usual to provide a couple of brass rails or handles, which are screwed one on either side of the woodwork, at the upper portion of the twin lantern. Some operators screen the light emitted from the jets by having a black velvet curtain hung by means of rings from a brass hoop, which is fitted into a couple of small sockets screwed one on either side of the back of the lantern body. Fig. 44 is a section of the lantern, showing clearly the arrangement of the interior.

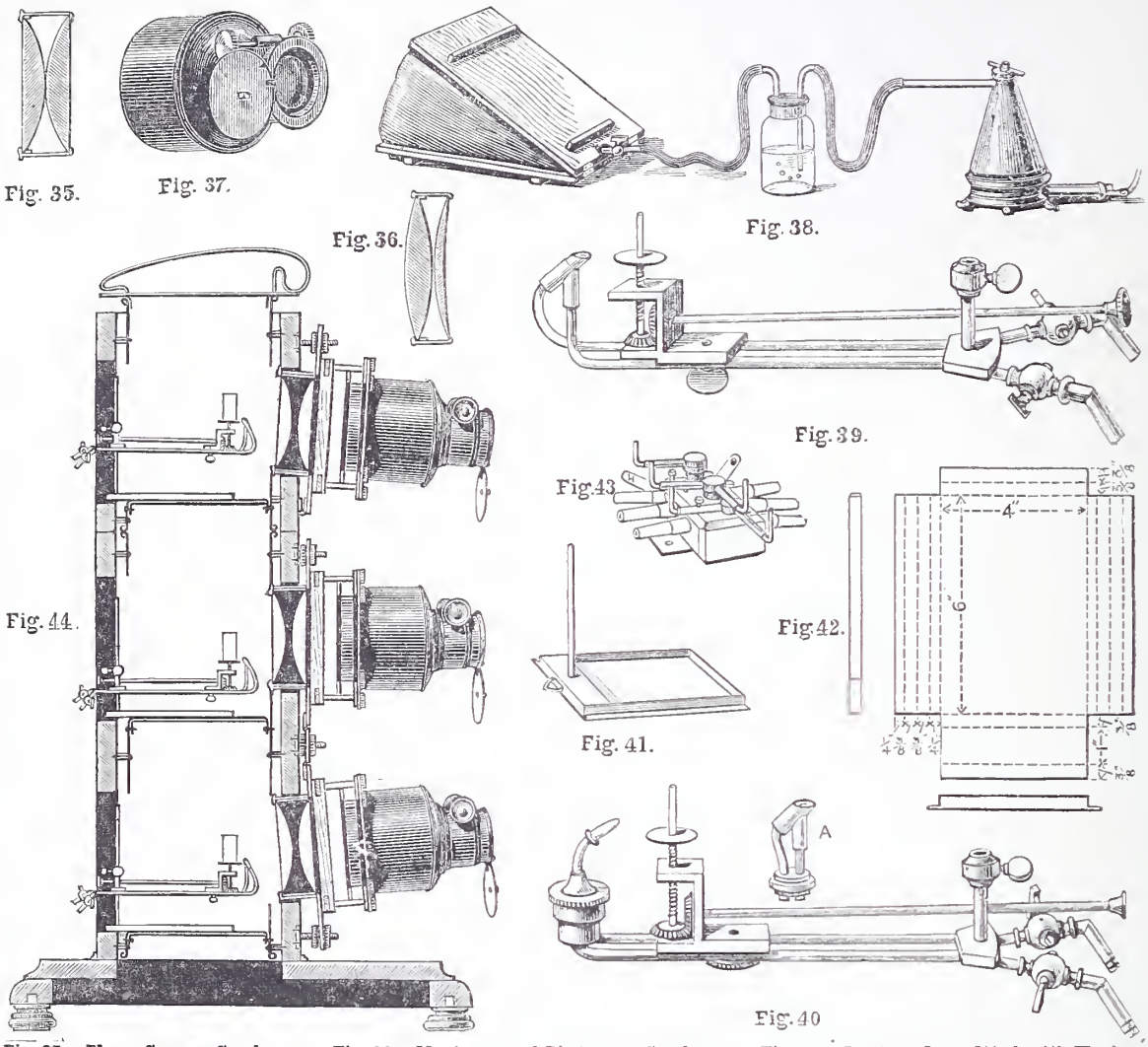


Fig. 35.—Plano-Convex Condenser. Fig. 36.—Meniscus and Bi-Convex Condenser. Fig. 37.—Lantern Lens fitted with Flasher. Fig. 38.—Arrangement of Retort, Purifier, and Gas-Bag. Fig. 39.—"Optimus" Blow-through Jet. Fig. 40.—"Optimus" Interchangeable Jet. Fig. 41.—Jet Tray. Fig. 42.—Plan and Section of ditto. Fig. 43.—Triple Dissolver. Fig. 44.—Section of Triple Lantern, showing Internal Fittings and Arrangement.

When quite ready to light up, a sufficient length of rubber tubing should be brought from the hydrogen bag or the nearest gas bracket, and connected with the hydrogen tube of the dissolver, the latter being connected by shorter lengths of tubing with the respective jets. A lime may now be slipped on to the lime-pins, and the hydrogen side of all the jets lighted up a little, with the dissolver taps placed so that a small flame is burned in each lantern, in order to gradually "warm up." Another piece of tubing is now brought from the oxygen bag or bottle, and is attached to the oxygen tube of the dissolver, care being taken to tie all the rubber tubes on to the connections with string. The taps may now be gradually turned on to their full extent—the hydrogen first, and then the oxygen—and as soon as they are all burning properly it will be necessary to see that the bye-presses for the oxygen act all right when the dissolver is turned off. When the jets are found to be working satisfactorily it will be time to see and adjust the light upon the screen, moving the jets up and down and from side to side until each disc is seen to be equally illuminated all over, the three discs being finally made to register correctly on the screen by means of the set-screws attached to the stage-plates. The above description of the working of the lantern is necessarily brief, and those who desire further information should consult one of the many excellent manuals on the management of the optical lantern. A very useful little booklet, containing a vast fund of information on lantern matters, is published by Messrs. Perken, Son and Rayment, of Hatton Garden, London, at the low price of 6d.

For home use, where portability is not an object, it will be found useful to have a paper screen mounted on a roller, similar to a map, a screen of this description presenting a much smoother and whiter surface than it is possible to obtain by the use of linen. When, however, it is requisite to employ a screen which will pack into a very small compass, it is better to have one made of a material known to lanternists as "union cloth." The screen can generally be suspended from a cord stretched across the room in which the exhibition takes place by means of a couple of steel eyes or staples; or, better still, it can be hung against the wall from a picture rod. In either case, however, a cord should be attached to each of the lower corners for the purpose of steadying it. The majority of operators prefer to have the screen mounted on an iron or wooden stand by itself, which can readily be carried about from place to place, and may be speedily erected or taken down without disturbing any of the surroundings.

In conclusion, the writer may add that any reader wishing for further information upon any matter relating to the lantern can rely upon his assistance through the medium of "Shop."

CLOCK CLEANING AND REPAIRING.

BY A PRACTICAL HAND.

MUSICAL CLOCK—CLOCK SHOWING TIMES OF ALL NATIONS—CHIMING CLOCK.

Musical Clock.—To make, say, a long case eight-day clock, purchase the works of a large musical-box whose case is destroyed; if it works a little out of order, repair it, (for instructions, see Vol. II., page 23), and then screw it to side of clock below movement, clear of pendulum. Solder on to the hour axle—say at 9, 12, 3, and 6 o'clock—four wires to just raise a small lever you attach with screw to one of the clock plates, and from it have a wire which will draw away from the fan of musical-box; it will then play one tune through and change every time if you leave the change part set. At the next three hours period it will play again, and so on till ten or twelve tunes have been gone through, when you re-wind the box or leave it silent, as you desire. You can do the same with a small musical-box and small clock.

Clock Showing Times of all Nations.—A timepiece showing times of all nations is made thus: Fix in centre a dial of large size, with room for, say, six or eight smaller dials around. You now only require broken movements, with dial wheels placed at equal distances from centre stud, which have all to turn on this barrel; inside affix a large-sized wheel with small teeth, so as to turn the other six or eight dial wheels on the front dial; make the smaller ones with hands to fit, and set them according to the tables thus: New York five hours behind

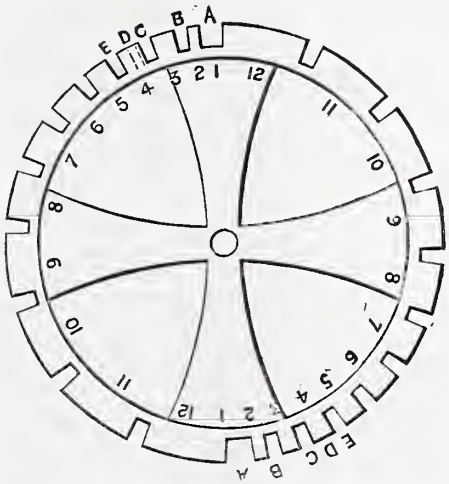


Fig. 1.—Count Wheel for Chiming Clock.

Greenwich time, shown by the centre large one, etc. They will all turn correctly, and at a glance show to the most ignorant the times of the places chosen.

Chiming Clock.—I will now describe a chiming clock I made, similar to those that may be seen in London and some of our great cities—it chimes on the two bells, and strikes the hours on the large ordinary one. This is a figure of Father Time striking the large bell, and two sailor boys the smaller ones. The quarters are more easily distinguished than those at Westminster or Cambridge by their simplicity. Any reader with a little mechanical skill can fit one up to an ordinary clock. Procure an old eight-day American spring clock movement—there are lots at the marine stores for 1s. or so; generally the pallet and pendulum are gone, but these are not required. Take the clock to pieces, and if the striking part is complete, you have only to alter it. Put the two plates together, and about ½ in. from the holes where the hammer works, drill a hole through both plates for a second hammer, and make one like it, but with a longer arm, say 1½ in. longer; cut the lifting part a shade longer, so that as the original hammer drops the other is lifting. Now put the hammers in, and striking wheel and stop wheel; try with your finger if they drop one after the other—if so, that is as it should be. Now procure two bells or two gongs—as you may prefer; try the tones heavy and light, then so place them and screw to case that the last falling hammer hits the heavy tone; you can bend the wire arms any way to hit the bells right. Now take the minute wheel of your other clock, with the small lever to lift striking part at each hour; solder on or drill three similar levers one-fourth the way round axle, but behind the one that strikes the hour, at equal distances from the one already on; the reason of placing the three behind being that they may not interfere with the ordinary hour lever. They will lift at quarter past, half past, and three-quarters past the hour, but the unoccupied fourth of axle having no lever will not chime: this will be at the hour, and its own hour lever will act. It is not necessary to chime then and strike: you can make it do so, but it will be more trouble to make the count wheel act. Now take the count wheel of the extra works for chiming, and solder pieces on, and cut fresh notches as required. The spaces A, B, C require nothing; next cut out D with C the same width as A; leave a part uncut the same size as that betwixt A and B. Now solder up the other open spaces half-way round until you come to A, B, C again, then repeat what you have done in the first half. Now mark out openings and standing pieces A, B, C until you come at A, B, C again, and you will find them fit, so the finish will be just where you commenced. To be more certain that you have cut them right, place wheel in frame, and the counting lever and the striking wheel; now, if you make it strike as you go along the cutting, you have not done wrong. After first chime A, B, C is right, cut extra piece out at D so that it will strike one; leave piece standing to strike one again, and the other one to make two, or the half-hour chime will be struck as the lever falls into E; repeat all round the inside figures at which it used to strike. Now put your bells on the board on which you have fixed the works, and let it chime all round; thus it will do twenty-four quarters before wheel goes once round. Now arrange a lever wire inside the ordinary clock-case in which you will fix the chiming, so that it will lift your chiming stop lever as the going part did when the works were perfect—I refer to those you have altered; it is somewhat troublesome, but it is worth while, especially at so trifling a cost. Full chimes are very costly; but the above is inexpensive, and will suit an amateur well.

Cleaning Dials.—Some may have an old clock or barometer with a shabby dial, which may be re-silvered and lacquered thus:—Unscrew the four ornaments at the corners, then polish them with emery (fine quality), and next apply brass polish sold in tin boxes; now clean it off, using dry rotten-stone very fine and a clean wash-leather; next, without soiling surface, place it upon a stove, so that you can scarcely handle it for heat, then apply best quality lacquer with good camel's-hair brush; lay it on in straight strokes, as it dries very quickly; but you will soon get into the way.

Now clean the corner pieces by placing in nitric acid of the strength of one part acid and three water. Leave it in this bath two hours, then wash it in clean water; scour with stiff brush, sand, and water; now rinse well in clear water. Next take pure nitric acid, dip the corner pieces into this and out again at once, wash again, and dry in hot sawdust (fine); now lacquer as before, heating first. The following is a recipe for pure lacquer:—One gill of rectified spirits, half an ounce of turmeric powder, one drachm of arnotto, and one drachm of saffron; let

these stand ten days in a warm place, shake every day or so until all is finally dissolved, then filter through muslin into a clean bottle; in doing this the greatest care is required, as the least dirt shows. Add now one and a half ounces of seed lac, and again leave the mixture ten days, shaking as before; let it settle now, and it is ready for use.

Re-silvering Dials.—To silver clock and barometer dials, take nitrate of silver 25 grains, cream of tartar 30 grains, common salt ½ oz.; mix thoroughly. Now mix a part of this powder with distilled water. Having cleaned the dial well as before stated, take a good-sized cork covered with lint, and apply the mixture; when well covered, gently polish with clean lint, and protect with a coat of crystal varnish. If you desire to make the varnish, take pickled mastic 1 oz., rectified spirits 5 oz., animal charcoal ¼ oz.; digest and filter, well shaking the bottle.

OPENING OF THE "WORK" EXHIBITION.

THE following verbatim report of the proceedings at the opening of the "Work" Exhibition on December 29, 1890, at 2 p.m., in the large Hall of the Polytechnic Institute, Regent Street, London, W., by the Rt. Hon. Sir John Lubbock, Bart., M.P., is given to meet the wishes of many readers of WORK in town and country who were not able to be present at the ceremony. Sir John Lubbock was accompanied by Lady Lubbock, and among those present on the platform were Sir Lyon Playfair, M.P., Sir Philip Magnus, Mr. Wemyss Reid, Mr. H. O. Arnold-Forster, Mr. Francis Young, Editor of Work, Mr. R. Mitchell and Mr. J. E. K. Studd, of the Polytechnic Institute, etc., etc.

SIR JOHN LUBBOCK, in addressing the assemblage, said:—Mr. Arnold-Forster, Ladies and Gentlemen,—I think I may very fairly congratulate you on the interesting Exhibition which it is now my privilege to open. We owe it mainly to the energy and enterprise of Messrs. Cassell & Company, to whom we are indebted in so many ways. I believe that the happy thought rests with the Editor of WORK, and for the satisfactory condition to which the Exhibition has been brought we are, of course, indebted to Mr. Harland, who has been good enough to act as secretary to the Exhibition. You will see it is one of very great variety. I have made a little list of some few of the things which are to be seen in the rooms. The exhibits amount to more than a thousand, and of course I shall only mention a few of them. In woodwork, which constitutes a very large part of the Exhibition, there are cabinets, screens, brackets, frames, panels, candlesticks, tables—in fact, furniture of all kinds. Then in metal-work—another very important branch—there are arms, guns, swords, and a great variety of tools—planes, saws, centre-bits, lathes, photographic cameras, galvanometers, induction coils, and steam engines. In another branch, no less important, are designs for stained glass, tiles, panels, fire-escapes, iron gates, dynamo engines, automatic signals, and gas engines. Again, there are to be seen specimens of lithography, printing, bookbinding, wood engraving, maps, a quantity of needlework, a great variety of articles of dress, terra-cotta vases, flower stands, and pottery; a number of exhibits of leather work; and a great variety of miscellaneous objects, including bird cages, aviaries, boats, bats, telephones, jewellery, musical instruments, besides a number of domestic appliances for economising labour and minimising danger, as, for instance, by the provision of self-extinguishing and non-explosive paraffin lamps. The exhibitors come from all parts of the country, including several from my old constituency of Maidstone. The competitors, I am glad to see, moreover, come not from England only, but from Scotland and Ireland, and from our colonies, even distant colonies like the Cape, and also from foreign countries. The exhibitors are men and women, old and young, some being boys and girls as young as twelve and fourteen years of age, and one (Jackson) is an old man of eighty-nine, who exhibits a ship and shows how to sail it. Rich and poor are among the exhibitors. Mr. Twist, an unskilled labourer at the Docks, exhibits a beautiful Smyrna rug from his own design; and Mr. Collins, a moulder, shows a pianoforte entirely of his own construction. For the first time, I am informed, in adjudging prizes, a distinction has been made between the exhibits of persons who are especially engaged in the production of articles of which they send specimens, of masters and journeymen, and the exhibits of the second class, for apprentices, and of the third class, for amateurs; so that amateurs will not have to compete with those who make such work the business of their lives. In this Exhibition amateurs predominate, and even skilled workmen exhibit in lines different from those in which they are primarily engaged. Perhaps this is the greatest collection of hobbies that has ever been seen, not that I would say anything against hobbies, which add so much to the interest of life. While we cannot hope to emulate the achievements of some of the exhibitors, yet the objects made by amateurs are such as anyone of us, with time and application, might hope to produce. The large number of exhibits sent by English workmen is a very satisfactory feature of the Exhibition. No workmen in the world are more anxious to improve themselves than our English workmen. It is some satisfaction that most of the strikes of the present day are not so much for increased wages as for increased leisure in which to effect self-improvement. I have always been of opinion that our system of education is too bookish, and that it might be much improved by more attention and more time being devoted to manual instruction, not only in our elementary schools, but in the great public colleges, and even in the universities. But at the same time, I am not one of those who are afraid of education upon that account; and I think that anyone who had the impression that education had tended to prevent people from using their hands, would have his fears considerably mitigated by going carefully through the different departments of this Exhibition. It is, no doubt, a very great mistake to suppose that clerical work is necessarily of a higher order than hand work. We do not, indeed, apply this test to painters or sculptors, and why, therefore, should we apply it to other walks of life? We all remember the story of Northcote the painter when he was asked how he mixed his colours—"With brains, sir, with brains." And such work as we see here is in reality brain work as much as, and even more than, hand work. It is, I am sure, a great evidence of thought having been devoted to the objects which have been produced. A very charming writer, whom we have unfortunately lost (Mr. Jeffries), very truly says, in one of his books: "If anybody imagine they shall find thought in many books, certainly they will be disappointed. Thought dwells by the stream and sea, by the hill and the woodland, in the sunshine and free wind;" and he might have added that thought is also to be found in the workshop.

Those who are exhibiting here, will have found that the production of the articles they have sent has been a great pleasure and advantage. The boy or man who makes something for himself finds that he must think and exercise his reason. He is brought in contact with the forces of Nature, and he is compelled, in order to apply and control those forces, to devote some thought and study to the laws of Nature; and from thence he is almost irresistibly led up to the phenomena of mind. The greatest literary authorities have always cordially recognised this.

"Man," said Carlyle, "is a tool-using animal. He can use tools, can devise tools; with them the granite mountains melt into light dust before him; he kneads iron as if it were soft paste; seas are his smooth highway, winds and fire his unwearying steeds; without tools he is nothing, with tools he is everything." But besides the advantage to the exhibitors themselves, we hope and believe that such exhibitions as this tend to develop and promote our commerce, and especially our manufactures. Who can tell what discoveries are awaiting us? One of our great statesmen said, the other day, that we could not hope in the next half century to see discoveries as marvellous and as far-reaching as those made in the last fifty years. But I should venture very humbly to differ entirely with him in that respect. As we widen the circle of knowledge, the chances and the prospects of discoveries become greater and greater. And, on the other hand, those who have been trained to take advantage of their opportunities are also far more numerous than they were fifty years ago. I for one, therefore, should be disposed to hope that, so far from the next fifty years being less fruitful of discoveries than the past half century, the very opposite will be the result.

And how very simple many of the most far-reaching discoveries really are! Just look, for instance, at the inventions of Sir Henry Bessemer. The saving to mankind from Sir Henry Bessemer's discoveries in the manufacture of steel sounds almost fabulous. Steel rails have, to a great extent, taken the place of iron rails, and the former are said to last twenty times as long as the latter. Yet what was his invention? It consisted mainly in blowing air through crude melted iron for a quarter of an hour. Look again at coal mining. Formerly, the coal was carried up a ladder; then it was taken to the fireplace of the manufacturer in a basket on a man's back. Then occurred the use of pack horses, then the use of the cart, then the use of rails with horse power, and then the use of steam. With the basket, a man carried a half hundredweight; the pack horse three hundredweight; the cart sixteen hundredweight; the rails and horse-power, forty hundredweight; and steam, forty tons. Just see what enormous progress there is, and yet how very simple each step is. In fact, everyone of us may hope to add something to the store of human knowledge. There is no single substance in Nature of which all the properties are yet known to us, and we do not make half the use we might of the forces of

ature. But we continue to make progress. hear that a Scotch firm have taken the olcano of Stromboli, which they have ented for the purpose of using it as a natural hemical laboratory. In this Exhibition here are many ingenious suggestions, and I annot doubt that many of them will prove seful and fruitful in the future. It is onderful to think what our machines lready do. It has been calculated that the nachines of this country alone, of this island, o small a part of the world, are capable f doing as much work as the whole human ace put together. In fact, Emerson has ery justly said that, as far as he could see, 'steam is really half an Englishman." It is ot so contradictory as might at first ppear, to apply the word "manufactures" o things made by machinery, because the and is, after all, the finest and most elicate machine in the world. And even n things which, so to speak, are made by nachinery, the hand, after all, has no small part. To do anything well, hand, mind, and machine must all work harmoniously together, and both in this respect, and in the intelligence and character required, we shall, I feel satisfied, come to appreciate more and more the dignity and usefulness of manual labour. It is because I believe this Exhibition is calculated to take us a step onward, and in the right direction, that I have very great pleasure in tendering, as I think I may do in your name, our thanks to those who have taken the most active part in its preparation, and in now declaring this Exhibition duly opened.

MR. ARNOLD-FORSTER : — Ladies and Gentlemen, — As a representative of the Company which has had the privilege of organising this Exhibition, I think you will agree with me in the vote which I intend to propose. I have no hesitation in saying that you will all agree with me in feeling that the compliment which has been paid to the organisers, and to those who have taken part in this Exhibition, or to those who have shown their interest in its objects, by the presence of the Chairman of the London County Council and President of the London Chamber of Commerce, is no ordinary compliment; and, if that boon could be increased, it has been increased by the speech which Sir John Lubbock has just made to us. Speaking on behalf of Messrs. Cassell & Company, I may say that we feel grateful for the compliment which Sir John Lubbock has paid us. We are, of course, like a great many other manufacturing institutions, a manufactory established for the purpose of stereotyping and recording the thoughts of people wiser than ourselves, and distributing them throughout the world. But I can safely say —speaking as one who has taken some part in this business—that this is a side to our business which is not common to other great manufactories. Compare it, for instance, with the manufactories which turn out so many thousands of bushels of tin tacks, or so many thousands of yards of linen sheeting, and you will find that it is replete with ever-varying and intense interest; and it is of great value to all of us who are engaged in it to feel there are men taking a leading part in the scientific, political, and municipal work of this country who recognise that we are endeavouring to do our best to carry on what has for a long time been the original tradition of our House—that of bringing the best works within the means of the largest number of people in this country. It is a gratification we do not often get in our trade, to be allowed to come face to face with the people whom we serve. Therefore, I look upon this occasion as rather a special one, and as giving us—me and those with me engaged in the actual work — an opportunity — which we are pleased and proud to possess—of meeting face to face a very large number of those whom we are able to provide with material for the informing of their minds. I hope I may be permitted to ask a very well-known and very distinguished friend, who is on the platform, to say a word or two in seconding the resolution which I now propose, of a cordial vote of thanks to Sir John Lubbock for the part he has taken here this afternoon. I ask Sir Lyon Playfair to address to the meeting a few observations in seconding the resolution.

SIR LYON PLAYFAIR, M.P. :—Ladies and Gentlemen,—All those of you who have read Messrs. Cassell's interesting periodical, WORK, will agree that it was a very happy idea to enable the encyclopædic contributors to that publication to show what they can do with their own hands. It is a periodical embracing a marvellous number of subjects, and giving a most accurate and full description of the matters with which it deals, and it is one to which I have often had occasion to refer. My right hon. friend, Sir John Lubbock, quoted an interesting passage from Carlyle. Now, Carlyle was a mental philosopher, but he was not an industrial man, or I do not think he would have used the definition that the characteristic which distinguished man from all other animals lay in his being a tool-using animal. The fact is that man is very singularly deficient in naturally born tools. If you look at the lower animals you will see they are often born into the world provided with the most admirable tools for the work they have to perform. The spider is the best of all weavers, and has admirable tools within itself for performing that work. The beaver is a capital engineer, and makes bridges, and the tools which it possesses are admirably calculated for the work it has to perform. The great friends of my right hon. friend, the ants, which build their cells and their store-houses, and show such a wonderful sagacity in the work that they are destined to perform, have admirable tools to work with. So have the bees, which have also received the attention of my right hon. friend. The bees are also capitally fitted with tools for their purposes. The tailor bird can sew; the silkworm can spin; the mole can make tunnels, all with appropriate tools. But only consider what a position man is in. Man is born into the world in such a way that the other animals that work with tools would, if associated with him, look upon him with the greatest contempt. Only think of a new-born baby! If you got together an inquest of the other animals upon that new-born baby, and they found that it was not even protected with the covering of the crust-shell, like the lobster, or like other animals of earth and air, with furs and feathers, they would decide at once that it was a miserable little thing, that it had no business in the world at all, and that it was not fitted for the struggle of life. But though he is as naked as the earthworm, he has an intellect far above all animals. How is it that an animal, possessing none of the tools necessary for work, comes to be such a great tool-using animal as it ultimately becomes? It is not the tools which teach him to work. It is the brain and intellectual development of man which enable him to perform the work that is necessary for his existence, sustenance, and propagation through the world. I used to define man as a fire-using animal, for no savage has been found in so low a state that he did not know how to make and continue a fire. But I begin to doubt —not very much to doubt—whether it is a good definition now. The definition is that man is distinct from all other animals by being a fire-using animal. You never find any other animals using fire. You may find monkeys surrounding and warming themselves at a fire made by man, and one of them, perhaps, running away with a burning brand, but you will never find it apply the brand to dried leaves or to woods in order to propagate the fire—unless we are to believe the astonishing, and, to me, incredible, statement of Emin Pasha, that he found chimpanzees making long processions in the woods, and lighting their way with torches. I have great respect for Emin Pasha, and what he has done, but I want verification of that statement. Even if it is true, it is the only instance where a lower animal has used fire in any history which we possess. It is the brain of the man which enables him to use fire and to apply it to industrial purposes. There is one thing in which we have gone back very much in industrial art, and that is—that the great division of labour has prevented men from getting an intelligent and intellectual knowledge of their work. Formerly, men were apprentices to the whole trade. The ancient guilds, which abound so much in London, used to exist in other parts of the country, and they were really universities for giving technical education. In the old charters of the guilds, the only word which is used in defining them as an institution was that they were founded as a *universitas* —as a university. They were really a university of technical education. The apprentice was taught his whole trade. He was, by his connection with guilds, made ambitious with regard to his trade. He wished to become a good workman, and under the rules of the guild he required a technical knowledge of the industry in which he was to work. Even with that knowledge of his entire trade he was not made a full workman. Afterwards he had to become what is a mere name now, but was then a reality —a journeyman. That is to say, he was obliged to make journeys all over the kingdom, and to work with his own hands in different parts of the country, seeing the different kinds of industry to be found therein—when I was a student in Germany, many years ago, I used to meet these "journeymen" on the roads and talked with them about their training—and then, having finished his time as a journeyman, he became a real workman. Now all this is lost to us. The division of a trade has become so great that a man may be engaged in one department of it his whole life. Suppose he is in the pin-making trade: he does not know how to make a pin. He may be engaged his whole life in pointing the pins, or in putting on the heads, or in drawing out the wire for the body of the pin, but he never makes the whole pin. So in other industries. He does not acquire an intelligent knowledge of the art or industry in which he is working. And what is the meaning of this Polytechnic Institution with which now I have the honour to be officially connected? What is the meaning of all the classes? Why do regular tailors come here to learn tailoring? Why do you get watchmakers here to learn watchmaking? You have bricklayers coming here to learn the

art of bricklaying and the use of ornamental bricks. Why do they come here? They come here because they want to improve their intellectual position as workmen by having an intelligent knowledge of the industry in which they are engaged. That adds to their dignity as men and to their efficiency as workmen. They do not want to be confined to a mere corner of their industry. Industries are continually altering. Some day a method will be found of doing by machinery the work in which they are engaged, and if they do not know the whole of the industry, and are unable to adapt themselves to the altered conditions, they will be thrown out of employment; but if they possess that knowledge, they will be in a position to adapt themselves to the new circumstances. For instance, take the case mentioned by Sir John Lubbock just now—that of Bessemer steel. By this process thousands and thousands of men were thrown out of the old occupations of puddling iron, because iron does not now require puddling to make steel. If men know their particular industry in an intelligent way, they can apply themselves easily to new modifications which may be made. That leads me to what is desirable in an exhibition of this kind, and why I came here—not to speak, for I did not know I was to speak when I came on to this platform. Why I came here is—that I meant to recognise the fact that an exhibition of this kind shows to us the just pride of men who exhibit to us specimens of their best work. It also leads to the public recognition of that work, and encourages workmen to entertain honest pride in their handicraft, to understand that craft, and to use the best efforts of their brain in improving it. Every man that produces a good piece of work is a benefactor to the community. If he shows pride in his work, and improves it, or, by his invention, improves its method of production, he is a most important benefactor to the community. And, therefore, I think all exhibitions of this kind should be encouraged, and I am sure that you will feel grateful to Messrs. Cassell & Co. for having given an opportunity to the contributors to their journal of WORK to show what they can do by themselves, and in what manner the industries which they represent can best be improved. There is one thing more in which I am sure you will agree with me. My right hon. friend, Sir John Lubbock, is Chairman of the County Council; indeed, he is chairman of so many things that it would require a census to enumerate them. He undertakes so many things, and does them all so well, that the compliment is all the greater to you that he should have found time in the midst of his many avocations to come and give us such an excellent address this day, and to have declared open this Exhibition, which I hope will be attended by a great many visitors.

MR. ARNOLD-FORSTER:—The resolution is that you accord a hearty vote of thanks to Sir John Lubbock for the part he has taken in these proceedings. Sir John Lubbock has not only been present at this meeting, but he spent an hour before this meeting began in going carefully through the exhibits. I ask you to give him a hearty vote of thanks.

The resolution was carried unanimously and with acclamation.

SIR JOHN LUBBOCK:—Mr. Arnold-Forster, Ladies and Gentlemen,—I am sure you will all agree with me that although Sir Lyon Playfair did not know he was going to speak, he has given us a most interesting address, and one for which we are very grateful to him. He alluded to the very interesting statement which has recently appeared with reference to the chimpanzees using fire. But I think he need not be alarmed that his definition will be undermined in that respect. Emin Pasha is a good naturalist. He has been in communication with naturalists both here and in Germany, and if he had really made such a very remarkable observation as that, I think we should have had it from him direct, and not second-hand. I cannot help thinking that the statement must have originated in a mistake, and I hope Sir Lyon Playfair will not too hastily abandon the definition which he had arrived at. I am very much obliged to you indeed for the kind manner in which you have received me. This is not the first occasion I have had the honour of addressing you from this platform. It is always a very great pleasure to come to a hive of industry of this kind, where work is to be seen in its highest aspects. I will not detain you any longer. No doubt you are all anxious to examine the very interesting Exhibition, and I conclude, therefore, by again thanking you for your very kind reception of me, and by formally declaring the Exhibition now open.

The proceedings connected with the opening ceremony were then brought to a close, and Sir John Lubbock, followed by a party of visitors, went through the various departments of the Exhibition.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

**** In consequence of the great pressure upon the "Shop" columns of WORK, contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.

I.—LETTERS FROM CORRESPONDENTS.

Hand Saws.—A. R. (*Scorrier*) writes to AMATEUR and others:—"In reference to hand saws (see page 701, Vol. II.) the sketches are reduced, consequently a greater number of teeth are given to the inch. The number of points should be four to the inch in the rip-saw, and from five to six in the cross-cut saw for general work."

Formulæ.—A. R. (*Scorrier*) writes, in sequence to BRASS (see page 699, Vol. II.):—"I hope I have given no offence in writing as I did in reference to formulas in No. 89, page 599. The reason I made such remarks is—more than once really good workmen, who may not be, like myself, too well up in arithmetic, have said to me, 'I don't understand so and so;' and more than one has said the same in reference to your reply on 'Speeds of Pulleys.' I thought, therefore, if I could make the thing more clear and simple, I was only giving a helping hand to those who needed it. I agree with you that we don't all read WORK through the same pair of eyes; if so, there would have been no need for me to write as I did."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

The "Ariston" Organette.—C. J. G. C. (*Brighton*).—The "Ariston" Organette has a scale of 2 octaves—we believe from C to C, but C. J. G. C. can easily ascertain this by purchasing a pitch-pipe or tuning-fork, giving the C or A, and then testing it. The paper tunes are punched by a machine, and must be made with great accuracy to get the right duration for crotchets, quavers, and for rests, etc.; also for the different time marks, so that our correspondent, even if a skilled musician, could hardly succeed in making them by hand. In any case it would be far cheaper to buy them, as they can be obtained for about fifteenpence each.—G.

Brass Instrument Bruises.—METAL WORKER.—Musical instrument makers employ various methods for removing the bruises in brass instruments, according to the position of the bruise. In some cases, in order to avoid taking the instrument to pieces, the top of a piece of stout brass wire is soldered to the indented spot, and the bruise is then *pulled* up. This is, however, only practicable in the case of slight dents. Where the damage is too serious for this treatment, and is in the smaller tubings or too far round the *main bow* to be accessible from the bell, the instrument must be taken to pieces at the joints, and even then special tooling is required to fit the bend. By means of a series of steel balls of graduated sizes, which are screwed on to the point of a curved steel-tapered arm, the bruises from tubes of various calibres can be removed. The arm is fixed in a vice, and a ball screwed on the top to fit the diameter of the tube which it is desired to level. This is then thrust over the arm, and the bruise pressed up from the inside on the steel ball. We should, however, recommend our correspondent not to attempt the repairing of brass wind instruments, unless he has had some practical experience, as it is easy to ruin the musical quality by altering the proportions of the smaller tubes. If he will attempt it, let him try his 'prentice hand upon some old worn-out instrument, or he may purchase his experience dearly.—G.

Old Violin.—T. L. (*No Address*).—Get the surface quite even with fine sandpaper, and cover with a spirit varnish strongly coloured with dragon's blood or sandal wood. Should these be redder than you fancy, add a little saffron; this will modify the tint, and make it slightly "orange." A varnish composed of four parts of seed lac to one part of benzoin, dissolved in methylated spirit, will answer your purpose very well. Colour the spirit, and filter before adding the gum.—B.

Dissolving Varnish.—MANCHESTER.—Dragon's blood is soluble in spirit, turpentine, and some kinds of oil. If you get it in the powder form or pulverise it yourself, you will probably have no difficulty with it, but the idea of anyone living in a city like Manchester wishing to prepare his own varnish is rather peculiar. Varnish making is not a kind of manufacturing that can be practised on a small scale by amateurs with much success.—D. D.

Recipes for Polishing, Paste for Cleaning Brass Plates, and Solid Ink for Stencils.—N. W. (*Leicester*).—(1) Soft soap, 2 oz.; rotten-stone, 4 oz. (2) Rotten-stone in paste, with sweet oil. (3) Rotten-stone, 4 oz.; oxalic acid (in fine powder), 1 oz.; sweet oil, 1½ oz.; and turpentine, sufficient to make a paste. The above are used to clean brass-work, when neither varnished nor lacquered. The first and last are best applied with a little water; the second with a little turpentine or sweet oil. Marking or "Packer's" ink is the "bottoms" or settlings of the ink manufacturers. It is chiefly used in a solid state by packers for marking bales, boxes, etc.—N. M.

Polish.—H. W. (*Tottenham*).—Pine does not look well when finished with wax polish, which, by the way, is not generally adopted for any kind of bedroom furniture, though, beyond custom, there seems no good reason why it should not be. If, as you suggest, you want to make a really good bedroom suite, why not use mahogany, ash, or American walnut? Any of these will be much handsomer than pine, and, as you are no doubt aware, the extra cost will not be great if you go to work in the proper way for getting the stuff. Yes, wax-polishing has been very fully treated in WORK in the current volume. As all the back numbers are in print, you would find it a great help in your hobby to get them.—D. D.

Cutting Machine.—J. H. (*Harpurhey*).—The price of a machine would be about £100; you could not make it for that sum, and, apart from the cost, the undertaking would be too much for you.—G. C.

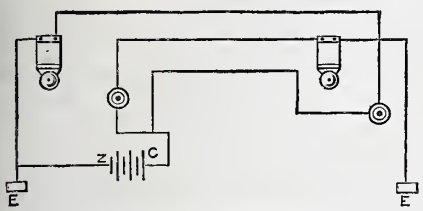
Folding Screen.—F. C. (*Swanley Junction*).—I should advise you to use wood ¾ in. or ⅞ in. thick for a screen of the height you mention. I am unable to tell you how to construct a screen to fold both ways, and yet show no crevice between each frame. There have been a few notes in WORK already dealing with screens; perhaps they will assist you. Gold, silver, and coloured paper is obtainable at or through any fancy stationer's.—J. S.

Lathe Making, etc.—J. H. F. (*Nottingham*).—You should advertise your address and cheap prices in the "Sale and Exchange" column of WORK.

Plumbing Book.—W. R. (*Kerry*).—The address of Messrs. Houlston and Sons, who sell the "Plumber and Painter and Glazier One Shilling Hand-Book," is Paternoster Row, London, E.C.

Diamonds for Boring and Cutting Rock.—J. S. (*Aberdeen*).—As there are two or three ways of using diamonds for drilling, and as tools are wanted in each case, I will give you two addresses. The first is J. E. Slyper, 40 and 41, Kirby Street, Hatton Garden, London, E.C. Here you will be able to obtain a quotation for any description of diamond that you may send particulars of, not forgetting to mention the quantity required. If the black variety from Brazil (carbonate) is required, the cost will be rather heavy to bear. Any tools that you may wish for can be supplied by Messrs. Cotton and Johnson, 14, Gerrard Street, London, W. This firm also keeps in stock diamond already powdered, and they will be perhaps the better of the two to send to if small quantities only are required. The first mentioned firm are diamond cutters, and I do not think would care to be bothered for very small quantities, but you might write to them and see.—H. S. G.

Telephone.—A. W. (*Wakefield*).—Your letter speaks of former favours and expresses very kindly your thanks. I do not remember having given you any assistance on this point before. But, all the same, you are perfectly welcome to whatever assistance I can give you now or at any future occasion. I cannot make much of your letter, and I am sorry to say that I can make less of your sketch. I gather this much: you have a pair of telephones complete with bells, batteries, etc.; one of these is fixed in your bedroom, and the other in your workshop at a distance of 150 yards. These, according to your letter, have been supplied by a respectable firm of electrical engineers and answer your purpose admirably. I presume they have been fitted by the parties who supplied them. Is this right? If so, leave them as they were and do not attempt to make any addition to the connections, for you may be setting up currents which



Telephone Connections.

will run contrary to first directions, and thus interfere with their proper working. Besides these, you have two bells, two pushes, and one battery. One bell is also fixed in your bedroom beside the telephone, and the other at another part of your works 200 yards distant. This is right, I think. You have thus two complete electrical circuits running in contrary directions. Well, just allow them to be completely separate from each other. Take away all the connections from the telephone circuit which were not originally there, and make a new arrangement for your two separate bells. I do not wonder at you not being able to ring the distant bell when you pressed the push A in your sketch, neither would you yourself if you just looked at it closely. Your line runs direct from push A to push B; now, as there is a break in every push (you surely do not want pushes to alter their conditions to suit your requirements), it would be necessary for the current to jump from one spring of the push to the other before it could get to the bell; but even should such a thing happen, it would not reach the bell, for you have the carbon of the distant battery connected to push B, so that the current coming from that battery would meet that coming along the line, and in that case something is bound to happen, although the consequences would not be quite so disastrous as when two locomotive engines going at express speed meet on the one line. You want me now to tell you how to connect up your bells and use up the materials which you have. You have two bells, two pushes, and one battery. These can be easily connected together in different methods, but I think the one shown before will suit you best, being the most simple. Be careful in joining your wires to follow the sketch, and in making joints in your wire, scrape away carefully the covering, and while soldering, use resin as a flux; and when the joint is made, cover up with gutta-percha tissue. Being a plumber, you will be able to make a good joint. To ring your bells properly, you will require not less than three No. 2 Leclanché cells, and all your wires must be insulated.—W. D.

Impressions.—H. M. (*Leeds*).—I am sorry that I am unable to describe a method for taking out an impression from the leather cover of your book. It is one of the impossibilities one meets with now and again. All that you can do is to cut the piece out, and insert another piece to fit exactly. You might insert a different coloured piece with effect. But this will have to be done judiciously in your case, as I see that the book under discussion is a Bible.—G. C.

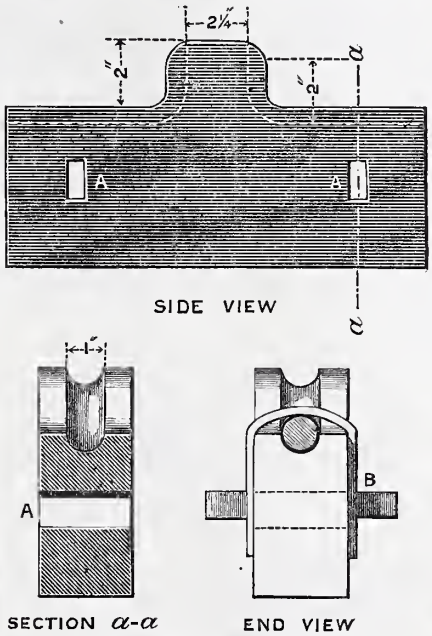
Parchment Diaphragm.—F. W. B. (*Golcar*).—These diaphragms are all more or less subject to atmospheric changes, and it is difficult to remedy them. I think you should get a pair of new ones, and try gold-beater's skin, or even bladder skin, for them; and be sure when putting them in that they are well stretched and clamped closely. It is usual to have a metal ring round the edge, to ensure the clamping being perfect.—W. D.

Die Stamping.—C. L. (*Hulme*).—I cannot treat this subject fully in "Shop." Colour stamping is done with one die and with several dies, according to the style. The samples sent are very nice, and can only be done by experts. The large sample is done with three dies, I think: the one fitting over the other. The small sample is done with one die. The gold is put on with the ordinary varnish used for colour stamping. After it has become dry it is stamped again to burnish it.—G. C.

Book Boards.—H. N. (*Broadmoor*).—I understand that you have an idea of making moulded boards for scrap albums, these boards to be a certain size. Now, if you know anything about reliefs, scraps, or pictures of any kind, you must know that the sizes of these are very varied; it is rarely possible to get two the same size. Looking at it from this point, I do not see what would be the use of a portion of the page being sunk: there would be no end of waste space in fitting the reliefs in the pages. When making scrap albums, we make the back thicker than the rest of the book, so that when it is filled it will lie nice and flat. Your idea *might* do for photographs. I do not say that it will, seeing that the sizes of the cards are well known, and but few of them. You say that you are desirous of eliciting the approval of manufacturers. Why not submit your idea to a paper-maker, or get the advice of a patent agent? Pulp boards could be blocked in a much simpler method than the one you propose; and they are so done. But I do not think they are used for scrap albums in the way you have laid out, as they would not do at all.—G. C.

Error in Telephone.—W. R. (*Glasgow*).—You are quite right in regard to the above. I did not observe it until I read your note. It should have been printed as you have it—that is, with the hook pivoted at the end of the line wire, and free to move between the two connections of the receiver and bell-push. However, as these connections are given plainly, it really does not matter, for in actual practice anyone setting out a switch-board would be able to make the connections all right from the sketch.—W. D.

Cress.—J. F. (*Bogay*).—You want a block like that shown in the figure. It is of cast iron, made from a pattern cut to precisely the same outlines, and the cottar-way holes A, A, are cored out by means of pocket prints. The crank is turned round, and hammered into the semi-circular recess, whose



Cress Block and Parts.

dimensions you will see correspond with the sizes given in your sketch, and its ends are clamped down with straps and cottars shown at B. The outside dimensions of the block are of no importance, so long as you have it strong enough to stand the shocks of hammering.—J.

Bookbinding.—H. B. (*Jarrow-on-Tyne*).—At both the beginning and ending of your letter you express the hope that I will not take offence at anything you have written. I am exceedingly anxious that your mind should be set at ease on this point. Hence my reason for giving it precedence. Let me then assure you that your letter, instead of giving me offence, was the cause of much amusement to me. I was so delighted with it that I have read and re-read it again and again; and just by the way, allow me to give you a wrinkle in letter-writing. Throw out that lovely violet shade of ink, and use common black. I know that the black is very common and much cheaper than the other, but then, in this case the common is the best, inasmuch as the violet is trying to the eyes. Now as to the contents of your letter. You want me in the course of my "articals" on bookbinding to write as a working-man to working-men. I have always striven to do so; in fact, I could not do otherwise, for I am a working-man. As to the illustration which you give, taken from my reply to P. B. on page 44, allow me to explain to you a little matter which you seem not to be aware of: it is simply that WORK is not an amateur magazine entirely. We have, therefore, to write to practical workmen; and as the querist referred to asked for the prices of the articles specified, I gave him the best answer I could, as I would to you if you asked me to suggest a makeshift for a certain thing. Supposing you had asked me for the price of a "glue-pot"; it would have been ungentlemanly to have given you the price of a marmalade jar. I think it is not necessary to say anything further. I suppose the Editor will deal himself with the other part of your letter. If you have a dictionary, you might look up the meaning of the word "artical."—G. C.

Telephone Connections.—J. H. (*Mullingar*).—I cannot make out from your letter or diagrams what is wrong with your telephones. The fault may be in the receiver or transmitter. Faults may occur in any part of the circuit, and sometimes, although they may be very small, are a source of much trouble. If you can manage it, test your line in the first place, and if you find no fault in it, look to your instruments, testing each one separately, and thus you may be able to get at the fault and the means of remedying it. At any rate, I cannot help you unless you try and make your case a little plainer.—W. D.

"Holdfast" Egg-Cup.—NEMO (*Manchester*) has unfortunately lost a hand—a misfortune the more to be deplored, as from his letter and what he tells of his work, it is evident that he would have kept two hands busy to good purpose. He asks for some plan on which he might make a cup which would hold his egg still whilst he eats it. Might not he make a simple and cleanly contrivance on the principle of the crayon-holder, as in the annexed sketch? The egg would be held firmly by a ring made to slide up the stem. The foot he would make steady by casting it in some heavy metal. The bottom ends of the clips he would insert in his mould before casting it; and if he could not make or get them made readily, the middle parts of two metal spoons would serve. He might, of course, steady his egg by an elastic ring inside a heavy cup, but this would be less cleanly. Or he might turn a wooden cup, load the foot with lead, saw a slice out of the centre, and draw the two parts together when his egg was in, either with a ring as above, or with a screw below the cup. These are given as alternative suggestions. As regards naming his coins, he will find Colonel Thorburn's "Guide to the Coins of Great Britain and Ireland" (Upcott Gill, Strand, W.C., 6s. 6d.) a most useful handbook in small space, and more especially so as it gives some idea of values.—M. M.

"Holdfast" Egg-Cup.

Piano Reeds.—W. H. C. (*No Address*).—If you intend to make a round fall to your piano, you must make your cheeks 2 in. wider, for this reason: that you fit your round fall in between the cheeks, and make a mark round the top side of the fall on the inside of the cheeks, then you cut round carefully with a bow-saw. The piece of wood you cut off is used for a caul to press the reeds round the cheeks. Proceed in the following manner:—Get your reeds out $\frac{1}{16}$ in. wider than your checks; as they shrink a little, work the reed with your plane to the pattern you require, and leave the outside edges square, as you can work these after they are on. You will need to steam them for this purpose. Make a narrow box the length of the reeds, fill one end with a piece of wood, and bore a hole in the centre large enough for the spout of your kettle to enter; this is placed on the fire with water in, the reeds are placed in the box, and a piece of sacking is stuffed in the end to keep the steam in; let them remain steaming until you find they will bend. Now, before you glue the edge of your cheek, use a rasp or coarse file on it, and take all the lumps off and size with thin glue. Of course, you will need pressure, large handscrews or cramps being used. When glued down, leave all night to dry, then clean up with glass-paper.—T. E.

Cramp and Block.—D. M. G. (*Old Cathcart*).—The combined cramp and block on page 3, Vol. II., for both cutting and fixing mitres of picture-frames is ingenious and good, but personally I should prefer separate appliances for the two purposes. D. M. G. ought to procure all the back numbers of WORK, in which he will find several excellent mitre cramps and blocks illustrated. He should also watch the "Shop" columns, for there are now in print several answers that would go far to answer his question.—B. A. B.

Imitation Ivory.—C. W. (*Kensington*).—Xylonite, which seems to be the best imitation ivory, can be procured in thicknesses varying from $\frac{1}{200}$ of an inch to 1 in. in thickness. It works very smoothly and kindly with wood-carving tools, and it is also adapted for modelling by means of heat and pressure; in fact, very many of the Xylonite Company's productions—their salad-servers, for example—are made that way; for that purpose properly made and finished dies are, of course, necessary. This same material is used for fretwork too. The Xylonite ivory is kept in four qualities: "grained ivory;" then two kinds of ungrained, called "ivory white," one quality being much darker than the other; the fourth is called "snow-white." Besides the imitation ivory, many other colours are kept, some of which are excellent imitations of coral, tortoiseshell, and lapis. The address is the British Xylonite Company, Limited, 3, Fore Street Avenue, E.C. Will you please clearly define the thickness, size, and quality, that you require, when you write for prices?—H. S. G.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Electric Light.—J. S. H. (*Dublin*) wants to know how to construct a small electric light to burn for five or ten minutes at a time by making contact with an ordinary bell-push or otherwise. Can any reader give the desired instructions in "Shop?"

Wood-Slicing Machine.—W. H. (*Belfast*) writes:—"Will any reader inform me where I can procure a machine that will slice wood as thin and clean as the wood used for bandbox making? I want a machine that will slice blocks of wood about 12 in. by 7 in."

Hardened Putty.—J. G. (*Hull*) asks for "The best way to prevent putty from getting hard."

Pig-Scalding Tub.—J. G. (*Hull*) writes:—"I should be glad to know the best method of making a pig-scalding tub about 6 or 7 ft. long, also size of wood required, and all other particulars. A sketch would be very acceptable."

Packing-Cases.—W. G. (*London, N.*) writes:—"Will anyone tell me a more simple way of fitting up packing-cases than that given on p. 293, Vol. II.?"

Sand-Blast.—MIEUX QUE ÇA writes:—"Will anyone impart a word or two of practical information on the construction of the sand-blast?"

Draught-Board.—J. W. M. (*Driffield*) writes:—"Can any reader oblige me by letting me know the cleanest, best, and quickest mode of making a draught-board on plate-glass, size 15 in. by 15 in. square; and the best colours for the squares? Board to be 12 in. square inside, with 1½ in. border round to make 15 in. I should like to know the cost of it as near as possible. The board to be put in about a 2 in. moulding-frame either plain or gold, with back complete, or to have it to fix on four legs like a table, but to be loose when not playing."

A Cold Room.—SESTO writes:—"There are several methods of operating a 'cold room' whereby perishable articles can be well preserved during hot weather, and that for months at a stretch. I shall be glad to know who are the makers of the best apparatus, and, perhaps, how it operates. I may state that it is to be capable of keeping the temperature, if necessary, considerably below the freezing point."

Hand-Power Circular Saw Bench.—S. P. (*Penarth*) writes:—"I wish to ask assistance in the construction of a hand-power circular saw bench which I am wishful to make, one that will require the least manual labour to drive it. I should require it to cut stuff up to 5 in. thick. Being a joiner by trade, I would make wooden standards and framing (if advisable), also the best and cheapest firms to get the required wheels, plumber blocks, etc., with probable cost (complete). Any suggestions or sketches will be esteemed a favour."

Castings.—J. D. (*Glasgow*) writes:—"Will anyone tell me where I can get a set of castings for 2½ in. or 3 in lathe back-geared in Glasgow; also the price?"

Schooner Rigging.—T. C. (*Manchester*) writes:—"I have a 'Model Schooner Yacht,' 4 ft. long by 8 in. broad, and do not understand how to full rig it. Would any reader kindly inform me?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Frosting Glass (Windows).—H. B. (*Brighton*) writes, in reply to BETA (see page 734, Vol. II.):—"Thoroughly clean the glass inside and give one coat of the following: With a soft brush, leaving a nice smooth finish, make a clear solution of gum-arabic, then prepare a very strong solution of Epsom salts in hot water, and apply to the glass while warm as directed above, where it will crystallise and form a very pretty pattern, and is very durable. Another, but very common and somewhat unsightly, method is to dab the glass all over with a piece of soft glazier's putty and allow the marks left to dry; this sets very hard and is durable, but the former plan is by far the best and easiest, costing only about threepence for what is really a pretty decoration."

Setting a Razor.—J. H. (*Leicester*) writes, in reply to J. C. (see page 551, Vol. II.), who asks for the best way of setting a razor;—"I do not know if my way is the best, but I can always depend on getting a good edge on my razors. First of all, get a razor, then a good stone (I believe there have been directions in this paper for choosing a good stone), moisten the stone with a few drops of sweet oil, and place it on a firm bench or table, then take hold of the blade firmly. To avoid cutting your fingers, lightly rest the fingers of the left hand on the blade, while the right holds the haft; lay the blade flat on the stone, the side of the blade resting on the stone with the edge just touching it, the edge of the blade being from you. Then, while applying some pressure, work the blade along the stone in a straight line from you, and draw it back without pressure (Fig. 1). After a few passes, turn the blade and reverse the action. Draw it to you with pressure and push it back without (Fig. 2). Never make the back of the blade go first, or you will produce a thin useless edge which will double up. If you have two stones, all the better: one rough to grind on, and the other smooth to put a smooth edge on the blade. Take care to move the blade backwards and forwards in a straight line, not in a circular motion (Figs. 3 and 4), and keep the blade always at the same angle, or you will cross the line of friction and fail to produce a good edge. The effect of the crossing of the lines of friction is seen in Fig. 6 considerably magnified; if properly set, it will be as seen in Fig. 5. Be very careful to keep trying the blade after every few passes, and apply very slight pressure, or you will rub the edge off as fast as you put it on; when properly set, you will be able to cut a hair through when held in the fingers, or a piece of tissue paper with a clean cut: if it drags and tears the paper, you have not got a good edge; you have either crossed the lines of friction, not set it enough, or have applied too much pressure and turned the edge: to remedy the first and last of

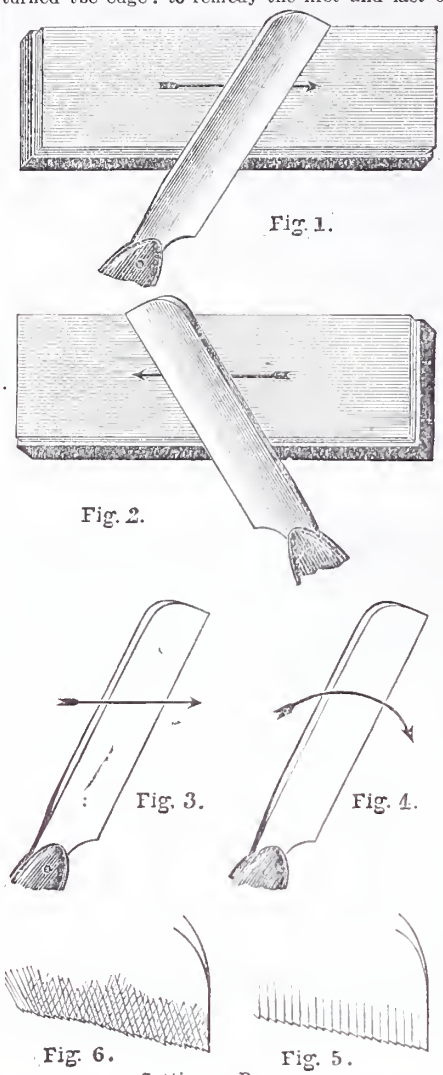


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 6. Fig. 5.

Setting a Razor.

these three, you must take off this edge and commence again. But we have not yet got through the wood; many who can set a razor cannot strop it. Get a good strop, a piece of buff (soldier's belt preferred), and if you have a heavy hand, try to strop the back of the razor; this will help you to strop it without turning the edge; be very careful to apply very slight pressure, and turn the razor on the strop with the edge upwards; never allow the edge to turn downward on the strop. If J. C. follows these directions, I have little doubt that he will find no difficulty in setting his razors."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. J. S. (*Deptford, E.*); AMATEUR; C. F. W. N. (*Forest Gate*); W. R. (*Manchester*); J. G. (*Glasgow*); O. C. (*Derby*); W. E. H. (*Hebburn-on-Tyne*); E. D. (*London, S.E.*); L. F. (*Plymouth*); P. J. R. B. (*Manchester*); S. S.; A NEW READER; J. M. (*Newport*); J. C. (*Belfast*); BEACON; J. J. (*Leeds*); W. J. F. (*Cork*); A. R. (*Scorrier*); B. T. W. (*Leeds*); J. S. (*London, N.*); STEAM ENGINE; W. P. (*Withington*); MATHEMATICS; E. R. N. (*Forest Gate*); H. J. S. (*Homerton, E.*); G. W. (*Barnsbury, N.*); A. G. (*Cardiff*); J. Y. C. (*Croydon*); J. O. (*Chatham*); J. M. (*Parkstone*); J. J. D. (*Douglas*); BRITANNIA CO. (*Colchester*); H. T. G.; G. S. W. (*Walford Heath*); TOMMY JEE; H. B. (*Haydon Bridge*); J. T. (*Huddersfield*); T. W.; A. H. (*Maidstone*); J. M. (*Halifax*); C. M. C. (*Forest Gate*); C. A. (*Rawtenstall*); G. S. (*London, N.*); A. B.; J. W. (*Birkenhead*); IMPROVER; D. M. S. (*Glasgow*); C. F. N. (*Cheltenham*); R. M. (*Liverpool*); H. B. (*Brighton*); B. A. (*West Kensington*); E. H. H. (*Chatham*); J. L. (*Airdrie*); CONSTANT READER; R. W. W. (*South Shields*); J. E. (*Chatham*); T. W. (*Bradford*); W. H. T. (*London, S.W.*); G. V. (*Esclairmonde*); J. T. (*Leeds*); H. A.; W. A. H. (*London, S.E.*); BLOWPIPE; CAMERA; CYPRINE NORWICH; W. J. S. (*Glasgow*); W. O. J.; TREADLE PUSHER; S. W. (*Kidderminster*); OBLONG; DEAN FOREST; T. E. B. (*Farringdon, O. E. R.*); (*New York, U.S.A.*); OGRAPH; AMATEUR; W. S. (*Highbury*); BRASS; D. W. (*Liverpool*); BANNERMAN; R. G.; NORTHERNER; S. S. (*Salford*); S. S. G. (*Walworth*); F. J. D. (*York*); COMME IL FAUT; A. S. D. (*London, S.E.*); J. B. (*Southwark*); J. S. (*Amsterdam*); W. E. D. (*King's Lynn*); RULER; S. A. L. (*Walsall*); J. E. (*Skipton*); LAUNDRY; J. M. B. (*Dumfries*); G. C. (*Huddersfield*); EXILE; J. T. (*Manchester*); J. D. (*Glasgow*); DESPAIR; R. T. (*Paisley*); W. J. J. (*Sunderland*); W. T. (*Lymington*); A. P. G. (*London, W.*); E. T. (*Blackburn*).

"WORK" EXHIBITION.

PRIZE DISTRIBUTION.

THE Manufacture of the Medals and other arrangements in connection with the Prize Distribution are now in a forward condition, and the Editor hopes to announce in an early number the date and place at which the Distribution will take place.

JURORS' AWARDS.

The Editor hopes to publish a full list of the Jurors' Awards in No. 101.

Price **3d.**; post free, **4d.**

"WORK" SPECIAL EXHIBITION NUMBER.

Containing an **Illustrated Descriptive Account** of the most remarkable Exhibits.

Among its contents are:—

Working Model of Steam Fire Engine.
The Story of the "Work" Exhibition.
Protected Exhibits under Certificate of Board of Trade.
The Value of Art Training to the Professional Workman. By C. R. ASHBEE.
Sir John Lubbock, Bart., M.P.: His Services to Science and Labour.
Fifty Years of Recreation Work. By the Rev. C. C. ELLISON.
Our Exhibits and Exhibitors.
Work and the "Work" Exhibition. By the SECRETARY.
My Ideas about Hobbies. By OPIFEX.
Special Gift Books to Exhibitors.
The Story of the Prize Certificate and Medal Competition.
Certificate Granted to Prize Winners.
"Work": Its Utility and Importance to all Workmen, Professional and Amateur.
Statistics of the "Work" Exhibition.
The Polytechnic Institute.

NOTICE.

Numerous applications having reached the publishers for the

"Work" Exhibition Official Catalogue,

they beg to say that a few copies can still be had, price 2d. each; or post free, 2½d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [11 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

2,000 Lots of Second-hand Lathes, Drilling Machines, Gas and Steam Engines, and miscellaneous items. Call at 100, Houndsditch, London, or send 4 stamps for Register.—BRITANNIA CO. Tool Factory, Colchester. [12 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E.

Forty Fretwork Designs, 7d. free.—TAYLOR'S FRETWORKERIES, Blackpool. [15 R

Lettering and Sign-Writing made Easy.—Also diagrams for marking out eight alphabets, only 1s.—F. COULTHARD, Terrace Road, Bournemouth.

Fret, Carving, and Repousse Patterns.—100 of either, full-size, 1s.; 300 Turning designs, 1s.; 400 small Stencils, 1s.; 500 Shields, &c., 1s., postage free.—F. COULTHARD, Terrace Road, Bournemouth. [2 S

Bolts and Nuts, Screws, etc., for Model Work. Large new illustrated list, 2,800 varieties, 3d.; abridged list, 1d.—BUTLER.

Electrical Terminals, Binders, Contacts, Parts for Electric Bell Work. Illustrated list, 2d.—BUTLER BROS., Bentham Road, S. Hackney, London. [1 S

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

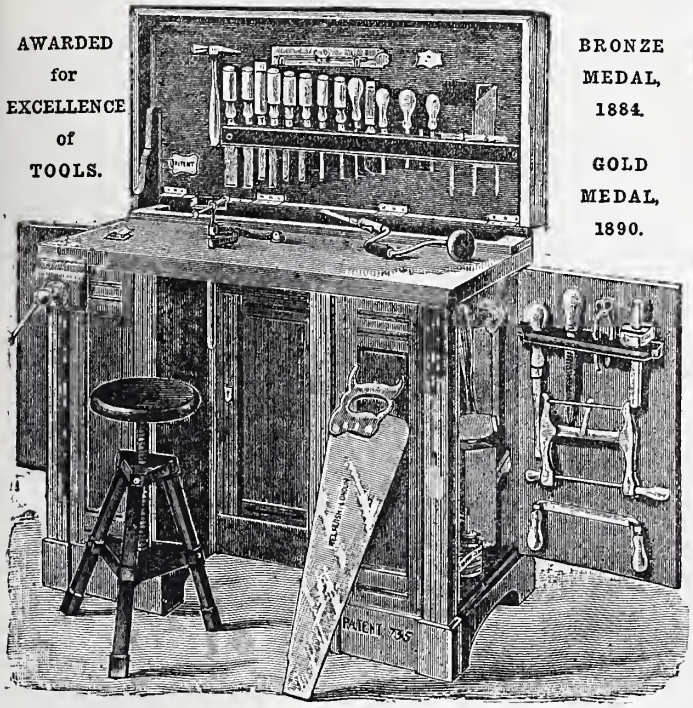
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

For Home Decoration!!

USE

JUDSON'S LIQUID GOLD

6d., 1s., and 5s. per Bottle.

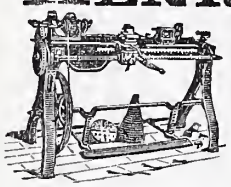
(READY MIXED).

SOLE MANUFACTURERS,

DANIEL JUDSON & SON, LIMITED.

SOUTHWARK, LONDON, S.E.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

PICTURE FRAME MAKING.

FOURTH EDITION. Enlarged and Revised.

THE FRAME MAKER'S INSTRUCTION BOOK.

150 *Diagrams, Designs, and Patterns.*

Instructions in Joining, Fitting, Mount Cutting, &c. Also Prices of Mouldings, and every requisite for the Trade. Post Free, **6 Stamps.**

GEO. REES, 115, Strand (Corner of Savoy St.);

Moulding Dept., 41, 42, 43, Russell St., Covent Garden, London.

Cassell's Classified Catalogue, containing particulars of upwards of ONE THOUSAND VOLUMES, published by Messrs. CASSELL & COMPANY, ranging in price from THREEPENCE TO FIFTY GUINEAS, will be sent on request post free to any address.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

PIANO LEARNT IN A WEEK.

Why spend years in learning the Piano by Music? when RITCHIE'S MUSICAL-CHORD INDICATOR enables anyone entirely ignorant of music to vamp accompaniments to thousands of songs (in all keys), and play dozens of pieces, waltzes, &c., by ear in one week. Price, with Book of Songs and full instructions complete, post free, 1s. 8d.

W. RITCHIE & CO.,

22, MAPLE RD., ANERLEY, LONDON, S.E.

(Please State Name of this Journal.)

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design. No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill**, with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design **SENT GRATIS** with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO.,

Manufacturers of Fretwork Materials, W Department,

EAST DEREHAM, NORFOLK.

Kindly mention this paper when ordering.

CARVING AND FRET SAWING FOR PLEASURE OR PROFIT.

Highest Award Gold Medal for Fretwork and Carving Tools and Designs.

The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION. Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS, at 1/3, 2/6, 3/6, & 5/6 each, *post free.*

Parcels of Assorted Fretwork, 10 feet ... ... *4s.* free.
12 Finely Lithographed full-sized Patterns ... ... *1s.* ,,
Sets of 12 Carving Tools... ... ... *10s.* ,,

None should buy elsewhere before seeing our **New Catalogue** of all Requisites, with instructions. Acknowledged the **Most Complete and Cheapest List** of Fret Goods published. Free for 6 Stamps.

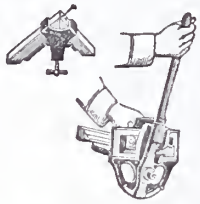
Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

JUST PUBLISHED—THE "FORTH BRIDGE BRACKET."

HARGER BROS., Settle, Yorks.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6D OR FOR 7 STAMPS BIRMINGHAM.

London Warehouse: 124, NEWGATE STREET. [33



PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine**, any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,
TOOL MAKERS, DUBLIN.

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY**, imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the **MANAGER, SALT REGAL WORKS, LIVERPOOL.**

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELENS, LANCASHIRE, in Boxes, 1s. 1½d. and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 101.] SATURDAY, FEBRUARY 21, 1891. [PRICE ONE PENNY.

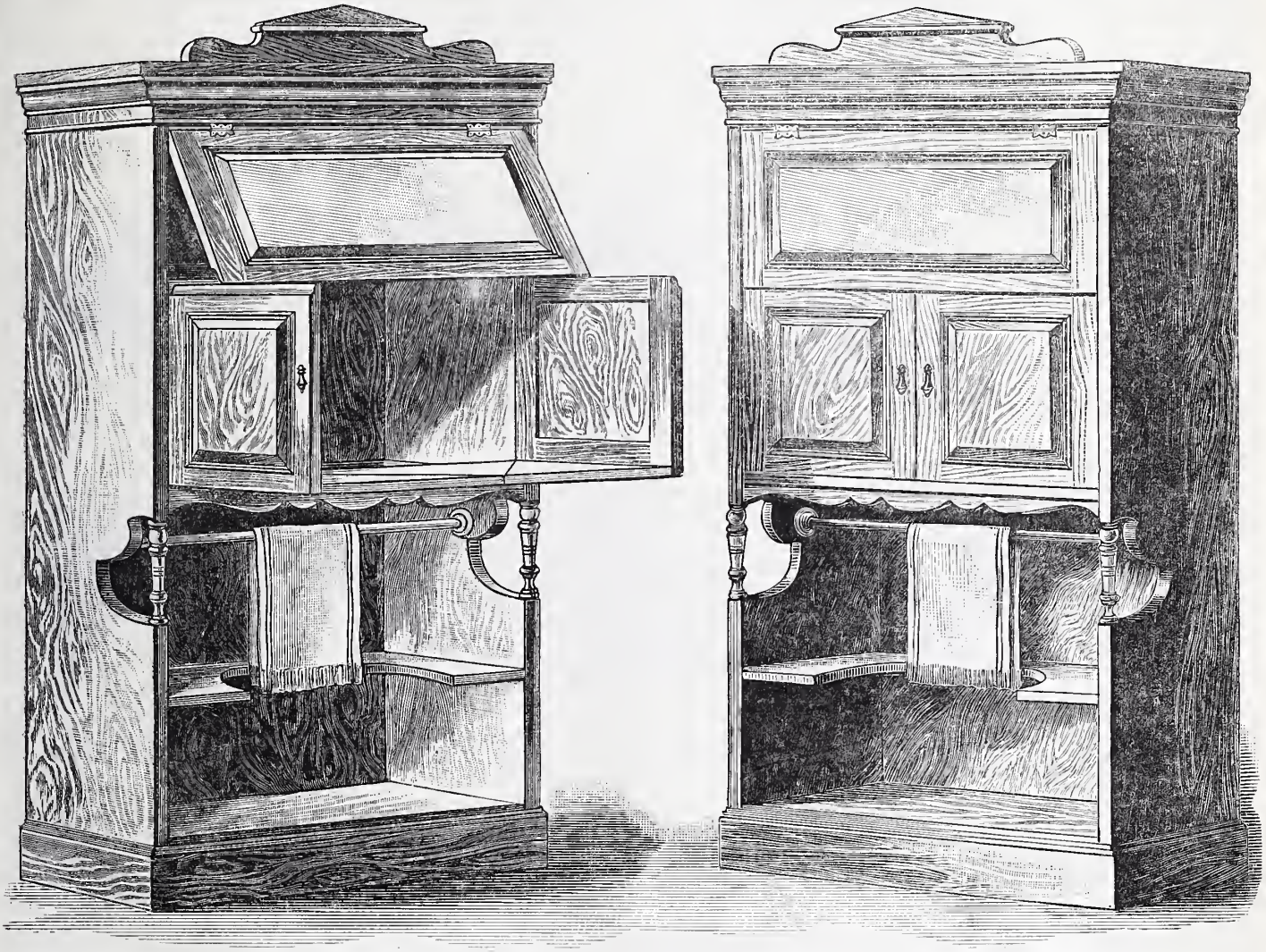


Fig. 2.—Flap in addition to Glass Door, adjusted.

Fig. 1.—Cupboard with Flap concealed behind Doors.

A NOVEL FOLDING CUPBOARD-FLAP.

BY JAMES SCOTT.

"TIME is money." If these words contain any truth—and no one can doubt that they do—one would think that that truth would be applicable in any degree and in any case: that is to say, if time is economised to the extent of but a few moments, money would be saved to a proportionate value.

However, it would not do, nor indeed is it considered an essential matter, to be always endeavouring to regulate all our actions in such a manner that each and every moment of time is occupied profitably. If time-saving were uppermost in our thoughts, I am inclined to think that this reasonably good quality would be its own executioner; inasmuch that, in order to *save* time, the thoughts dwelling so much upon the subject would have the influence of diminishing the amount of attention requisite for the proper performance of any particular action or actions. This is exemplified in the case of a man about to travel a certain distance by foot. In order to save time, he may run briskly for half the way; but, then, for the remainder of the journey it would in many instances be found that, in addition to his slower progress by reason of physical exhaustion, he would be casting up in his mind how much time he had saved, thus making his later movements even slower still than they might have been had he travelled the whole distance at an ordinary walk, and also wrongly occupying his thoughts, which should have been dwelling upon the business to be transacted at the journey's end, which business would then probably require more time to transact than had been saved by the half-journey run.

Of course, in travelling by conveyance of any description time *is* most undoubtedly saved, because then the thoughts *can* dwell upon the future transaction; but I am speaking of individual actions, and the purport of my words is intended to illustrate the fact that if certain actions, assisted by certain methods, take less time to perform than they do by other methods, time or money is not thereby necessarily saved.

Space requires almost as much considera-

tion as time, and it is needless to say that anything which economises it to an appreciable extent is welcomed by those who have not much of it at their disposal. Of course, there are people to whom anything of the kind is utterly useless. But then, because this is the case, they should not pronounce them so in every instance, for I am sure there are many homes and offices where such articles find favour and good use. If people would recollect this, we should not be told by cynical men, who, doubtless, can invent nothing more than a poor and feeble joke, that "if 'Necessity is the mother of Invention,' there must be a lot of inventions that are orphans." Such remarks seem to spread a tint of uselessness over a number of inventions, but if the writers of them would remember that all orphans *have had* mothers, they will see the foolishness of their words; for if an invention were found of necessity at one time, is it in any way the fault of that invention that it becomes motherless?

conjunction with the other necessary parts, could be appropriately utilised, for although, as I hinted previously, the consideration of the time saved by opening and adjusting the doors, flap, and glass by one action instead of, perhaps, four or five (for it must be remembered that in most cases the doors would first have to be opened to get at anything within the cupboard, then the basin-flap would have to be brought down, up, or out from somewhere—certainly, this flap could be made to answer the purpose of the doors, thus making only one action necessary in this direction—then one or two brackets, or something similar, brought out to support it, and, finally, the glass flap fixed at a suitable angle)—although the consideration of time saved may not be of much importance, it will be very handy and convenient indeed. As a cupboard of this description, I should advise the use of a rail across, as I show, to be utilised as a towel-airer. A lower shelf also would prove serviceable.

An advantage of this flap is that it in no

them. The length of this board should be just twice its width, so that if the doors are each 18 in. square and ½ in. thick, the board will be 35 in. long and 17½ in. wide. Mark a line down the middle of it, as represented by the dotted line A′ A″ in Fig. 4, and after drawing lines from A′ to, B′ B′, cut off each corner separated by those lines. The board will then be divided into three parts, A, B, C.

The hingeing of the three pieces should be plainly understood from Figs. 5 and 6, the letters in both diagrams representing the same parts. The method of hingeing B and C to the doors is shown in Fig. 8. The back part of A need not be hinged at all, for sufficient strength will be obtained with the hingeing I have mentioned, as, if the hinges are properly screwed on, the flap will be equally as firm as a solid board. A back view of the flap and doors when the doors are closed is shown in Fig. 9.

If it is intended to have the glass flap as well, it must be borne in mind that it will hang away from instead of laying flat

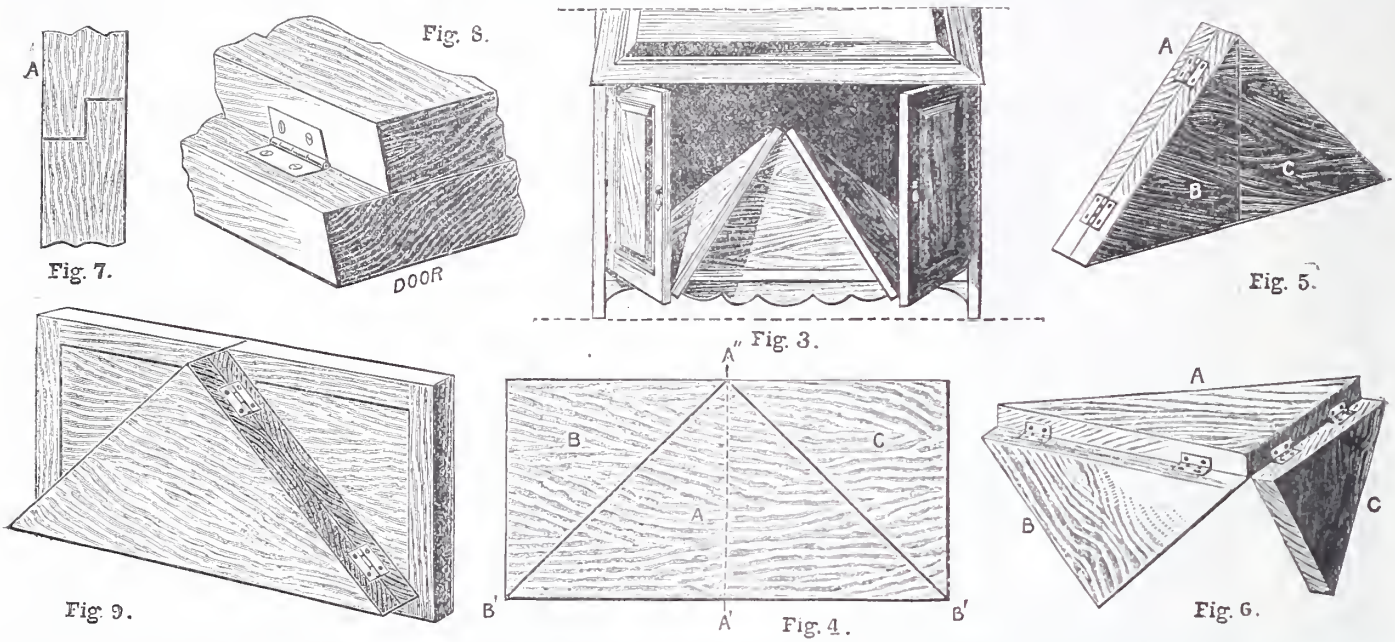


Fig. 3.—Diagram showing how Flap folds. Fig. 4.—How to cut Boards to obtain Flap. Figs. 5, 6.—Diagrams showing Flap folded, and folding, and how the Hinges are fixed. Fig. 7.—Section of Glass Flap and Doors. Fig. 8.—Diagram showing how to hinge Parts B and C of Flap to Doors. Fig. 9.—Flap folded behind Doors.

Even supposing that many of the great number of inventions are of such a character as these writers would intend to convey by their illogical witticisms, my belief is that no invention creates waste of anything, for if it is comparatively useless for its named purpose, it will generally be found that suggestions are taken from it whereby useful articles are made.

I have said this much because I wish to imply that the design I give this week is offered principally as a suggestion. Hence my reason for not giving any particular title to the article as a whole. Neither shall I burden the reader with measurements. I will only explain what it is and how it acts, and name some of the uses to which it may be put.

In Fig. 1 is shown a cupboard—an ordinary looking article. In the front is represented two doors and a looking-glass flap. When either or both doors are opened, a flap is adjusted as in Fig. 2, and the glass flap is also placed at an angle, represented also in the same diagram. In Fig. 3 the movement can be better understood.

As a toilette cupboard, the idea, in

way interferes with anything within the cupboard—it folds up quite flat behind the doors.

It would also be extremely useful attached to a medicine or other cupboard, where search might have to be made among the contents for a particular bottle or article. Of course, the glass flap in such cases would be dispensed with.

Although the folding of the flap appears simple, care must be taken before the proper result can be attained.

It can be attached to any existing cupboard, providing the latter has two doors, each square; the main thing being to recollect that the pieces necessary to form it must, when placed together, fit close up against each other and the doors to which they are hinged.

The flap consists of three pieces, A, B, C, Fig. 4, hinged together so that they may fold as in Figs. 5 and 6. A must be just the size of B and C put together. Supposing it is desirable to attach a flap to an existing cupboard, the way to proceed will be to open the doors at right angles to the cupboard, and cut a board to fit exactly in between

against the cupboard, unless it is treated in a similar manner to that which I advise. Along the bottom edge, nearer to the *front* of the flap than to the back, cut a groove, and place some lead or other heavy substance in it. The front of the flap is supported by the hinge, but the back, although supported in a literal sense, falls away from the cupboard, therefore it is that something is needed to counterbalance it.

The bottom edge of the flap is rabbeted: as are also the top edges of the doors, in order that they may fit together as in Fig. 7. Thus it will be seen how the doors adjust the glass flap. The deeper the latter hangs over the former, the greater will be the angle at which the latter may be adjusted.

I have no doubt that several readers who will note the above particulars will find the suggestions conveyed in them very serviceable, if they carry them out and construct a cupboard with a flap attached to the doors in the manner described. For the encouragement of those who may hesitate to begin the work, I may add that the construction is by no means as difficult as it looks.

XYLONITE: ITS NATURE AND USES.

BY D. DENNING.

There is manufactured, under the name of Xylonite, a material which can be used with advantage in many crafts and trades. As Work is cosmopolitan in its character, and does not refuse to notice anything which can be utilised by its readers, either in pursuit of their various hobbies or of their means of livelihood, no excuse is necessary for devoting some space to xylonite and a few suggestions about its employment. Although not exactly a new material, it is not yet so widely known as it deserves to be, and it is more than probable that many of our readers have never even heard of it. Probably, however, some of them may be acquainted with "ivorine;" if so, it may interest them to know that this is merely xylonite of a particular finish. What the material is actually composed of, I am notable to state exactly; but it is a preparation the base of which is paper. How it is made, and of what, is not, however, of much consequence just now, as it is not one of the things which are suitable for amateur manufacture. The user must buy it ready made, as he can easily do from the makers—the British Xylonite Company, Limited, 124, High Street, Homerton, E.

The appearance of the preparation is by no means easy to describe, for it is to be had transparent as glass or opaque, snow-white or jet-black, or, in fact, apparently any colour or mixture of colours that may be wanted. It is not surprising to find that this facility of lending itself to assume such a variety of appearances has been taken full advantage of by the manufacturers in giving to the public the "counterfeit presentment" of various animal and mineral substances. The imitations of the real thing are, in many instances, simply wonderful in their close approach to Nature. The "grained ivory," for instance, has the peculiar grain and creamy look which are seldom seen in substitutes for ivory. Tortoise-shell, both red and dark, clear and cloudy amber, the costly lapis lazuli and malachite, are all imitated with great faithfulness to Nature. In addition to these and other imitations, plain xylonite can be had in all colours.

It is made in any thickness up to about 1 in., in sheets or slabs which generally run about 35 in. by 20 in.; and is sold by weight. The price is 4s. per lb., except for the grained ivory, which is 1s. more. Of course, it may be assumed that in small retail quantities higher prices will have to be paid, so that the amateur must not be disappointed if he has to pay more. In texture xylonite is close and compact, without any grain like that of wood. It is, to a small extent, flexible, and can be rendered more so by heat—which, however, should be carefully applied, as the material is very inflammable when brought into actual contact with fire. It is only of moderate hardness, so that it can be cut with the greatest ease. It cuts freely and cleanly, without the slightest tendency to tear, or roughness of surface. On this account it is admirable as a material for carving, especially for small articles which require carefully and minutely working out. Indeed, it may be said that anything which the high price of ivory, or other costly materials, renders inadvisable for employment, may, so far as appearance is concerned, be successfully rendered in xylonite. In case the suggestion of ivory may lead some to think that carving tools as used by the ivory worker are wanted, let it be said that ordinary carving tools are best. The only point in which it may be at a disadvantage is in durability; but as small ornamental articles are seldom exposed to much wear and tear, this is of little consequence. Of course, there are some people who on principle object to all imitations; and if the mention of xylonite offends their sensitive æsthetic feelings, because they regard it as an outcome of perverted ingenuity, let them treat it as xylonite simply, and as a manufactured production of which many beautiful articles can be made, without reference to its being an imitation of anything. The most enthusiastic Ruskinite could hardly object to this, unless he is prepared to ignore all new productions which may perchance happen to resemble something that has been previously familiar to him.

In thin sheets (*i.e.*, those of the thickness of veneer), xylonite, under the name of ivorine, has long been well and favourably known to the inlayer, or—to give him his trade name—the marquetry cutter, who in most cases is precluded from the use of ivory on account of its costliness. Now that the once fashionable Boule furniture seems as though it would again enjoy a run of popular favour, it may be useful to suggest that the tortoise-shell-finished xylonite is well adapted for use, and is much superior to the common French imitations which are so frequently seen.

Those who take up fret-cutting as a means of recreation or profit, might greatly enhance the beauty and intrinsic value of their productions by the judicious use of the material under notice. Small things only would be made entirely of it; but the capabilities of original execution in working from fretwork designs as published, are much greater than most amateurs imagine, if one may judge from their slavish following of the printed suggestions which are so often given with the designs. What, for instance, is to prevent a design being cut in xylonite some $\frac{1}{16}$ in. thick, and used as an overlaid fret on solid wood? Everyone knows the fragile nature of most fretwork articles when the wood is, as is generally the case, cut through. What is to prevent the article being made of wood of appropriate thickness, and then overlaid with xylonite? If this be done, an article infinitely more durable, and not a whit less beautiful than if it had been made of ordinary fretwork, can be produced. To give an instance from an article before me. It is a "postcard-holder," or receptacle for note-paper—just such a thing as would be useful and ornamental in any room—from a design which came under my notice in one of the periodicals. If the working directions had been adhered to, $\frac{1}{4}$ in. stuff would have been used, with the result of an elegant but fragile article. Instead of that, fret-cut xylonite glued on solid $\frac{1}{4}$ in. mahogany gives a really serviceable thing. Another consideration is that the time and labour were less than if it had been made in plain fret, unless, indeed, duplicate parts had been cut together—which is not always convenient—instead of separately. There is, however, little appreciable difference in the amount of labour when several thin sheets of xylonite are cut at the same time, so that with one operation several parts of the same outline can be made at once. At first the fret cutter, especially if he uses a machine, may find xylonite rather awkward, as it is so much softer than the materials commonly used. A very small amount of practice will enable him to overcome this difficulty.

One more use may be suggested for xylonite—it has been found very useful as a substitute for ivory for piano keys.

In the lathe it works beautifully, and being susceptible of a very high polish, the uses to which it may be put are almost endless.

To give some idea of its weight in proportion to its size, I may say that a piece I am now working on, and measuring 6 in. by 3 in. by 1 in., weighs as nearly as possible 1 lb. From this the approximate cost of a piece of any size or thickness may be easily calculated. No doubt the Xylonite Company will answer any inquiries that may be addressed to them on points and uses which, on account of space, must necessarily be omitted here. I may suggest that inquirers should have the courtesy to enclose a stamp for reply; and that if they only want to purchase an infinitesimal quantity, it will be better to get it from some retail dealer than to trouble the manufacturers, who, however obliging, can hardly be expected to lay themselves out to supply small cuttings at wholesale prices.

WHIBLEY'S REVOLVING-TABLE BAND-SAW MACHINE.

BY THE INVENTOR.

The Use of the Machine and the Various Purposes to which it is Applied.

It will perhaps be advisable, as conducing to a clear perception and a correct understanding of the distinctive principles of the table and guide fences of this machine, as also the why and wherefore of their adoption, if we first investigate the conditions met with in the twisted form of a handrail wreath, whose plan must of necessity be partly or wholly curved, and its axis partly or wholly inclined. This is taken as a representative case, as it involves principles and operations associated with the production of many other forms of work. In Figs. 4 and 5 (page 789) we have the plan and elevation of such a rail. This, it will be seen, starts from a straight and level shank, from which it rises by an "easing" to its greatest pitch or inclination, and thence, without further alteration of pitch, extends upwards and onwards over a circular plan, thus forming at its upper part a solid helix or square thread-screw. The inner and outer edges of that portion of the rail standing over the circular plan, though not strictly cylindrical, may for all practical purposes be considered and dealt with as such, and as generated by two straight lines parallel to, and revolving around the axis of, "well" or cylinder at determinate distances therefrom; and the top and bottom surfaces as generated by two parallel lines, *a b*, and *c d*, moving horizontally along two "falling" or directing lines on either the inner or outer cylindric surfaces, and tangent to opposite sides of a smaller cylinder (A). For obvious reasons, the whole of such a rail would not be formed of one piece of wood, but of several pieces joined endwise, one of which is shown separately, Fig. 6 being plan and Fig. 7 elevation. It will also be evident that this piece of rail can be contained by or cut out of a plank whose thickness is equal to *e f*. If now the plan of wreath-piece be marked on a board (any thickness), as *a b d c*, Fig. 6, and this is made a level base whereon to "horse" or fix in any required position or inclination a piece of plank of sufficient size to contain the wreath-piece; then working upon the level table of an ordinary form of band-saw or fret-saw

machine, and using the plan of wreath marked upon the baseboard as directing lines to cut by, the cylindric surfaces of rail may be cut, as Fig. 8—if the capacity of machine will allow of the top end of plank passing under the upper saw guides and the machine arm. The conditions when this would be practically possible are few, and in them the liability to saw breakage considerable, in consequence of the large amount of unsupported saw between the guide blocks. The work would also be one of considerable danger, consequent upon the stability of the whole being destroyed by the act of cutting. We might, instead of "horsing" the plank, erect an auxiliary inclined table upon the machine table, a hole being formed in it for the saw to pass through, and the whole so arranged that though it could be freely turned around the saw—the cutting edge of the saw being preferably the axis of rotation—it would be restrained from movement in any other direction. Upon this auxiliary table the plank is placed, its upper surface marked to correspond to an oblique section of cylinders, such that the plan of lines will correspond with the plan of rail, as Fig. 6; but as this auxiliary table cannot be traversed about the machine table, the plank must have a traversing motion of its own, of such a character that though the plank may be moved anywhere about the inclined surface upon which it rests, yet any horizontal line upon it, as, for example, the minor axis of our directing curves, shall at all times be horizontal. This done, the plank can be cylindrically cut, as Fig. 8, the same as when horsed, subject, as then, to there being sufficient space under the machine arm for the plank to clear—a proviso that effectually limits the application of these methods to cases in which the inclination of the plank is extremely small, and then in very few instances would the end warrant the means.

If, instead of forming an auxiliary table to work upon the level table of the machine, the machine table can itself be inclined from the horizontal and caused to turn around the saw, as I have done in my machine, and the movements upon the table of the material to be cut can be suitably controlled, as they can be by means of my adjustable guide fence, with its double sliding action—viz., that in the direction of its length, and that transverse to the table—then, as in the manner described, any point upon the material can be brought into contact with the saw teeth, and the material advanced against the saw in such a manner as to cause the saw to cut in any required direction, the result being as before. It will also be evident that by working direct upon the machine table we gain in convenience, safety, and range of capabilities; and the table that is adjustable for one pitch is adjustable for any within its range of inclination.

As I am strongly desirous that there shall be no misapprehension in the minds of any with reference to the description given, and that the character of the cut and the principles involved in forming it shall be clearly understood, I shall, at the risk of being thought unnecessarily tedious, beg my readers' indulgence for a moment, for the sake of those, if any, who may have failed to follow me in the foregoing description, whilst I present the conditions in the form of a comparative illustration. Imagine the wreath-piece required, and the containing plank of least thickness for same fixed in space at its proper inclination and position, as Figs. 6, 7, and also a narrow saw, as a bow-saw, working vertically and cutting to guide lines upon the upper surface of the plank, the guide lines to be the projection upwards upon the inclined face of the plank of the plan of rail, Fig. 6, and the saw caused to advance in the cut, as made—then the form cut out will be that shown by Fig. 8. Suppose, next, that instead of the saw being advanced to the material and turned to suit the curve, the material is advanced to the saw and itself turned, then the same result must follow as before; the motion between saw and material being relatively the same whichever way we work. This movement of the material to the saw in the manner stated is that which it will be seen is obtained by means of my table and guide fence as described.

The method of working this machine for the production of oblique parallel cuts is further illustrated by Fig. 9, in which a block or piece of plank *a*, corresponding to that shown in Figs. 6, 7, is shown in position upon the inclined table of the machine; the inner cylindric surface having been cut and the outer cylindric surface partly cut. The block *a* is secured to the fence *b* by any suitable means; it can be secured by a screw passed through the side of the fence into the waste wood of the block, screw-holes being provided in the fence for such purposes, or in the manner I have shown. A strip of wood *c*, whose width is equal to the thickness of the plank, can be screwed to the fence and the plank secured to that, either by a couple of metal dogs *d*, *d*, or, what is often preferable, by a thin strip of wood lightly nailed to the batten *c* and the plank *a*. With various conditions various modes of attachment will readily suggest themselves to the practical workman, and need not be further dealt with here. It must be distinctly understood that any horizontal ordinate of the directing curves upon the surface of the plank must be placed horizontal when attaching the plank to the machine, and this position can always be found by placing the line parallel to the sliding plate *g* in the table. If then the sliding plate *g* and the sliding portion of the fence *b* are each free to move in the direction of their lengths, and the table is free to turn around the saw, the plank can be readily and easily cut as shown, no thought being given by the operator to the movements of slides and table, which movements take place, as it were, automatically, subject to the pressure necessary for guiding and feeding the work to the saw.

Having cut the cylindrical surfaces of the rail, the inside falling lines are next marked upon the concave side of the block, and the upper and lower surfaces of rail cut by "cradling" our block or wreath-piece upon the level table of the machine, the block being caused to turn therein, and kept axially in line with the cradle as advanced to the saw. In Figs. 10 and 11 a simple form of cradle is shown, consisting of two straight pieces of wood extending from side to side of the table, parallel to each other, and secured in position by thumb-cramps or hand-screws (not shown in drawing), so that the outer surface of the wreath-piece may bear on their inner edges and on the table, as shown. It will be noticed that the cutting edge of the saw does not intersect the axis of the cradle—*i.e.*, of rail—but will correspond in position with the lines *a b* and *c d*, Figs. 4 and 5. For this work it is necessary to use a very narrow saw having a large amount of set, as the work is all atwist. When, as in our example, the wreath is of equal pitch throughout its length, the table may be a fixture; but if the pitch varies the table must be free to turn around the saw, as otherwise the rail could not be cut to the proper line. In Fig. 10 the wreath-piece is shown in plan with one twist cut completed, and in position for commencing the other. Fig. 11 is end elevation of same. The dotted lines show position of completed wreath at end of cut.

The heading joint of wreath described is formed at right angles to the axis or falling element of rail, but it would be outside the scope of this paper to explain how this is done.

It may be objected by some that however suitable these machines may be for the production of wreaths by the so called bevel-cut system of handrailing—my illustrations being of that character—that they would be useless for the production of rails by the square-cut system of working. This is not so. What applies to one system of working will, in the main, apply to both, each system being based upon the same fundamental principles. In fact, wreaths exactly alike have been cut by these machines to the bevel and square-cut systems respectively; the waste wood removed by process of sawing being in each case glued together again in such a manner as to form a hollow case the original shape of the block, in which the wreath-piece could be replaced, making all solid as at first, the wreaths being interchangeable, each fitting either case. Several large buildings in London have also been fitted with continued rails cut to shape with this machine by the square-cut system of working.

Circle-upon-circle framing is cut in a similar manner to handrail wreaths. Thus in the case of a circular-headed frame in a circular wall, the jambs of frame being parallel on plan and crown of soffit horizontal, the intrados and extrados and the inner and outer faces of frame are cylindrical surfaces, and as such can be cut in the manner shown. If the jambs are radial on plan and the crown of soffit horizontal, then the intrados and extrados of head are twisted surfaces, and the cradle must be used.

Fig. 12 shows plan of table as applied for angular cutting, such as roofing; the sliding plate in table is parallel to the saw and free to move a determinate distance, regulated by an adjustable stop, not shown in drawing. The arrow in this and subsequent diagrams indicates direction of motion.

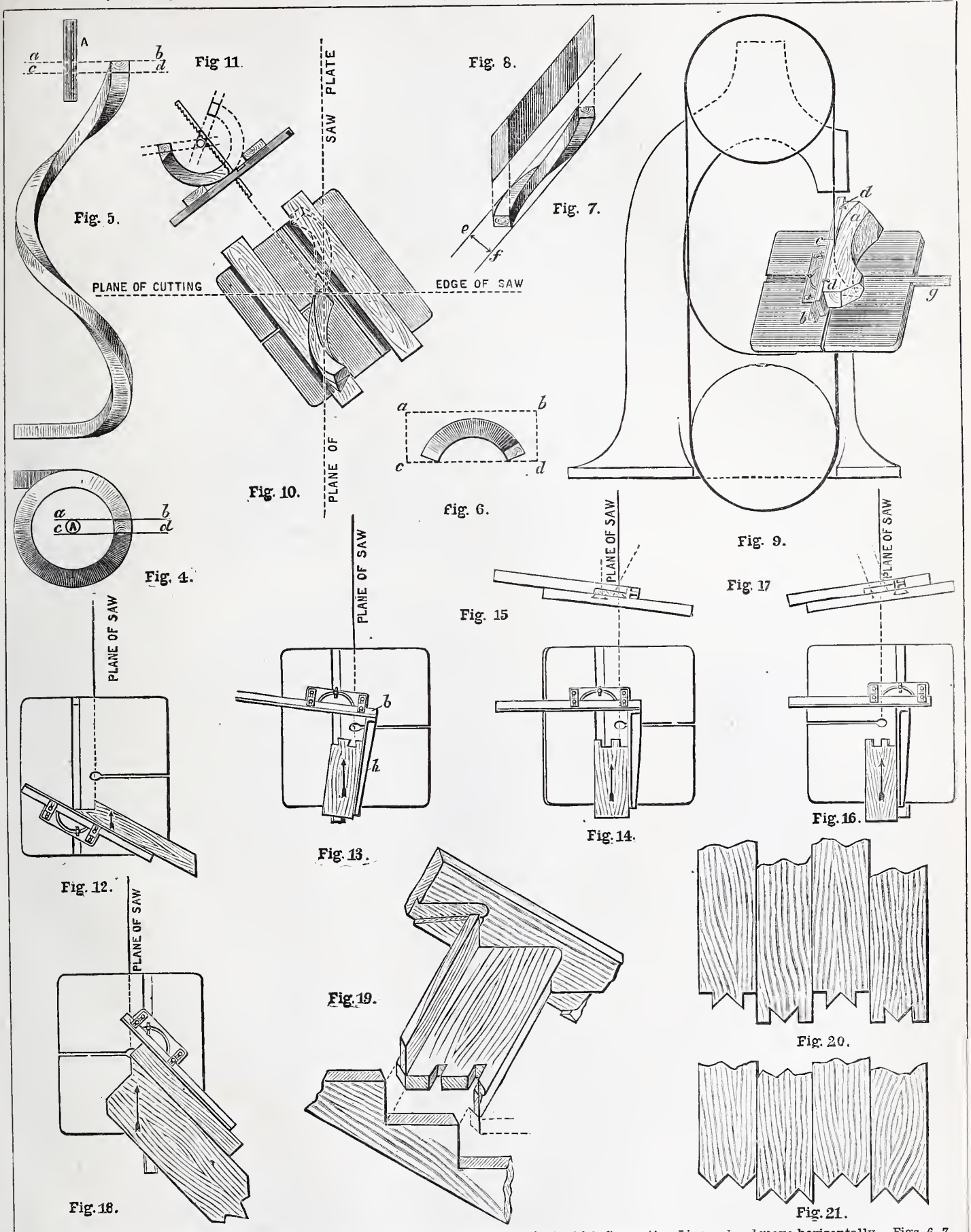
Fig. 13 is plan of table adjusted for cutting dovetails. An accessory fence *h* is here shown affixed to one end of the fence *b*, but can be affixed to either end.

Figs. 14, 15, 16, and 17 show plan and end elevation of canted table in two positions, adjusted for cutting dovetail pins. In this case the sliding plate can be made fast, and the material only moved.

Fig. 18 is plan of table as adjusted for cutting the mitres to nosings of stair-treads.

Figs. 19, 20, and 21 are illustrations of work for which these machines have been found to possess considerable advantages.

Fig. 19 is a sketch of part of a staircase, having a housed wall string-board and a cut outer string-board. The outer string is detached from the treads and risers to show the manner in which the various parts are cut, every part being cut to the required form and dimension by these machines, by the aid of the adjustable fence and stops and the sliding plate in table. The mitres to risers are cut upon a canted table, the sliding plate in table being parallel to the side of saw, and free to slide, and the fence



Figs. 4, 5.—Plan and Elevation of Handrail Wreath—A, Imaginary Cylinder against which Generating Lines *a b*, *c d* move horizontally. Figs. 6, 7.—Plan and Elevation of Portion of Rail. Fig. 8.—Edge Elevation of Plank obliquely cut to form of Cylinder. Fig. 9.—Machine with Handrail partly cut. Figs. 10, 11.—Plan and End Elevation of Table, with Wreath Piece cradled for cutting Twist Surface. Fig. 12.—Plan of Table with Fence angularly adjusted for cutting Rafters, etc. Figs. 13, 14, 15, 16, 17.—Arrangement of Table and Fence for Dovetailing and other like purposes. Fig. 18.—Ditto for cutting Mitres to Return End of Stair Ends, etc. Figs. 19, 20, 21.—Work done on this Table.

at right angles thereto. To cut the corresponding mitres in string-board, the fence must be angularly adjusted to suit the angle made by mitre with edge of string. The stopped square cut at end of treads next outer string is made with table level (as Fig. 12), but with fence at right angles to the saw or sliding plate. By adjusting the fence angularly to sliding plate (as Fig. 12), the square cuts to string-boards for treads to rest on can be made, as also the mitres to treads, by working the back edge of treads next the fence. A better arrangement for the mitres is that shown in Fig. 18—a strip of wood three or four inches wide being placed between edge of tread and fence, to which it may be secured; this to give clearance to saw between the cuts. As when cutting this way the fence is simply a guide giving no support to the material operated on, the material and fence must be held firmly together whilst cut is being made.

The dovetailed notches to treads, and dovetailed ends to balusters, can be cut as shown in Figs. 13 to 17.

Figs. 20 and 21 are two common patterns of valance-boards, used extensively for the platform roofs of railway stations, verandahs, etc.

The whole of the various operations illustrated by Figs. 12 to 21, inclusive, can be executed accurately to form and dimensions by unskilled labour, no previous marking or setting out of the work being required.

The examples here given are but a representative few of very many special to these machines, as apart from those possessed in common with other band-saw and fret-saw machines; but sufficient has been shown to give some idea of the many advantages these machines possess over other forms. It is, however, only by use of these machines that any adequate idea can be formed of their capabilities and value as labour-saving appliances.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

ACCUMULATORS OR STORAGE BATTERIES—ACCUMULATOR PLATES—CHARGING ACCUMULATORS—POCKET ACCUMULATORS.

Accumulators or Storage Batteries.—If we can ensure a constant, steady, and equable source of power to drive our dynamo machines, such as that obtainable from a good steam engine fitted with a sensitive governor, or from a water motor fed with a constant and equable flow of water, or from a large gas engine working with a constant heavy load, we shall be able to ensure steady electric lights, free from pulsating effects and flickering. But if the engine is doing other work beside electric lighting, such as driving lathes, planers, drilling machines, and drawing machines, where the work is always varying, consequent upon machines being taken off or put on at intervals, or heavy cuts being taken on the material operated on in the machines, we must not expect to have steady electric lights. At one time the speed will slow down until the red light of the lamps will be intolerable, and at another time the engine will race until the lamps twinkle with the unwonted radiancy imparted by extra current to their filaments. Such usage must shorten the existence of the filaments, and there is always a danger of total and instantaneous disruption of all or nearly all the lamp filaments when an engine races off in this manner. Under such circumstances as these, it is advisable not to attempt electric lighting direct from the dynamo machines, but to use these in the work of charging accumulators, and thus store up the surplus energy of the engine. The accumulators can be placed in circuit with the dynamo during the day, and be made to receive the surplus energy of the engine whilst it is also doing other work. At night the dynamo may be stopped, and the electric lights fed with the energy stored up in the accumulators. This is also a convenient method of obtaining an electric light after an engine has stopped running, as during a breakdown of machinery, or after the ordinary day's work has been done in the workshop. It will also solve the difficulty of obtaining electric lights from windmills and from tidal movement.

Accumulators, or storage batteries, or secondary batteries, as they are sometimes named, are not, as some persons suppose, reservoirs of electricity. They are as truly generators of electricity as any primary battery in which zinc is oxidised to generate an electric current. The electric current made to pass through the cells of an accumulator for the purpose of charging it, does not remain in those cells as a fluid, but merely passes onward, and effects in its passage a chemical change in the materials contained in the cells. This change is similar to that effected in a plating vat by electrolysis, where the electric current breaks up a salt of a metal and deposits the metal itself on the negative element in the vat. There is, however, this difference: The deposited metal on the negative element in a plating vat is usually identical with that composing the positive element in the same vat, and, being thus alike in composition, they do not form in themselves the positive and negative elements of a battery or generator of electricity as do the plates of an accumulator. At first, as in the Planté accumulator, it is true that both negative and positive plates are exact in composition, being both of sheet lead. The passage of the electric current from one to the other through a solution of dilute sulphuric acid soon alters the composition of their surfaces, for, as the oxygen of the solution is set free at the negative plates, it unites with the lead to form lead peroxide, and thus coats the negative plates with a salt that becomes highly positive to those plates which formed the positive elements whilst the cells were being charged. By frequently charging and discharging the cells of his battery, Planté "formed" the battery plates and built up his accumulator. Modern accumulators are made up in a more expeditious manner, as will be seen, but even now much time is consumed in "forming" the plates of an accumulator, or, in other words, making them fit to undergo the chemical change which converts them into the positive and negative elements of a primary battery.

Accumulator Plates.—In the accumulator invented by M. Planté, the plates were made of long strips of lead rolled on a wooden cylinder, with insulating strips of rubber placed between the plates. This roll of lead was then placed in the containing cell in a dilute solution of sulphuric acid, and a strong current of electricity passed from one plate to the other, backward and forward, until both plates had been formed. This tedious process of "forming" went on for some fourteen days, or until the surfaces of both plates had been rendered spongy. He subsequently found that he could shorten the process of forming by roughing the plates with nitric acid before making them up into a roll.

But it was left to M. Faure to discover that the process could be much more shortened by coating the plates with red lead before immersing them in the acid mixture. Since his discovery the process has received much attention from inventors, and innumerable patents have been taken out for its improvement. No real advance has been made, however, on M. Faure's discovery in substituting any other material for plates, although some important improvements have been effected in the application of lead peroxide to the plates of accumulators. It was soon found that the red lead paint put on the battery plates peeled off whilst the plates were being charged and discharged, and this peeled-off coat fell to the bottom of the cells, where it short-circuited the plates. To fix this coat securely on the plates has been the chief aim of improvers, and the many patents taken out represent various devices to secure that end. I cannot here stay to mention all the many "improved methods" of preparing accumulator plates by means of envelopes, and grids, and pastes, and perforations, but will proceed to describe one method which has the double merit of being as good as any other in its practical results, and far superior to many in its simplicity and cheapness.

The roll form of accumulator plates introduced by Planté has been superseded by the oblong form now in general use. A number of oblong plates are vertically placed in a rectangular trough or cell, parallel to each other, after being first prepared so as to ensure the plates following each other alternately positive and negative. To explain this arrangement, I will give a detailed account of how a cell may be made up:—First, then, the cell itself—that is, the vessel to contain the plates and the acid charge. This may be made of stoneware, or of wood rendered water-tight, but is best made of glass when required for general purposes. Ebonite cells are used when lightness and portability are desired, as in the small accumulators used for lighting up "gem" or "fairy" lamps. Cells made of wood will recommend themselves to amateurs and readers living away from districts in which glass cells can be procured, because wood cells can be made at home. The best wood for the purpose is teak. The planks, or boards, of teak should be at least $\frac{3}{4}$ in. in thickness for small and medium-sized cells, and 1 in. for very large cells. It must be understood at the outset that the cells have to be made not only water-tight, but also acid-proof; and this is not an easy thing to do, seeing how rapidly sulphuric acid will disintegrate woody fibre. The joints of the wood must be well made and closely fitted. The edges of the boards must be grooved and tongued when more than one width is employed. The end joints are best dovetailed. Some makers put the cells together with brass screws. After the cells are put together, they must be made water-tight and acid-proof. Where cells have been put together with screws, a little white or red lead priming may be run in the joints, and the whole cell soaked in hot linseed oil to which a little resin has been added. The most recent method of treating the cells is to put the parts together with dovetailed or morticed joints, and then soak the cells in melted paraffin wax made boiling hot. The cells are kept in this until bubbles cease from coming off the wood, when it is known

that all crevices and pores have been filled up with the hot wax. Cells may be made of *papier-mâché* and then boiled in paraffin wax to render them impermeable to acid.

The dimensions of the various parts of a cell must be determined by our requirements. If we wish to store up a large volume of electric energy, we must use large cells. It matters but very little whether we make the cell to hold a small number of large plates or a large number of small plates connected together, as regards the quantity of energy to be put in them. But experience points to the use of a large number of medium-sized plates coupled together in an oblong cell rather than a small number of large plates placed in a large square cell.

The table at foot of page will give some idea of the dimensions required :—

At first sight the dimensions of the cells would appear to be wrongly stated—the width will appear to be greater than the length. This is due to the fact of the cell being viewed from the front, with one set of terminals on the right and the other set on the left hand. In the seven-plate cell (No. 1) each plate will have a length of 12 in. and a width of 10 in. The plates will be fixed in the cell, side by side, nearly $\frac{1}{2}$ in. apart, the longest way of the plate, taking up the depth of the inside of the cell, consequently the cell must be wide enough to take the width of the plate. The cells Nos. 1 and 2 will be found most suitable for all ordinary electric light work in small installations. No. 3 will also be found a useful size. Nos. 4 and 5 are suitable for storage batteries where these have to be placed away under seats, or in other similar low recesses. Nos. 6 and 7 will be the best sizes for portable accumulators. No. 6 must be divided into four water-tight and acid proof compartments of equal dimensions, and No. 7 must be divided into eight similar compartments. Each compartment will then take the place of a separate cell, and be fitted with its own pair of plates, thus actually enclosing several cells in one box.

The plates for these cells are made of sheet lead, which may be of any thickness from $\frac{1}{16}$ in. upwards. Thinner plates are not desirable, since these are apt to buckle whilst in work. If the plates are intended for small accumulators, they may be cut to the shape shown at Fig. 64, but the plates for larger accumulators should be shaped as shown at Fig. 67, the notched lugs on each side being intended to fit on a wooden frame let into the cells to support the plates. Each plate must have a lug at the top for making connection to the main connecting bar running along over each set of plates, as shown at Fig. 68. When the plates are cut out to fit the cells, they should be mapped out into $\frac{1}{4}$ in. sections, as shown at Fig. 65, by first drawing a square with the help of a ruler and a scribing awl, and then scribing the surface with lines. A hole must next be punched in each square section, as shown at Fig. 66, and this may be done with a large bradawl by amateurs. The perforations thus made must next be filled up with a paste formed of red lead mixed with a small quantity of diluted sulphuric acid, one part acid to two of water. This should be mixed in an earthenware or stoneware vessel, and applied with a wooden spatula, pressing the paste well into the perforations and coating the plates on both sides. Set the plates aside until the coat of red lead becomes firm, then mount them in the positions they are to occupy in their respective cells. If the plates for one side of the cell are coated with a paste made of litharge and sulphuric acid instead of the red-lead paste, these may be marked at once with N on the lugs, to denote negative plates, whilst the red lead plates may be marked with P, to denote the positive, and all the negative plates should have thick rubber bands placed around them, to insulate them from the positive plates when placed in the cell. The arrangement of the whole set of plates is shown at Figs. 68 and 69. If the cell is to contain eleven plates, six of these must be negative, and their lugs must all be soldered to one thick strip of lead (as shown at Fig. 68), with one end projecting a few inches beyond the cell for convenience in connecting the plates to those in another cell. This strip should be marked N. The other five plates must be soldered to a corresponding cross strip of lead, with its free end projecting beyond the cell in the opposite direction. This strip should be marked P. The strips of wood for the supporting frame must be fitted to the plates when in position, before placing them in their cells, and their ends dovetailed together. Then these, and also the wooden grid at the bottom of the cells (on which the plates rest), should be well soaked in melted paraffin before putting the whole together and fitting in the cells.

Fig. 64.

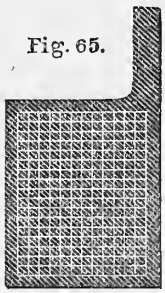


Fig. 65.

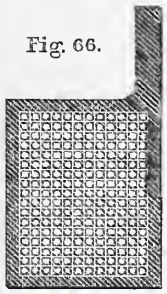


Fig. 66.

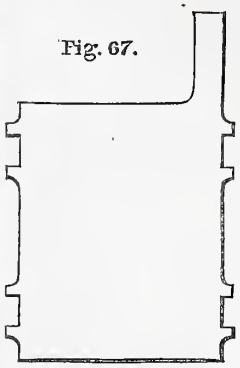


Fig. 67.

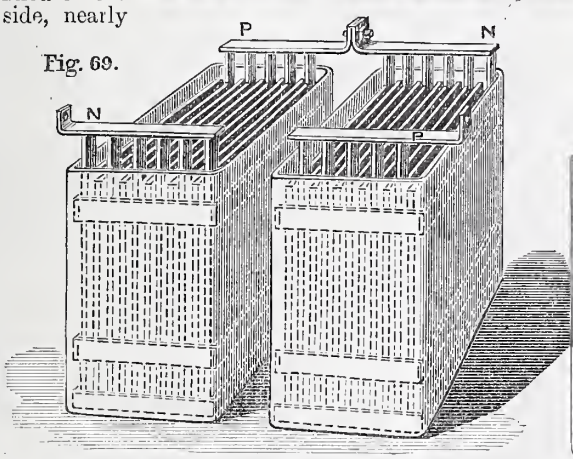


Fig. 69.

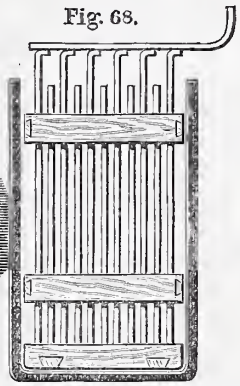


Fig. 68.

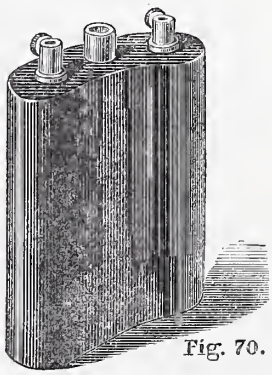


Fig. 70.

Fig. 64.—Shape of Lead Plate for Small Accumulator. Fig. 65.—Accumulator Plate marked out for Perforations. Fig. 66.—Accumulator Plate perforated. Fig. 67.—Shape of Bed-Plate for Large Accumulators. Fig. 68.—Section of Cell showing arrangement of Plates. Fig. 69.—Two Accumulator Cells connected in Series—P, Positive Plates; N, Negative Plates. Fig. 70.—Cathcart and Peto's Pocket Accumulator.

The cells may now be filled with the charging fluid, which is composed of one part sulphuric acid in four parts of water; or, in other words, sulphuric acid diluted with from 75 to 80 per cent. of water.* The mixture should be made in a strong and large vessel capable of withstanding the sudden expansion caused by an evolution of scalding heat generated in the water by mixing it with sulphuric acid, and this is best made of wood lined with lead, the seams being burnt, not soldered. The acid must be poured slowly and carefully into the water whilst this is being stirred with a stick. As the acid is very corrosive and very destructive to clothing, even when thus diluted with water, great care must be exercised in handling it and its solutions. The best antidote to its corrosive action is liquor ammonia, diluted with ten times its bulk of water to prevent the stinging effect of its fumes on eyes and nostrils. The mixture must be poured into the cells carefully and brought up nearly, but not quite, to the tops of the plates. The cells are now ready to be charged with electric current.

Charging Accumulators. — Before we connect up the plates of the accumulator to the dynamo selected to charge them, it will be advisable to

TABLE SHOWING DIMENSIONS, ETC., OF ACCUMULATORS.

	External Dimensions.			*Number*	*Weight*	*Weight when*	*Capacity in*
No.	Length.	Width.	Height.	*of Plates.*	*of Acid.*	*complete.*	*amp. hours.*
1	$5\frac{3}{4}$ in.	13 in.	$17\frac{1}{2}$ in.	7	13 lbs.	74 lbs.	130
2	$7\frac{1}{2}$,,	13 ,,	$17\frac{1}{2}$,,	11	25 ,,	107 ,,	220
3	$8\frac{3}{4}$,,	$8\frac{1}{4}$,,	$11\frac{3}{4}$,,	15	14 ,,	52 ,,	95
4	6 ,,	$13\frac{1}{2}$,,	$6\frac{1}{2}$,,	9	$8\frac{1}{2}$,,	38 ,,	72
5	$9\frac{1}{2}$,,	$13\frac{1}{2}$,,	$6\frac{1}{4}$,,	15	14 ,,	62 ,,	136
6	9 ,,	$8\frac{7}{8}$,,	$13\frac{3}{4}$,,	8	$4\frac{3}{4}$,,	54 ,,	18
7	$16\frac{3}{4}$,,	$9\frac{1}{4}$,,	$13\frac{1}{2}$,,	16	$9\frac{1}{2}$,,	104 ,,	18

* The solution for charging the cells should have a specific gravity of not less than 1·130, nor more than 1·170.

clearly understand what happens in the cell of an accumulator when an electric current is passed through its plates and solution. The red lead put on the positive plates is composed of three parts lead and four parts of oxygen. On adding the dilute sulphuric acid to form the paste, this red lead is decomposed into brown lead, composed partly of lead sulphate and partly of brown oxide of lead. The paste on the positive plates is therefore really an oxide and a sulphate of lead, whilst that on the negative plates is oxide of lead if litharge instead of red lead has been used in making the paste for the negative plates. On sending the charging current from the positive to the negative plates, a part of the paste on the positive plates is converted, first into oxide of lead, and then, as the charging proceeds, into a higher oxide of lead containing four parts of oxygen to one part of lead. At the same time a part of the lead oxide paste on the negative plates is converted into spongy lead. The positive plates will therefore, at starting the charge, have a dark brown appearance, with white blotches on the brown coat, and the negatives the yellowish appearance of litharge. As the charging proceeds, the brown of the positive plates changes to chocolate, then plum colour, and finally, when fully charged, to the colour of wet slate. The negatives change from yellow to a slate colour, which becomes a more decidedly lead tint as the charging advances. We therefore convert the lead sulphate coating of one set of plates into a coating of lead oxide, and reduce the lead oxide on the other set of plates to pure spongy lead. As this spongy lead has an affinity for oxygen, and the highly oxidised plates on the opposite side are ready to part with their oxygen, we have formed, by electrical energy, two chemical compounds capable of effecting an exchange of their constituents under favourable circumstances, and giving out in this interchange a current of electricity.

If plates of the Planté type are used, the sulphate of lead, as well as the lead oxide, has to be formed on them by electrolytic action, hence the necessity of frequent reversals to "form" both plates. If red lead is used on both plates, intead of red lead on the positive and litharge on the negative, a similar reversing process must be adopted at the outset to convert the lead sulphate into lead oxide on the negative plate.

During the process of charging the cells, there is created in the cells themselves an opposing force to the charging current. This is known as the counter or back E.M.F. of the cells. It is low at first, but gradually rises as the charging proceeds, until at the last, when the cells are fully charged, it reaches as much as from 2·2 to 2·5 volts per cell. In choosing a current to charge the cells, we must therefore take into consideration the maximum counter E.M.F. of all the cells (if these are to be charged in series, as arranged in Fig. 69), and see to it that the E.M.F. of the charging current exceeds by ten per cent. the combined E.M.F. of the charged cells. The volume of current required in charging accumulators should be at the rate of $5\frac{1}{2}$ ampères per square foot of positive surface. Less than this will do no harm to the plates, but a larger current is liable to cause buckling of the plates through unequal expansion. When this takes place, the coating peels off in patches, and the plates are ruined. If, therefore, a small accumulator with seven plates (each 12 in. by 12 in.) is about to be charged, we should employ a generator capable of giving a current of 16 ampères at a pressure of from three to five volts, because there are three positive plates in the cell, and each will take $5\frac{1}{2}$ ampères of current. If we have more cells than one to charge, it is best to arrange them in series up to within ten per cent. of their combined maximum voltage, and to charge them thus with a generator having a voltage ten per cent. above the combined voltage of the cells in series. Thus, if we have ten cells of the size mentioned above, and have a dynamo capable of giving a current of 16 ampères at a pressure of 15 volts, the cells must be arranged in series of five, and only one set charged at a time. If the voltage of the dynamo is over 30, the whole ten cells may be arranged in series. Even then it must be distinctly understood that a shunt-wound dynamo must be employed, and the current switched off at once should the machine stop, as also when the charging is complete. Unless this is done, the charged cells will discharge themselves by way of the commutator on a shunt-wound machine and injure the plates by a too rapid discharge; or discharge themselves through the coils of a series or compound-wound machine, and burn up the insulation of the coils as well as reverse the polarity of the field magnets. Automatic switches and governors are made and sold by dealers in dynamo machines to prevent accidental reversals of the current from accumulators.

The charging current should have a low E.M.F. at starting, or the volume passing into the cells be controlled by a resistance board to prevent a rush of current and buckling of plates. As the charging proceeds, the full current should be switched on, or the E.M.F. raised by increasing the speed of the machine until the maximum has been reached. The colour of the plates will change during the process of charging, as previously noted, and this will indicate the progress made. As the charge approaches completion, the solution in the cells becomes agitated and appears to boil. This may be continued for some time without injury, unless the boiling commences at the outset. If this happens, stop the charging for a short time, and commence again with a current of lower pressure. The cells should always be charged until this boiling appearance is well pronounced, but a long period of over-charging should be avoided. These are the main points to be noticed in charging and forming accumulators, but there are many little hints and wrinkles required to ensure success under the special conditions which crop up from time to time in practice. I have not space to notice these here, but have pleasure in referring my readers to an excellent little work on the "Management of Accumulators," by Sir D. Salomons, price 5s., in which most of those difficulties are met and explained.

Pocket Accumulators.—These differ from those already described, only in the kind of vessel employed as a cell. The cells in general use are made of ebonite, of book form, or curved to fit the pocket, as shown at Fig. 70. Such cells are not easily made by amateurs from ebonite. They are made and sold by Messrs. Cathcart and Peto, 57B, Hatton Garden, London, E.C., in the following sizes:—

No.	*Weight.*	*Dimensions.*	*Capacity in amp. hours.*	*Voltage.*	*Price.*
No. 2	11 oz.	$2\frac{7}{8}\times1\times4$ in.	2	2	10s.
3 S	$15\frac{1}{2}$,,	$3\frac{3}{4}\times1\times4$,,	3	2	13s.
3 D	$15\frac{1}{2}$,,	$3\frac{3}{4}\times1\times4$,,	$1\frac{1}{2}$	4	21s.

The same firm make and sell portable accumulators for table lamps, carriage lamps, and other similar purposes. Amateurs wishing to try their hands at making pocket accumulators, can make fairly good ones out of thick sheet gutta-percha. This should be soaked in hot water until soft, then moulded on a slab of polished slate or marble cut to the size of the intended cell. The softened sheet, or pieces of sheet cut to the required sizes, are moulded to the shape of the slab and then allowed to harden. All joints are then to be caulked with a hot iron and thus made acid-tight. The plates are prepared as already directed and enclosed in the cell, which is then sealed with a cover of gutta-percha, leaving one or two holes for the solution, which are also sealed after the solution has been poured in the cell. If the cell is divided into two acid-proof compartments, with a pair of plates in each part, a four-volt cell may be obtained.

Hints on working accumulators must stand over to my next paper, in which I hope to show how to fit up electric light installations.

THE ART AND PRACTICE OF SCENE PAINTING.

BY WILLIAM CORBOULD.

FLAT OR LOCAL COLOURING — DISTANCES — REFLECTIONS — ROADS — SHADOW COLOURS — GLAZES—LANDSCAPE SCENERY—PRODUCTION OF EFFECTS IN FOLIAGE.

Flat or Local Colouring.—The artist is now ready to lay in all the flat or local colouring, and, as I have said before, the outlines will remain perceptible through all the colouring until the finish.

The great object in beginning this part of your work is the perspective. The painter must lay in the first colours with this firmly fixed in his mind; for instance, the colours of the foreground are strong and bold, but the middle distance would be very much less so, and the third distance would get quite grey in tone.

Distances.—It is far better, if the artist can do it, to lay in the most distant objects, such as mountains or undulating hills, pasture lands, the sea, distant lakes, etc., etc., with as little delay as possible. These should be painted in while the horizon colours, and the grey tints that are being used are still wet, and then the whole, in drying up together, gives that aerial perspective that is so necessary, but which could not be obtained in an after-painting.

All the distances, especially the farthest, must be low in tone—that is, they must present only a slightest indication of colour—the sky colours being used freely with the tints that are employed for the distances. Supposing it is a green that is being used for very distant pasture land, or foliage, the said greens would be quite grey. I do not mean that the artist is to mix the distant colours with the blues and greys, but to lay them on in juxtaposition, reducing the grey tints and using the colours stronger as he gets more to the foreground. He thus keeps up his perspective, and by taking notice of these instructions makes the scene natural to the eye. With a little patience and perseverance he will soon be successful in pleasing himself and others also. The hand is but the servant of the eye. Every artist has a different way of working practically—that is to say, he falls into tricky ways of his own. As we go on, I shall explain a few ways of using the brush to produce certain effects, which, perhaps, could not be got by

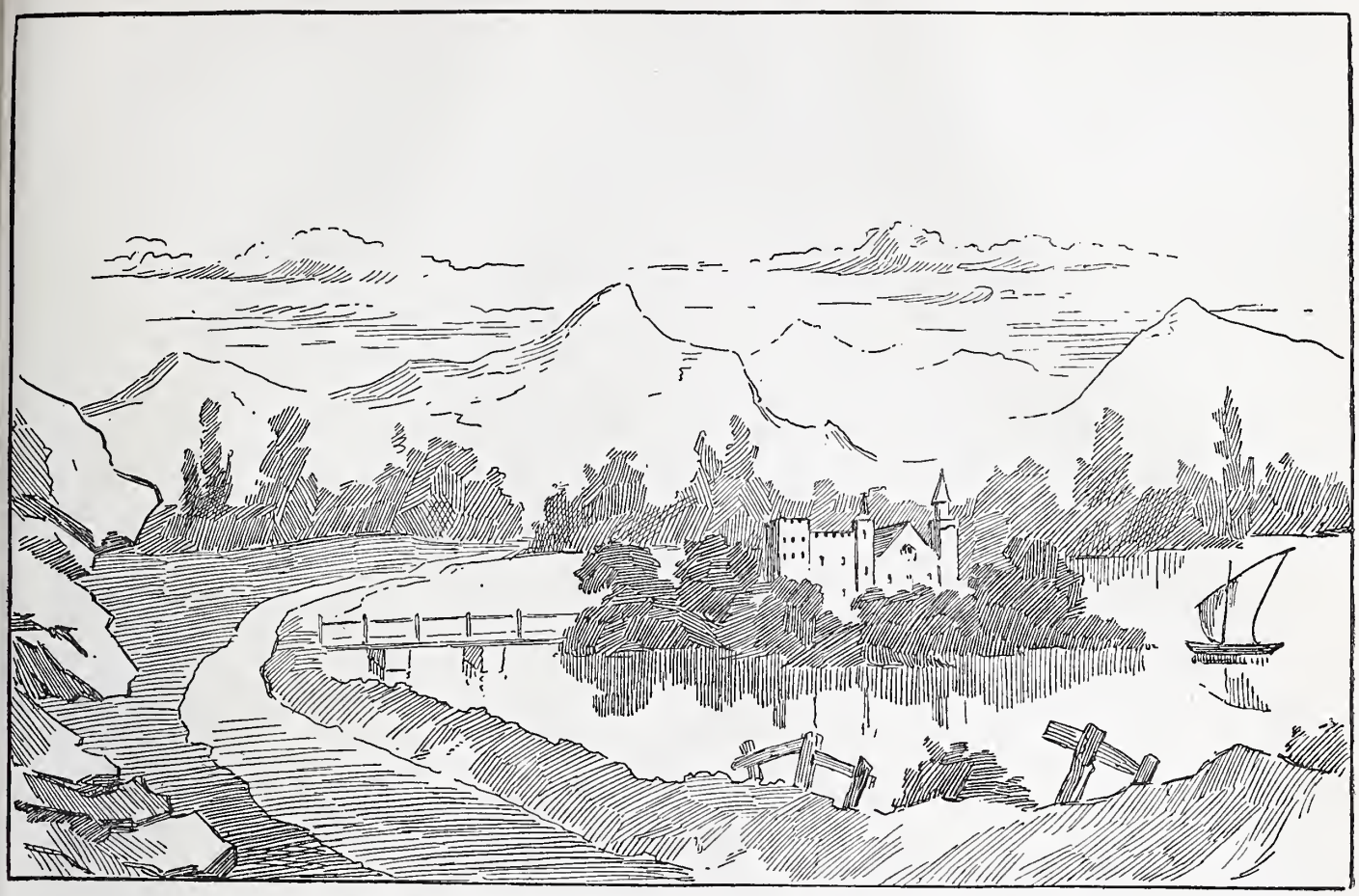


Fig. 1.—Sketch showing Scene with all the First or Local Colouring laid on and the Sky finished.

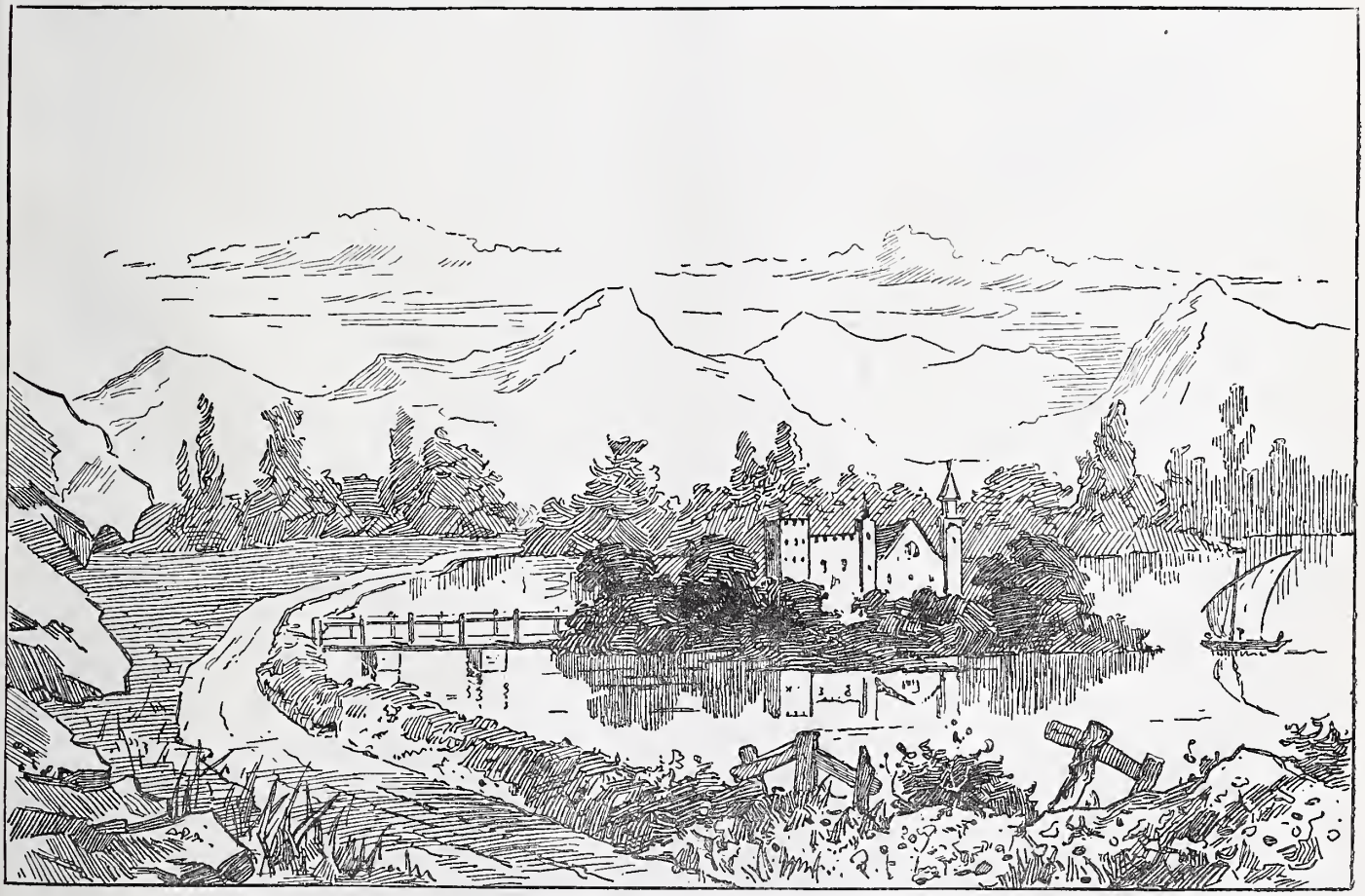


Fig. 2.—Sketch showing appearance of Scene when completely finished.

niggling over them for an hour or more, but which may be done with one touch of the brush and be far more effective.

Reflections.—Should the artist have water in his scene, whether river, lake, or the sea, he should always lay it in flat with the sky colours; and whatever objects are reflected in the water, the reflections must take the same colours as the objects themselves. A large sheet of still water is a natural looking-glass; and if the scene around it be mountainous, perhaps deeply wooded here and there, or picturesque buildings, or a beautiful sky, every object will be reflected in its own colours. When painting such objects it would be as well to paint their reflections at the same time. A fine white line, or a ripple on the surface over the reflections and shadows, will give transparency and depth. The artist will get the necessary effects after a little practice.

Roads.—In our scene we have a road winding round the lake, and losing itself in the distance. I have chosen this road as a lesson in colouring in perspective—that is to say, the road must appear flat and recede into the distance. Take burnt sienna, and white, and a little umber, or vandyke brown — burnt sienna might be a little too red for the road—and very little of either vandyke brown or umber will tone it to anything.

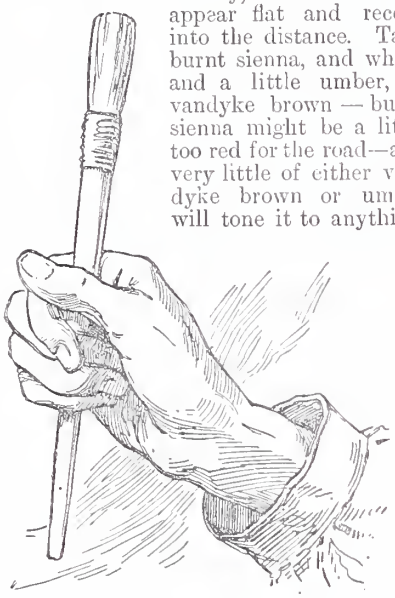


Fig. 3.—Mode of using Brush to produce Effects in Foliage.

This is for the foreground of the road. Lay this at the bottom, and as the artist gets higher up, let him use yellow ochre, or raw sienna and white, adding more white as he proceeds upwards, and a little grey in the far distance. As the road disappears from view, by graduating the colours as I have described, it will appear flat and in perspective.

Assuming that the scenic artist has now covered the whole of the cloth with the local colouring, he will have now brought his work to its third stage, as shown in Fig. 1, ready for finishing, as shown in Fig. 2.

Shadow Colours.—First of all, there are one or two colours that he had better prepare, such as the shadow colour, which is a thin glaze of indigo, or a little celestial blue subdued with a very little vegetable black, or vandyke brown, which should be brought to about the same tint as indigo. This shadow colour must be perfectly transparent, and of a bluish tinge. The best way to try the strength of this tint is to pass the brush over the back of the hand, leaving the colour on the hand. You should be able to see the hand distinctly through the colour. When using this colour, keep it well stirred, as the blue will sink to the bottom, and the artist will fail to get an even tint. In making this colour, do not use much size, as it must be liquid to flow evenly.

Glazes.—The remarks just made apply equally to the following colour as well. Take another clean pot and mix some celestial blue with a little size and water. This is for glazing and working in and under foliage. If you look under or through the branches of trees, shrubbery, hedgerows, or any mass of foliage, particularly an avenue of trees, you will see a bluish, misty shadow. If this tint is mixed and used properly, you will get the desired effect.

Take another pot, and mix some yellow ochre and damp lake with size and water, to be used also as a glaze, but not too strong in colour. This is for glazing the parts of foliage where the sun's rays are shining through. More or less red—that is to say, damp lake—should be used in the yellow according to the tints of the sky: for instance, if it were a sunset that the artist were depicting, he should glaze with nearly all lake, if a red sky; but if a yellow sky, yellow ochre would predominate, according to the brightness of the sky and clouds. This is another point in which, with practice, the artist's own taste and judgment will aid him.

Landscape Scenery.—The different greens required for landscape scenery are compounded with several colours, such as indigo and Dutch pink. A splendid set of greens can be got from these two colours; celestial blue and azure blue, as well as indigo, will, in combination with burnt sienna, raw sienna, and the yellows, produce good useful greens. Avoid raw, cold-looking greens. We know at one time of the year, at least, the trees are green, but a little burnt sienna, or damp lake, or the yellows judiciously used, will take off the raw, cold look. The under side of the leaves are much paler and less glossy than the upper surface. When moved by the slightest breeze, they all catch up, as it were, different lights and tints in the sky, producing all those beautiful tints seen in good painting.

Production of Effects in Foliage.—The scene painter has many ways of producing certain effects by the tricky way in which he uses his brushes. I will here explain two or three ways to get a few effects which would never be obtained by niggling over them. Take the foliage brush, fill it with colour by laying one side of the brush in green, and the other side in red or yellow—that is to say, burnt sienna, or damp lake, or one of the yellows, lemon or orange—so that there are two distinct tints in the brush. Let the artist balance the brush between his thumb and forefinger as shown in Fig. 3. Now by patting the brush on the canvas, the brush rolling backwards and forwards on the finger, the painter will in this way produce the touch required to represent leaves, and in two different tints; and as each leaf has its light and shade he gets it in this way. When this part of the work is quite dry he may glaze over with sunlight, or shadow colour, as the case may be, according as he is working on the part in the light or shadow. When dry, he may again use his foliage brush to put on more leaves; and in this way he may get as much depth and boldness as he pleases. Tone down the branches and foliage farthest from the eye, using brighter colours on the front foliage, as, by this, flatness is avoided, and the trees are made to appear round as in Nature. For the branches, twigs, and other dark markings of the trees and foliage, use brown lake with celestial blue, more or less of either being used according to the depth of colour required, touching and marking them with high light colours where the light may catch them. When the branches of trees are buried in the foliage and shadow, they will look almost black at a little distance. The trunks of some trees are very rugged, and must be boldly painted and well marked out, as well as being brought into strong relief by light and shadow. For hedgerows, shrubbery, and all foliage with small leaves, use smaller foliage brushes. Some trees have much larger leaves than others, and to paint these, the artist will require larger brushes. Sometimes the leaves differ in shape, but it is not necessary they should be depicted with accuracy of form and outline like an illustration in a work on Botany. Still, every kind of tree has a distinct form on the landscape. The reader may buy at any artist's colour shop a small work, "Outlines of Foliage"—I think by Birket Foster, and published by Winsor and Newton. This book would be found useful by all intending scene painters.

THE JURORS' AWARDS, "WORK" EXHIBITION, 1890-91.

COMPLETE AND CORRECT OFFICIAL LIST.

THE Proprietors of WORK have the pleasure to announce that the following Prizes and Honours have been awarded by the Jurors as under:—

GOLD MEDAL for best Exhibit in whole Exhibition, with first-class Certificate, Mr. THOMAS COATES, *Peckham.*

SILVER MEDAL for second best Exhibit in whole Exhibition, with first-class Certificate, Mr. R. A. McFEETER, *Southport.*

EXTRA BRONZE MEDAL for third best Exhibit in whole Exhibition, with second-class Certificate, Mr. J PYVES, *Westminster.*

GROUP I.—WORK IN WOOD.

SILVER MEDAL, 21s., and first-class Certificate for best Exhibit in Group, Mr. R. A. McFeeter, *Southport.*

FIRST-CLASS CERTIFICATE for second best Exhibit in Group, Mr. H. Selmes, *Eastbourne.*

IN DIVISION A (FURNITURE).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate:—
Workman's—Mr. F. Holliday, *Norwood.*
Apprentice's—Mr. G. J. White, *Leytonstone.*
Amateur's—Mr. N. T. Lee, *Battersea.*

Extra Prizes for Carving:—
Amateur's—Mr. J. R. Hall, *Carnforth.*
" —Mr. G. Howard, *Darlington.*

Extra Prize for Fretwork:—
Amateur's—Mr. W. Ironside, *Laurencekirk.*

Extra Prize for Turning:—
Workman's—Mr. W. Gleeson, Cardiff.

FOR SECOND BEST EXHIBITS. — Second-class Certificate of Honourable Mention:—
Workman's—Mr. W. E. George, *Sutton.*
Apprentice's—Mr. H. Tomkinson, *Birmingham.*
Amateur's—Mr. C. W. Selves, *Sydenham.*

Extra Prize for Carving:—
Amateur's—Mr. R. D. Dugdale, *Carnforth.*

Extra Prize for Fretwork:—
Amateur's—Mr. J. T. Willis, *Sunderland.*

FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention:—
Workman's—Mr. J. P. Lunn, *Stepney.*
Apprentice's—Mr. J. G. Borrows, *Islington.*
Amateur's—Mr. T. Evans, *Carnforth.*

Extra Prize for Carving:—
Amateur's—Mr. A. T. Castle, *Rochampton.*

Extra Prize for Fretwork:—
Amateur's—Mr. W. H. Saunders, *Wetley.*

IN DIVISION B (WOOD PATTERNS FOR CASTINGS, MODELS FOR FORGING, ETC.).

FOR BEST EXHIBIT.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate:—
Workman's—Mr. A. E. Turner, *Gloucester.*

FOR SECOND BEST EXHIBIT. — Second-class Certificate of Honourable Mention:—
Workman's—Mr. C. B. Maltby, *Sheffield.*

*** Entries by Apprentices, *one;* by Amateurs, *none.* No Awards.

IN DIVISION C (CARTS, CARRIAGES, ETC.).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate:—
Workman's—Mr. H. Selmes, *Eastbourne.*
" —Mr. F. A. Witham, *Kilburn.*

FOR SECOND BEST EXHIBITS. — Second-class Certificate of Honourable Mention:—
Amateur's—Mr. C. H. Vanner, *Bethnal Green.*
" —Mr. W. R. Harland-Church, *Notting Hill.*

*** No Entries by Apprentices. Entries insufficient for Third-Class Prizes.

GROUP II.—WORK IN METAL.

SILVER MEDAL, 21s., and first-class Certificate for best Exhibit in Group, Mr. T. Coates, *Peckham.*
FIRST-CLASS CERTIFICATE for second best Exhibit in Group, Mr. W. Surman, *New Cross.*

IN DIVISION A (DECORATIVE).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. W. E. Turner, *Birmingham.*
Apprentice's—Mr. T. Blatcher, *London, W.*
Amateur's—"Opifex" (Rev. W. Falkiner), *Navan.*
FOR SECOND BEST EXHIBITS. — Second-class Certificate of Honourable Mention :—
Workman's—Mr. J. S. Barwick, *Plymouth.*
Apprentice's—Mr. H. F. Boult, *Euston.*
Amateur's—Rev. C. C. Ellison, *Lincoln.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—
Workman's—Mr. W. E. Dobner, *Thirsk.*
Apprentice's—Mr. J. Drielsma, *Hackney.*
Amateur's—Mr. T. Holt, *Nottingham.*

IN DIVISION B (ARMS, ARMOUR, ETC.).

FOR BEST EXHIBIT.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. W. E. Main, *London.*
FOR SECOND BEST EXHIBIT. — Second-class Certificate of Honourable Mention :—
Workman's—Mr. C. Thurkle, *Clapham Junction.*
*** Entries by Apprentices, *none;* by Amateurs, *none.* No further Awards.

IN DIVISION C (MISCELLANEOUS).

FOR BEST EXHIBIT.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. C. E. Turner, *Birmingham.*
Amateur's—Mr. T. Coates, *Peckham* (also First Prize in Group).
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. W. Osborne, *Birmingham.*
Amateur's—Not Awarded.
*** No Entries by Apprentices. Entries insufficient for third-class Prizes.

GROUP III.—TOOLS FOR WORK.

SILVER MEDAL, 21s., and first-class Certificate for best Exhibit in Group, Mr. D. Low, *Blairgowrie.*
FIRST-CLASS CERTIFICATE for second best Exhibit in Group, Mr. C. Holmes, *Waterloo.*

IN DIVISION A (HAND TOOLS).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. E. Higgs, *Camden Town.*
Amateur's—Major J. D. Lysaght, *Queenstown.*
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. A. Cheek, *Hoxton.*
No Apprentice's Entry forthcoming.
Amateur's—Mr. G. Pope, *Leeds.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—
Workman's—Mr. J. S. Grant, *Bolton.*
No Apprentice.
Amateur's—Mr. A. J. Eade, *Edenbridge.*

IN DIVISION B (MACHINE TOOLS).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. W. Welbon, *Newcastle.*
Apprentice's — Mr. A. Leonard, *Tavistock Square.*
Amateur's—Tie :
Mr. J. W. Rhodes, B.A., *East Liss.*
Mr. J. E. Galliford, *Walthamstow.*
FOR SECOND BEST EXHIBIT. — Second-class Certificate of Honourable Mention :—
Workman's—Mr. E. Whibley, *Peckham.*
*** No further Entries noticed by Jurors.

IN DIVISION C (TOOLS FOR SHARPENING TOOLS, APPARATUS, ETC.)

No Entries to justify Awards.

GROUP IV.—WORK IN ORIGINAL DESIGN.

SILVER MEDAL, 21s., and first-class Certificate for best Exhibit in Group, Mr. C. F. Davis, *Lisson Grove.*
FIRST-CLASS CERTIFICATE for second best Exhibit in Group, Mr. W. Farr, *Reading.*

IN DIVISION A (DECORATIVE).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. C. F. Davis, *Lisson Grove.*
Apprentice's—*Nil.*
Amateur's—*Nil.*
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. E. J. Williams, *Birmingham.*
Apprentice's—Not awarded.
Amateur's—Not awarded.
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—Not awarded.

IN DIVISION B (ARCHITECTURAL).

FOR BEST EXHIBIT.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. W. A. Burrow, *Bradford.*
FOR SECOND BEST EXHIBIT.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. S. J. Speller, *Frome.*
*** No Awards beyond these.

IN DIVISION C (MECHANICAL AND ENGINEERING).

FOR BEST EXHIBIT.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. Farr, *Reading.*
Amateur's—Mr. Whibley, *Peckham.*
FOR SECOND BEST EXHIBIT.—Second-class Certificate of Honourable Mention :—
Amateur's—Sergt.-Major Barry, *Brockley.*
*** No other Awards.

GROUP V.—WORK IN PRINTING.

SILVER MEDAL, 21s., and first-class Certificate for best Exhibit in Group, Mr. F. Simpson, *Corbridge.*
FIRST-CLASS CERTIFICATE for second best Exhibit in Group, Mr. G. Kipling, *London, N.W.*

IN DIVISION A (ACTUAL PRINTING AND APPARATUS).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. T. Powell, *Hoxton.*
Apprentice's—Mr. A. A. G. Francis, *Brompton.*
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. R. A. Allen, *Islington.*
Apprentice's—Mr. J. J. Mason, *Holborn.*
Amateur's—*Nil.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—No Awards.

IN DIVISION B (DESIGNING OR DRAWING FOR ENGRAVING OR PRINTING).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. T. S. Routledge, *Liverpool.*
Apprentice's—Mr. G. Kipling, *London, N.W.*
Amateur's—Mr. J. Williams, *Haverstock Hill.*
Extra Prize :—
Amateur's—Miss H. M. Rigby, *Chester.*
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. White, *Canonbury.*
Apprentice's—Mr. H. Feltham, *Brixton.*
Amateur's—Mr. T. E. Petley, *London, N.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—
Workman's—Mr. F. C. Jessop, *Masborough.*
Apprentice's—Mr. J. F. Offord, *Dalston.*
Amateur's—Mr. H. J. Gayton, *Northampton.*

IN DIVISION C (BOOKBINDING).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. W. Appleby, *Chatham.*
N.B.—No further Awards.

GROUP VI.—WORK IN DOMESTIC APPLIANCES.

SILVER MEDAL, 21s., and first-class Certificate for best Exhibit in Group, Rev. C. C. Ellison, *Lincoln.*
FIRST-CLASS CERTIFICATE for second best Exhibit in Group, Sergt.-Major Barry, *Brockley.*

IN DIVISION A (DECORATIVE).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workwoman's—Mrs. Hodgkin, *Manchester.*
Apprentice's—Mr. A. McCallum, *Helensburgh.*
Amateur's—Rev. C. C. Ellison, *Lincoln.*
Extra Prize, Miss A. M. Burgess, *Frome.*
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. F. C. Jessop, *Masborough.*
Apprentice's—No Award.
Workwoman's — Miss D. Barton, *Regent Street, W.* (Highly commended.)
Extra Prizes, Amateur's—Tie :
Mrs. E. M. Atkinson, *Liverpool.*
Miss H. B. Russell, *Egremont.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—
Amateur's—Ties :
Mr. T. S. Hartley, *Dalston.*
Miss C. Wilkinson, *Kilmessan.*
Miss N. Borrows, *Islington.*

IN DIVISION B (HOME COMFORT AND CONVENIENCE).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. J. Telfer, *Liverpool.*
Apprentice's—No Entries.
Amateur's—Miss E. Maybank, *Sutton.*
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. P. Gross, *Chelsea.*
Amateur's—Mr. J. W. Mumby, *Halifax.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—
Workman's—Mr. W. Osborne, *Birmingham.*
Amateur's—Mr. A. F. Winch, *Oldham.*

IN DIVISION C (HOME RECREATION, TEACHING, ETC.).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Sergt.-Major Barry, *Brockley.*
Apprentice's—Mr. W. G. Puleston, *Dalston.*
Amateur's—Mr. W. Carter, *Birmingham.*
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. A. A. Hollis, *Erith.*
No Apprentice's entry.
Amateurs—Mr. H. S. Nobbs, *Wood Green.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—
No Workman's entry.
Amateur's Mr. G. Mallett, *Wisbech.*

IN DIVISION D (APPLIANCES FOR THE SICK OR AFFLICTED: DEAF, DUMB, BLIND, OR CRIPPLED).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. J. H. Edwards, *West Kensington.*
Apprentice's—Mr. A. Dugon, *Brockley.*
Amateur's—Mr. J. H. Clymer, *Willesden.*

GROUP VII.—WORK IN WEARING APPAREL.

SILVER MEDAL, 21s., and first-class Certificate for best Exhibit in Group, not awarded.
FIRST-CLASS CERTIFICATE for second best Exhibit in Group, not awarded.
FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. G. Moore, *Lambeth.*
No Apprentice's award.
Amateur's—Mrs. J. L. Barker, *Walham Green.*
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Tie :
Mr. T. W. Forster, *Acklington.*
Mr. W. Morgan, *Chester.*
Apprentice's—No Award.
Amateur's—Ties :
Miss L. B. Rigby, *Whitcombe.*
Miss M. Nancollas, *St. Austell.*
Miss A. McCallum, *Helensburgh.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—
Amateur's—Tie :
Miss A. L. King, *Regent's Park.*
Miss M. Borrows, *Islington.*

GROUP VIII.—WORK IN PAINTING AND DECORATING.

SILVER MEDAL, 21s., and first-class Certificate for best Exhibit in Group, Mr. J. C. Mitchell, *Exeter.*
Extra do., Miss A. B. Woodward, *Chelsea.*
FIRST-CLASS CERTIFICATE for second best Exhibit in Group, Mr. F. W. Sharp, *Windsor.*

IN DIVISION A (PAINTINGS, DRAWINGS, STAINED GLASS, ETC.).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. C. F. Davis, *Lisson Grove.*
Apprentice's—Mr. R. Love, *Dundee.*
Amateur's—Miss A. B. Woodward, *Chelsea.*
Extra Prize :—
Amateur's—Mr. J. M. J. Dacombe, *Bournemouth.*
Extra Prize :—
Amateur's—Mrs. E. Green, *Norwood.*
FOR SECOND BEST EXHIBITS.—Second-class Certificate of Honourable Mention :—
Workman's—Mr. H. A. Barnes, jun., *Harrow.*
Apprentice's—No Award.
Amateur's—Mr. R. Butler, *Hertford.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—
Workman's—Mr. H. A. Barnes, *Harrow.*
Apprentice's—No Award.
Amateur's—Miss M. S. MacLean, *Lee.*

IN DIVISION B (HOUSE PAINTING, GRAINING, MARBLING, DECORATING, ETC.).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Mr. R. A. Dickson, *Bermondsey.*
Apprentice's—Mr. T. I. Mitchell, *Exeter.*
Amateur's—Mr. T. W. Taylor, *Birmingham.*
FOR SECOND BEST EXHIBITS. Second-class Certificate of Honourable Mention :—
Workman's—Mr. R. Ogilvie, *Elgin.*
Apprentice's—Mr. T. H. Jarman, *Margate.*
Amateur's—Mr. H. Crudgington, *Islington.*
FOR THIRD BEST EXHIBITS.—Third-class Certificate of Honourable Mention :—
Workman's—Mr. F. Kell, *Woodbridge.*
Apprentice's—Mr. A. C. Stroud, *Abingdon.*
Amateur's—Mr. W. A. Sell, *Wandsworth.*

IN DIVISION C (MISCELLANEOUS).

FOR BEST EXHIBITS.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate :—
Workman's—Willcox Bros., *Blackfriars.*
No Apprentices' Award.
Amateur's—Mr. G. H. Marshall, *Leeds.*
*** No other Awards.

GROUP IX.—WORK IN TEXTILE FABRICS AND LEATHER.

SILVER MEDAL, 21s., and first-class Certificate for best Exhibit in Group, Mr. T. Pyves, *Westminster.*

First-Class Certificate for second best Exhibit in Group, Mr. E. Lawrence, *Chelsea.*

In Division A (Fabrics).

For Best Exhibits.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate:—
Workman's—No Awards.
Apprentice's—No Awards.
Amateur's—Mr. W. J. Twist, *Royal Mint.*
For Second Best Exhibits.—Second-class Certificate of Honourable Mention:—
Workman's—No Awards.
Apprentice's—No Awards.
Amateur's—Tie:
Mr. H. Harris, *London Salvage Corps.*
Mr. J. Pugh, *Hoxton.*
No Third-class Certificate of Honourable Mention awarded.

In Division B (Leather, etc.).

For Best Exhibits.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate:—
Workman's—Mr. H. R. Hosking, *Forest Gate.*
Apprentice's—Mr. A. E. Kingsman, *Islington.*
Amateur's—"Opifex," *Navan.*
For Second Best Exhibits.—Second-class Certificate of Honourable Mention:—
Workman's—Mr. T. Buck, *Walthamstow.*
Amateur's—Mrs. A. Credland, *Leeds.*
For Third Best Exhibit.—Third-class Certificate of Honourable Mention:—
Amateur's—Mr. C. E. Kerswill, *Plymouth.*
*** No other Awards.

GROUP X.—WORK IN MUSICAL INSTRUMENTS AND MUSIC.

Silver Medal, 21s., and first-class Certificate for best Exhibit in Group, Mr. P. H. Ziedler, *Hammersmith.*
First-Class Certificate for second best Exhibit in Group, Mr. W. Wyatt, *Marylebone.*

In Division A (Furniture).

For Best Exhibits.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate:—
Workman's—Mr. A. T. Wilmshurst, *Bermondsey.*
Apprentice's—Mr. W. C. Porter, *Walworth.*
Amateur's—Mr. W. W. Thackrah, *Leeds.*
For Second Best Exhibits.—Second-class Certificate of Honourable Mention:—
Workman's—Not awarded.
Apprentice's—Not awarded.
Amateur's—Mr. W. H. Collins, *Tipton.*
For Third Best Exhibits.—Third-class Certificate of Honourable Mention:—
Amateur's—Mr. F. Fraine, *Lambeth.*
Extra Prize:—
Amateur's—Mr. R. L. Darby, *Euston.*

In Division B (Musical Compositions and Appliances).

For Best Exhibit.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate:—
Amateur's—Mr. J. S. Bickley, *Devonport.*
For Second Best Exhibits.—Second-class Certificate of Honourable Mention:—
Amateur's—Tie:
Mr. A. Costar, *Croydon.*
Mr. W. H. Scotcher, *Hackney.*
*** No Entries by Apprentices. Entries insufficient for Third-class Prizes.

GROUP XI.—WORK IN WATCHES, CLOCKS, ALARMS, ETC.

Silver Medal, 21s., and first-class Certificate for best Exhibit in Group, Mr. R. B. North, *Barnsbury.*
First-Class Certificate for second best Exhibit in Group, Mr. A. Kienzle, *Old Kent Road.*

In Division A (Furniture).

For Best Exhibits.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate:—
Workman's—Mr. E. M. Floyd, *Fulham.*
Apprentice's—Mr. E. Benest, *Goswell Road.*
Amateur's—Mr. W. G. Humphrey, *Plumstead.*
For Second Best Exhibits.—Second-class Certificate of Honourable Mention:—
Workman's—A. Kienzle, *Old Kent Road.*
Apprentice's—No Award.
Amateur's—Mr. R. C. Watkins, *Bermondsey.*
For Third Best Exhibits.—Third-class Certificate of Honourable Mention:—
Workman's*—Mr. J. T. Branwhite, *Brighton.*
Apprentice's—No Award.
Amateur's—Mr. C. Wise, *Bermondsey.*
* Extra Bronze to Branwhite for Horological Turning taken in error into Group II.

GROUP XII.—WORK IN WOOD.

Silver Medal, 21s., and first-class Certificate for best Exhibit in Group. Nothing worthy of this award.
First-Class Certificate for second best Exhibit in Group: Not awarded.

In Division A (Furniture).

For Best Exhibits.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate:—
Workman's—Mr. A. C. Hammon, *Southwark.*
Apprentice's—Mr. T. Smith, *Deptford.*
*** No other Awards.

GROUP XIII.—WORK IN CHEMICAL PROCESSES AND PRODUCTS.

Silver Medal, 21s., and first-class Certificate for best Exhibit in Group, Mr. H. B. Stocks, *Liverpool.*

First-Class Certificate for second best Exhibit in Group, Mr. F. W. Teale, *Heathfield.*
*** No other Awards.

SPECIAL PRIZES GIVEN FOR EXHIBITS TAKEN FROM DESIGNS IN "WORK" BY THE PROPRIETORS OF "WORK."

Ladies' Combined Work Table and Escritoire—No. 56 of "Work."

1. Mr. N. T. Lee, *Battersea* (in addition to prize above), Half-Guinea Book Prize and Certificate.
2. Mr. A. S. Allen, *Wetherby*, Bronze Medal and Half-Guinea Book.
3. Mr. A. Smith, *Fulham*, Half-Guinea Book and Certificate.

Cabinet from Design in No. 1 of "Work."

1. Mr. H. Dry, *Blackheath*, Half-Guinea Volume and Certificate.
2. Mr. G. N. Macintosh, *Lavender Hill*, Second-class Certificate.
3. Mr. Collinson, *Ulverston*, Third-class Certificate.

Model Cottages from Design—No. 70 of "Work." (Adapted for Doll's House.)

Mr. W. Smith, *Upper Clapton*, Bronze Medal and Half-Guinea Book.

Novel Chess Table from "Work," No. 90.

Mr. G. White (one-armed man), Third-class Certificate.

Casket from No. 10 of "Work."

Rev. R. H. Dunlop, *Elie, Fife*, Half-Guinea Book.

Children's Mail Cart—No. 30 of "Work."

Mr. C. W. Kelly, *Clerkenwell*, Second-class Certificate.

Carved Panel from Design in "Work."

Mr. E. C. Godfrey, *Bournemouth*, Third-class Certificate.

Engraved Monograms, Crests, etc., from "Work."

Mr. J. Cooper (Apprentice), *London, W.*, Bronze Medal and Half-Guinea Book.

GROUP XIV.—UTILISATION OF WASTE.

N.B.—There was no entry sufficiently meritorious to warrant the Award of a Gold Medal.

Silver Medal, 21s., and first-class Certificate for best Exhibit in Group.—Mr. J. B. Russell, *Mansfield.*

Second Best Exhibit.—Bronze Medal, Book Prize 10s. 6d., and second-class Certificate.—Mr. F. W. Brookman, *Rochdale.*

Third Best Exhibit.—Second-class Certificate.—Mr. J. Mangnall, C.E., *Manchester.*

Fourth Best Exhibit.—Third-class Certificate.—Mr. E. Ferry, *Dalston.*

John W. Harland, Secretary.

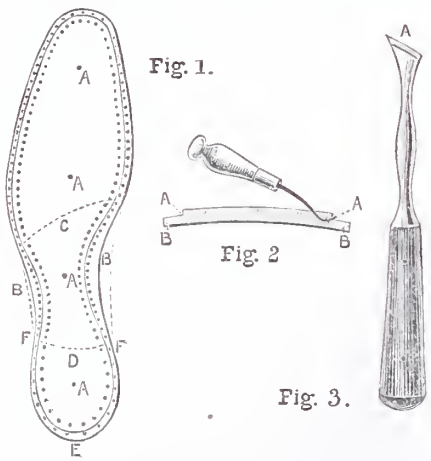
February, 1891.

SHOP:

A Corner for Those who Want to Talk It.

II.—Questions Answered by Editor and Staff.

Soling.—A. B. (*No Address*).—When you have wetted the insoles, scrape off the grain, flesh the back and gently hammer them, tack them to the last (grain side to the last) with four tacks, A, A, A, A,



Boot Soling Tools, etc.

Fig. 1, pull all round the sides with the pincers, and as you pull each place, put a tack through the edge of the leather into the side of the last to keep it well stretched. Then block to the last till the sole is nearly dry, take out the tacks, and round it up to the shape of the last, excepting at the waist. Here it can be curved in to make it narrower than what the last really is, as B, B, Fig. 1, assuming that the dotted lines at these points are the waist of the last. Then with a pair of compasses draw a line the whole way round (if for a gent's) from ¼ in. to ⅓ in. wide, mark off the two points C and D that you may know the length of the waist, and at either side (more especially the inside) make the line you have drawn a little wider; the wider you make the feather here, the smarter the waist will be, and you also make this line wider at E. This is done according to the range or pitch of the last; the more dead the waist the more the heel will want under-seating—that is, it must be feathered wide, and sewn under at E and feathered narrow, and sewn full at F, F, to prevent the heel when built from pitching on the breast. This line, when you have got it even, must be cut through to about one-third of the thickness of the leather, holding the knife perpendicular, and then open it with a prickstitch (Fig. 3); then cut the whole of this narrow strip of leather away, which will, of course, leave the feather about two-thirds of the original substance. The way to hole it is to make a second line from the feather as you did from the edge for the feather, and put the sewing awl in at this line, and bring the point out on the edge of the feather, as A, A, Fig. 2, which is a transverse section of the insole, also showing the feather B, B, which must be very smooth and even all round. You say "dress up the welt after sewing;" if you mean after sewing the welt in, I have a question in hand to answer for S. T. that will answer your query, but as you speak of dividing the stitch, I conclude you must mean after *stitching* the sole on. This is done (after the channel has been set down, and the sole and seam hammered) by rubbing the stitch down with a piece of bone—say, the handle of an old tooth brush, and after the boot is in colour, the stitch is divided with the prickstitch (Fig. 3). This little tool is generally made from the handle and shank of an old iron table fork, being bluntly tapered off at A, and pressed between every stitch; or you can run a fudge wheel round and stitch in the marks it has made, and then run the wheel round again over the stitches, and finish the edge with the guard of the iron, as you must also do if the prickstitch is used.—W. G.

Bicycle Plating.—Yorkshire could not replate his bicycle without providing a costly plating plant, and even then he would have to provide experience. Several correspondents have proposed to themselves this same job; they seem to have no sort of conception what plating is. Yorkshire will get the parts of his bicycle done by practical platers for a sum of 10s. to 30s., according to the amount of nickel used and the manner of using it. Good plating has a deposit of copper underneath, cheap plating has none.—A. S. P.

Electric Breast Pin.—D. M. K. (*Glasgow*).—The following reply to your letter has been obtained from Messrs. J. E. Hartley & Co., Electric Works, St. Paul's Square, Birmingham:—"We can supply electric scarf pins mounted with small electric lamps at 12s. 6d., 15s., and 17s. 6d. each, according to quality. Batteries for the same, carved to fit the pocket, 21s. each, or of square shape, 18s. 6d. each." You will note a difference in the price of lamps quoted in this reply, and that published on p. 813, Vol. I. This difference is due to the fact that breast-pin lamps have now to be imported from Paris.—G. E. B.

Seal for Battery.—H. M. (*Bristol*).—Pitch will do for the purpose, or equal parts of pitch and asphalte with an ounce of beeswax to the pound of pitch will be even better, because more elastic.—G. E. B.

Nickel-Plating Solutions.—Amateur.—As I have not up to the present given in Work directions for making a nickel-plating solution, I cannot be held responsible for your failure. This was evidently due to the directions given you by someone else. If you mix together sulphuric acid and nitric acid, and then plunge a $\frac{1}{16}$ plate of nickel in it, expecting as a result a nickel-plating solution, of course you will be doomed to failure. But if you mix the acids in a proper manner and then add the nickel, I will warrant that the metal will dissolve in them and form a sulphate of nickel solution. First, then, put half a gallon of water in a stoneware pan, add to it three pints of strong nitric acid, then add one pint of good sulphuric acid. Make this mixture hot on a sand bath and add your nickel, and it will dissolve nearly two pounds of the metal. But I do not advise you to thus prepare your bath. Better get the prepared nickel salts and anode plates from such firms as Messrs. J. E. Hartley & Co., 13, St. Paul's Square, Birmingham, who will also advise you how to set up and work a small nickel-plating plant.—G. E. B.

Demagnetising Watch.—T. K. (*Glasgow*).—Yes, you can now have a watch demagnetised without the old system of heating the plates, parts, etc., and regilding. Parties advertise to restore them by a process using a dynamo, and they charge 3s. to 5s., according to watch. Watch Work, or any such advertisements.—J. S.

Blueing Pointers.—Solway.—I find the best method for getting a good *blue* on steel parts is to make a bright fire of *old leather* scraps, and when red, place articles to blue on a copper plate or zinc held a short distance over it, and watch it until the desired colour is obtained. You can have any depth, from light straw to dark blue.—J. S.

Cinder Sifter.—ECONOMY.—I am rather doubtful whether your question is of sufficient importance to the majority of our readers, for such an article as a cinder sifter is obtainable at a price so very low that many would deem it hardly worth making. Of course, I am quite aware that most amateurs do not consider the lowness of cost any article could be purchased for that they would wish to make—they look rather to the pleasure to be felt at the result of their skill. But you must agree with me that they usually aim at something more ambitious than the article you wish described. However, as our Editor does not like to turn away any question, and as a cinder sifter can be put to very good use, although unpretentious in appearance, I will explain how to make one. As you are well up in joinery, you will not want me to say anything about that part. Wood and dimensions you must be the chooser of. I must confess to ignorance of the article you name in your letter, but I daresay it is patented, and if so, that reason alone would not allow me to describe it. The article I here show will be made in two separate parts; the top one being as in Fig. 2, to fit into the top of the lower one (Fig. 3). Two boards for the long sides, curved, as shown, at the bottom, united

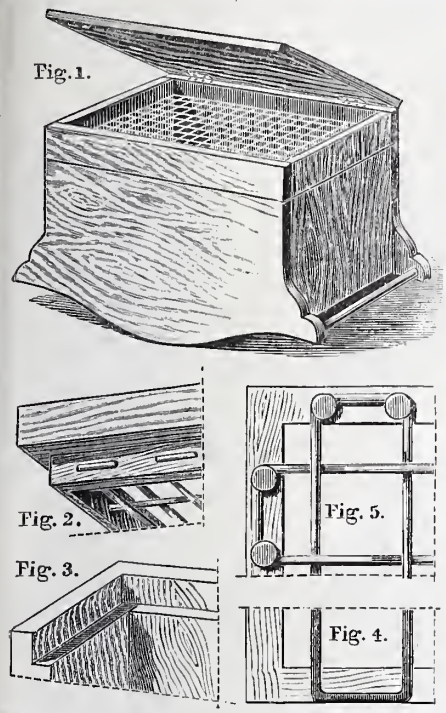


Fig. 1.—Cinder Sifter. Figs. 2 and 3.—Top and Bottom Parts respectively. Figs. 4 and 5.—Modes of fixing Wire.

by two end boards and a bottom board, will form the carcase. A narrow spindle, joined at the bottom of each end, will be found convenient for the foot to be used to rock the article in order to sift the contents. The top part can be taken out when it is desired to discharge the dust contained within the lower part; and if a lid is attached to the former, the cinders can be shaken without fear of any dust rising. You will not want very stout wire. Where to obtain it, and how to straighten it, see past numbers of WORK, particularly No. 54 (p. 20). It should be woven as shown in Fig. 5. The strongest way to fix it will be to bore holes at equal distances apart all round the bottom of the upper part, and beginning at an end hole, thread the wire through it and the hole exactly opposite, bringing it then round the wood (Figs. 2 and 4) and through the next hole, and so on until the last one is reached, when both ends can be secured in an easy manner. Thread the cross-wire in the same way, weaving it as stated above. Countersink, as in Fig. 4, the wire that shows outside by cutting grooves between the holes. A simpler way of fixing the wire will be to thread it round nails (as in Fig. 5), driving them into the bottom edge of the upper part.—J. S.

Improver.—CABINET MAKER.—There can be little doubt that on going into a shop in a larger town, where your son would be able to have more experience, he would have to begin as an improver. From what you say, I suppose his knowledge of the construction of furniture is little more than rudimentary, probably being confined to the rougher and commoner kinds of things. One important matter you omit to mention is whether he has been working chiefly in deal or whether he has been used to hard wood. It is quite impossible for me to say what wages he might get, as everything depends on his ability, and he ought to be content with a very moderate figure, probably not half of what he thinks himself worth. My experience of lads coming from small country shops after having served their time is that, to use a slang expression, they are not worth their salt, and that they very often, after a few weeks as improvers, think they know as much—if not more—than any old hand. This leads them to ask more than the powers that be think they are worth. If your son can get into a really good shop under a good foreman, on whom much of the progress of a willing youngster depends, and you can manage to help him financially for a year or so, my advice to him is not to haggle about wages. Let him take what he can get, remembering that after a time the experience he is gaining will be worth considerably more to him than a shilling or two a week higher wages at present in an inferior berth. I cannot recommend him to go to London, unless he has some friends there who could help him into a berth. He would probably drift into the shop of some small master or sweater, and his lot would be the same as that of thousands of others who have moved from the country to London in the hope of bettering themselves. If he wants to go to London, he had better defer doing so till after he has spent some time in a good provincial shop. He might then stand a better chance in London. As he has occupation now, let him stick to it, and keep his eyes open for any opportunity that may occur nearer home than the metropolis. He might obtain a situation in Exeter, where there are several good furnishing houses who have factories; and the same may also be said of Bath, where some of the best furniture in England is made. Possibly he might hear of something to suit in Plymouth. I cannot take upon myself to recommend any particular firm, but I should decidedly regard the one you name as being most unsuitable for your purpose, even without the objectives, as above given, to London. You might try the effect of an advertisement in one of the local journals of the place preferred, or in WORK. The more useful tools your son has, the better; and if he have none, I doubt very much whether he would have any chance of getting employment.—D. A.

Photographic Tent.—R. H. (*Bradford*).—Your query is rather vague; do you mean a tent in which to take portraits, or rather a portable studio, or a tent in which to develop your negatives, similar to those used by peripatetic photographers? As there is a wide difference between the two kinds of tents, will you kindly write again and specify your want as definitely as possible? and you shall have the required instructions. You might also say what size of plate you intend working, as the dimensions of the tent will depend in some measure upon whether you use quarter plates or larger sizes, say up to 12 in. by 10 in.—G. LE B.

Surveying and Levelling.—J. E. S. (*Stoke-on-Trent*).—Suitable books for you are "Subterraneous Surveying," by T. Fenwick and T. Baker, 2s. 6d.; "Levelling," by F. W. Simms, 8s. 6d., Weale's Series; or "Levelling," by T. Holloway, Spon, Strand. You can also get a good deal of information on levelling and surface-surveying from Nesbit's "Mensuration," but without practical teaching I am afraid you cannot make much progress. Take a course of lessons at the science classes which are held in most of the mining districts. In that case the teacher would tell you what books you would require. Also try to have some actual work with a mine surveyor and leveller, so as to understand how to set and read the instruments, and how to plot and lay the work down.—M.

Metal on Books.—H. S. (*Birmingham*).—The thin metal that you speak of for putting round the edges of books is mitred and soldered. It is impossible to bend, so I cannot tell you how to do it. These strips of brass are called "rims," and are made in sizes to suit certain books; but of all the things which I abhor, a brass rim on a book takes the cake. You may try cutting your metal and soldering it, as this is the only way it can be done; but don't, man! It does not add to the beauty of the book, and it really doesn't need it unless you are going to make a football of it.—G. C.

Steel Wire.—J. M. (*Southwold*).—I think pianoforte wire would suit your purpose. I cannot give you the name of a maker, but that you can get from any musical instrument maker.—F. C.

Simple Writing Cabinet.—H. G. L. (*London, E.C.*).—If you had read the article on "A Simple Writing Cabinet" right through, you must have seen the following:—"Having got, cut, and cleaned up to sizes given," etc. I think that further explanation is unnecessary.—R. F. H.

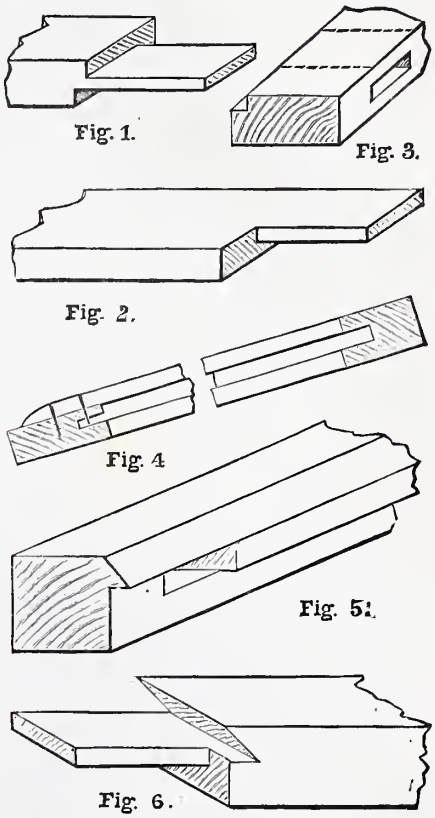
Crest Book.—G. W. (*Airdrie*).—Fairbairn's Crests and Monograms (2 Vols., cloth, 42s.), Lewin, 20, Ludgate Hill, London, would be a good book for you.

Edges of Books, etc.—J. B. (*London, W.C.*).—The colour for red edges for books is dry vermilion, and it is mixed with a little white of egg and water. It is applied with a sponge. Book-edge colour may be had from Messrs. Berry and Roberts, St. Bride's Street, London, E.C., ready mixed. Say if it was the inside or outside of hook that was soiled.—G. C.

Model Marine Engine.—W. E. (*Liverpool*).—Your query cannot be answered in "Shop." Be patient until I can describe such an engine in WORK.—J.

Twist Wire.—H. S. (*Wolverhampton*).—It requires special machinery. Try Selig Sonnenthal, Queen Victoria Street, for machine; and Newall, 130, Strand, for wire, or Wilkinson and Sons, Adderley Road, Saltley, near Birmingham.—J.

Garden Frames.—ALONSOA.—The wood for the framing of the lights you require having been procured, lay your stiles together in pairs, inside edge upwards, and mark off the extreme length, squaring across with a square; then measure inwards at one end the width of the top rail, and at the other end the width of the bottom rail or drop; divide the spaces thus got into three parts, the two inner parts to form the mortice, and the outer third part to be left solid; square across the marks to the back edge, and setting a mortice-gauge to ½ in., run it in the centre, and mortice carefully to all your marks, taking care to make the mortices a little longer at the back edge of the stile to allow for the insertion of the wedges. The rails must be measured off in a similar manner, and the tenons cut; of course, leaving the shoulder on the top side of the top rail, the width of the stile rebate is longer. The lower rail is only shouldered on the under side. Rough sketches of how the rails are shouldered and tenoned are given in Fig. 1 (top rail) and Fig. 2 (lower rail), and the end of stile with mortice in Fig. 3. Fig. 4 shows a section of the sash;



Garden Frame Lights.

the top end of the sash-bar is morticed in half-way, and the lower end is morticed and cut as shown, the part projecting down on top of the lower rail being secured from shifting by means of two long brads driven in. If you make your sashes of any great length, you had better mortice, say, every third bar right through both top and lower rails, to strengthen them. Put the framing together with good thick white lead, and wedge up the tenons well; also put in two pins, as you suggest, as an additional security. The ventilators you inquire about should be set out in a similar manner to the lights. Figs. 5 and 6 will give you an idea as to how to join them. Notice particularly that the rail is shouldered on one side to fit the bevel of the stile, and also that the stile is cut away outward from the mortice, to admit the square shoulder. There are other and different ways of putting this class of work together, and opinions vary as to their merits. I think, however, that you will find the way here given to be as easy for you as any other, having in view the manner in which you are purchasing your wood. These instructions are necessarily brief; but should you desire further details, write again.—G. LE B.

Force-Pump.—PLUMBER.—You can get a plumber's force-pump for the purposes you require of Messrs. Warner & Sons, Cripplegate, London, E.C., who make various kinds; about £2 would, I think, be the price. Refer to the Post-Office London Directory for the address you want.—R. A.

Combination Chuck.—A YOUNG BEGINNER.—You should repeat your question.

Joining.—A READER.—I do not know much about joining gut-bands. I believe they are joined with hooks and eyes; and I suppose the reason why your hooks and eyes keep breaking is because they are not good enough.—W. D.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Cork.—A READER writes, in answer to G. B. (*Poplar, E.*) (see page 650, Vol. II.):—"You can buy cork for making life-belts at Fisher, Howard and Son's, Cork Merchants, Minories, London, E.C. Send stamp for prices. It is sold in bundles from about 1½ or 2 cwt."

Blackboard Preparation.—E. H. (*New Brompton*) writes, in reply to A. J. L (*Paddington*) (see page 718, No. 96):—"Take one part of Japanese gold size and two parts turps, and mix up some drop-black with a little powdered pumice-stone, and paint over. It should dry with a hard dead surface."

Blackboards.—H. B. (*Brighton*) writes, in reply to A. J. L. (*Paddington*) (see page 718, No. 96):—"I have found the following superior to anything else, and trust it may suit you. Take an ordinary jam jar, and go to a respectable oil and colour dealer; ask for ¼ lb. of best ivory or drop black ground in turps, half a pint of turps (turpentine), and half a gill of coach gold size; the black should be in a pasty condition. Thin it down with the turps to consistency of an ordinary paint, then add enough gold size to bind it, but not sufficient to cause a gloss when dry. Find the proper conditions as follows:—Put in the gold size a little at a time, stir well, then rub a little drop on your thumb-nail. It will dry very quickly; when quite dry and dead black, try to rub it off with a finger; if it all comes off easily it is rotten (*i.e.*, not bound sufficiently); add a little more gold size and try again, repeating process until the black will not rub off the thumb-nail without some difficulty; if it sticks on hard and is also dead black (*i.e.*, no gloss whatever), it is in the proper condition. If your board is new, rub down well with glass-paper, and give two good coats of Young's patent size warm, darkened with a little vegetable black; when dry, rub with fine glass-paper—old, if you can get it. Now give one good coat of the prepared black, laying the board down flat, with the side you wish to paint upwards; this will prevent the paint running into waves—or curtains, as we call them. When thoroughly dry, give another coat same as the last, and let dry also. Now get some very fine emery—the finer the better—put a good teaspoonful or little more in the remaining paint, stir up well, and give one last coat and let it dry; it should now be a dead hard black with a slightly rough surface, sufficient to bite the chalk, but allow of the lines being easily removed with a damp cloth or sponge; the quantity named above should be sufficient for a board 4 ft. by 3 ft. super."

Camera Fittings.—H. P. (*Leeds*) writes, in reply to J. C. (*Glasgow*) (see No. 89, page 602):—"You will be able to get all you require well finished and cheap at Watkinson & Lonsdale's, Harrison Street, Leeds. The following prices are what they charged me:—Half-plate rack and pinion-set, Pr. 10-inch racks, 5s.; conical leather bellows, 14-inch pull, 6s.; milled screws with plug nuts, 4d. each; camera screw with two circular nuts, 6d.; double grooving for dark slides, 6d. per foot; focus screen to register, 3d. per foot. W. and L. will supply you with any part finished or unfinished, either brasswork or woodwork. They offered to sell me all the wood machined and planed for very little more than the mahogany cost me at the wood-yard. Had I have seen their advertisement in WORK sooner it would have saved me a lot of trouble. I had no idea we had such a place in Leeds, until I saw the advertisement in WORK. I should advise every reader interested in camera making to give them a call or write. It will well repay him, and by mentioning this paper he will get all the information he requires."

H.-P. Formula.—P. B. H. (*Hendon*) writes, in answer to PUZZLED (see page 718, Vol. II.):—"If you will again run the figures out according to the formula you have, viz.:—

$\frac{2\ A.S.P.R.}{33,000}$ where A.=area of piston=78·54,

S.=stroke 9 in.=0·75 of a foot,
P.=pressure=80 lbs.,
R.=revolutions=350,

you will get $\frac{2\times78{\cdot}54\times0{\cdot}75\times80\times350}{33,000}=99{\cdot}9$ H.-P. instead of 200 H.-P. as you state. There is, however, a slight mistake in the pressure you calculate on. To get the I.H.P. by the above formula, P must equal the *average*, not the boiler pressure, which you have used in your calculations. The average pressure can only be guessed in this case, as the cut-off of the valve is not stated. This can be taken at one-half the boiler pressure or 40 lbs., which will be as near as you can guess. Then the formula would stand $\frac{2\times78{\cdot}54\times0{\cdot}75\times40\times350}{33,000}=49{\cdot}9$ I.H.P., which comes very near that obtained in practice. The only way I can see how you have worked out 200 H.-P. is, that after calculating the formula you give, you have again multiplied by two as there are two cylinders; but these, as you state, are only single-acting, therefore they only count as one."

Illuminating.—A. A. B. (*Brighton*) writes, in reply to GILT (see page 601, Vol. II.):—"You will find full instructions as to gilding and burnishing in one of Messrs. Rowney's shilling treatises on the Fine Arts, entitled: "Guide to the Art of Illuminating and Missal Painting," which may be obtained of any artist's colourman. Both Rowney & Co. and Winsor & Newton supply water gold size at 1s. a bottle; the latter firm distinguishing between burnish gold size and mat gold size. W. and N. also advertise agate burnishers of various shapes at 2s. each. For marking lines on gold, an 'ivory tracer' (Rowney, 6d.) is generally used. Many illuminators prefer cakes of gold (W. and N., 5s. 6d. each), as giving a softer and more pleasing outline than gold leaf. Gold in this form requires no size, but is simply mixed with water, and applied with a brush, which, to avoid 'streakiness,' must be fully charged."

Cheffonier.—SCHEMER writes in reply to DUSTY POOL (see page 570, Vol. II.), and sends the following particulars for making a cheffonier:—"Top lined up 3 ft. 6 in. long, 18 in. wide; floor to top, 3 ft.; glass plates or panels in back, 18 in. by 16 in., and 9 in. by 7 in.; uprights in back, 2 in. wide; spindles, 2 in.

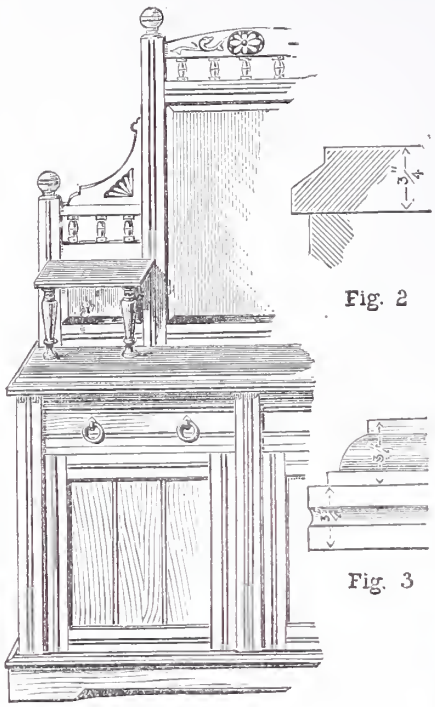


Fig. 2

Fig. 3

Fig. 1

Fig. 4

Fig. 5

Cheffonier and Parts. Fig. 1.—Half View as complete. Fig. 2.—Moulding on Plinth. Fig. 3.—Section of Top. Figs. 4, 5.—Mouldings on Edges of Shelves, etc.

long; shelf, 3½ in. wide, with small bead stuck round plinth, 4 in. deep; door frames, 2 in. wide; carcase uprights, 2 in. wide; drawers, 4 in. wide. A nice design in mahogany, but better in walnut. If SCHEMER wants to know anything else, I will answer in 'Shop.'"

Violin Mute.—F. S (*Normanton*) writes, in reply to VIOLIN (see page 650, Vol. II.):—"Violin mutes are made in a great many shapes and forms. The simplest one that I have seen is made of a piece of thin brass, which can be cut with a fret saw and then bent so as to clasp over the bridge, the tongues passing between the strings. Heavier and better mutes can be made by taking pieces of brass and cutting them out, putting a piece of perforated brass between them at the top and riveted at the shoulders. Before I made a mute, I used the door-key for one, which, though it was clumsy, made a very good one, and did not hinder the bow if put on with the ring towards the tail-piece. You could buy a mute for sixpence at any musical shop, but perhaps you want to make your own."

Camera Fittings.—M. writes, in reply to J. C. (*Glasgow*) (see page 602, Vol. II.):—"You can obtain these from Messrs. Lancaster & Son, Colmore Road, Birmingham. Rack and pinion for ½ plate costs 5s. Send 4d. for catalogue, which gives drawings and prices of each fitting."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. T. B. (*near Preston*); W. J. D. (*Crediton*); H. B. S. (*Huddersfield*); G. N. (*Stratford*); J. R. (*Belfast*); WASSE; ELECTRIC; C. A. W. (*Settle*); R. W. H. (*Glasgow*); L. S. L. (*Falmouth*); ETCHER; F. M. G.; W. H. F. (*Glasgow*); J. F. (*Bridlington*); J. D. (*Dundee*); G. O. M. (*London*); W. T. D. (*London, E.*); L. T. (*Harlesden, N.W.*); E. H. (*King's Cross, N.*); E. H. J. (*Norwich*); E. T. (*Great Yarmouth*); T. & I. W. (*London, N.*); A. S. (*Paisley, N.B.*); F. F. (*Brixton, S.W.*); J. P. (*Bethnal Green, E.*); F. H. (*London, S.E.*); AMATEUR; T. W. W. (*Hexham-on-Tyne*). NED; JACK OF ALL TRADES; N. M. (*Norwich*); H. D. (*Bury St. Edmunds*); P. H. B. (*Reigate*); J. W. (*Edinburgh*); STEEL; H. P. (*Oxford*); ONE IN TROUBLE; V. J. (*Kent*); PEN; J. H. (*Sunderland*); T. M. (*Deptford, S.E.*); A. J. A. (*London, E.C.*); G. P. (*Elgin, N.B.*); H. B. (*Hammersmith*); G. H. (*Burton-on-Trent*); H. H. M. (*Birmingham*); J. H. (*Monkwearmouth*); F. H. B. (*Halifax*); L. C.; BANJO; NIL DESPERANDUM; F. C. O.

"WORK" EXHIBITION PRIZE DISTRIBUTION.

ARRANGEMENTS are being made for holding a Meeting, at which Prizes, Medals, and Certificates will be presented. Full particulars will be announced in an early number of WORK.

Price **3d.**; post free, **4d.**

"WORK" SPECIAL EXHIBIT ON NUMBER.

Containing an Illustrated Descriptive Account of the most remarkable Exhibits.

"No one interested in the 'Work' Exhibition should fail to secure the 'Special Exhibition Number' of WORK, which Messrs. Cassell have issued at the cost of 3d. The articles, on a variety of cognate subjects, are especially valuable."—*Literary World.*

NOTICE.

Numerous applications having reached the publishers for the

"Work" Exhibition Official Catalogue,

they beg to say that a few copies can still be had, price 2d. each; or post free, 2½d.

CASSELL & COMPANY, *Ludgate Hill, London.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [14 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

2,000 Lots of Second-hand Lathes, Drilling Machines, Gas and Steam Engines, and miscellaneous items. Call at 100, Houndsditch, London, or send 4 stamps for Register.—BRITANNIA Co. Tool Factory, Colchester. [12 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E.

Forty Fretwork Designs, 7d., free.—TAYLOR'S FRETWORKERIES, Blackpool. [15 R

Lettering and Sign-Writing made Easy.—Also full-size diagrams for marking out eight alphabets, only 1s.—F. COULTHARD, Terrace Road, Bournemouth. Note.—100 Decorators' Stencils (60 large sheets), 2s. 6d.

Fret, Carving, and Repoussé Patterns.—100 of either, full-size, 1s.; 300 Turning designs, 1s.; 400 small Stencils, 1s.; 500 Shields, Monograms, &c., 1s., post-age free.—F. COULTHARD, Terrace Rd., Bournemouth. [2 S

Set Warranted Firmer Chisels to 1½ in., in bes octagon box handles, 10s. free.—SCLATER, Albion Street Exmouth. [1

Electric Alarums fitted to your own clocks. A clock, bell, battery, battery box, and switch complete, from 19s. Invaluable to early risers.—A. FLOYD, 32, Prothero Road, Fulham. [3 S

Picture Moulds.—15 to 25 per cent. saved. Send for wholesale list, one stamp.—DENT'S, Importers, Tamworth. [13 R

Safety Bicycle.—Ormonde, balls all over, cushion tyres. Brand new, and warranted faultless, and without a scratch. Must sell; accept 8 guineas; bargain seldom seen; absolutely certain to please. Particulars, CYCLIST 2, Tower Street, Ipswich. [4 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill**, with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

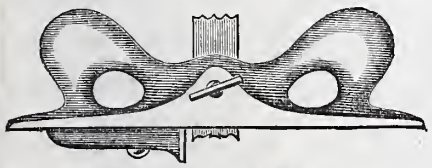
SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design SENT GRATIS with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, ***EAST DEREHAM, NORFOLK.***

Kindly mention this paper when ordering.



NEW HAND-BEADING TOOL,

which is accompanied by six irons, each having two cutting edges, comprising in the Twelve Cutting Edges thus supplied, Beads, Reeds, Quirks, Rebates, and Hollow and Fancy Reeds. The appliance itself is of japanned iron with a bright front. Its extreme length is about 5½ in.

POST FREE, 2s. 3d. 200 Page Catalogue, 700 Illustrations, by post, 6d.

MOSELEY & SON, 323, HIGH HOLBORN.

CASSELL'S

TECHNICAL MANUALS.

Illustrated throughout with Drawings and Working Diagrams, bound in cloth.

APPLIED MECHANICS. By Sir R. S. BALL, LL.D., F.R.S. Cloth, 2s.
BRICKLAYERS, DRAWING FOR. 3s.
BUILDING CONSTRUCTION. 2s.
CABINET MAKERS, DRAWING FOR. 3s.
CARPENTERS AND JOINERS, DRAWING FOR. 3s. 6d.
GOTHIC STONEWORK. 3s.
HANDRAILING AND STAIRCASING. 3s. 6d.
LINEAR DRAWING AND PRACTICAL GEOMETRY. 2s.
LINEAR DRAWING AND PROJECTION. The Two Vols. in One, 3s. 6d.
MACHINISTS AND ENGINEERS, DRAWING FOR. 4s. 6d.
METAL-PLATE WORKERS, DRAWING FOR. 3s.
MODEL DRAWING. 3s.
ORTHOGRAPHICAL AND ISOMETRICAL PROJECTION. 2s.
PRACTICAL PERSPECTIVE. 3s.
STONEMASONS, DRAWING FOR. Cloth, 3s.
SYSTEMATIC DRAWING AND SHADING. 2s.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

JUST COMMENCED,

A NEW WEEKLY ISSUE, *consisting of the most Popular Volumes in*

CASSELL'S

National Library.

Price 3d.; *or cloth*, 6d.

Already Published;

The Haunted Man	DICKENS.
Utopia	Sir T. MORE.
Lays of Ancient Rome	MACAULAY.
Essays on Burns and Scott ...	CARLYLE.
Wanderings in South America ...	WATERTON.
Heroes and Hero-Worship ...	CARLYLE.
Voyages and Travels	MARCO POLO.
Hamlet	SHAKESPEARE.

Ready during March:

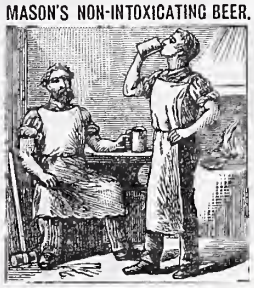
Mar. 4.—The Complete Angler	WALTON.
,, 11.—Essays, Civil and Moral	BACON.
,, 18.—The Lady of the Lake...	SCOTT.
,, 25.—Friends in Council ...	Sir A. HELPS.

"CASSELL'S NATIONAL LIBRARY *is a wonderful bargain at threepence.* No greater feat has been accomplished by any of our publishers during the last quarter of a century."—*The Athenæum.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER. MASON'S WINE ESSENCES.



These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. **One Tablespoonful of Mason's Extract of Herbs** makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, *Nottingham.*

NOW READY, Part 1,

price 7d.

Cassell's Storehouse of General Information.

Fully Illustrated with High-class Wood Engravings, and with Maps and Coloured Plates.

"CASSELL'S STOREHOUSE OF GENERAL INFORMATION will be the work of specialists in every branch of knowledge, and, judging from the first part, will be one of the most comprehensive works in the range of popular encyclopædic literature. The sixty-four pages of this part are crowded with admirably condensed information. . . . The number is profusely illustrated, and contains a folding map. There is, besides, an important extra feature in a series of four coloured plates, elaborate in detail, illustrative of as many branches of popular science."—*The Rock.*

"Its quality seems good, its style easy and conversational, and its illustrations—judging by the excellent physical map of Africa—of a high class. With this first part is given a large sheet of four remarkably well-executed coloured plates, representing Architecture, Botany, Geology, and Physiology."—*Christian World.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

MELHUISH'S No. 735 PATENT

COMBINED CARVING AND WORK BENCH CABINET.

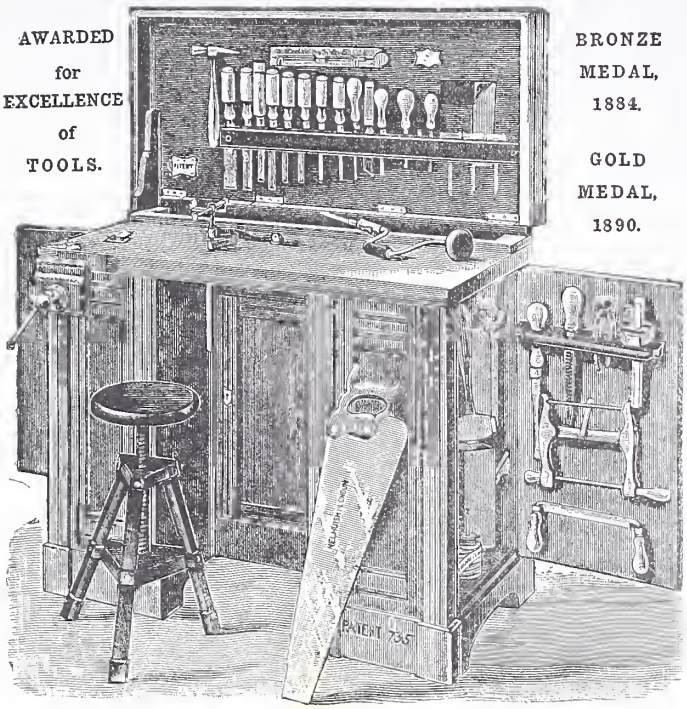
Fitted with WARRANTED TOOLS, precisely the same as we supply to Practical Workmen. From £7 10s.

Made from Bass Wood, Stained and Polished Walnut, and can be made to Harmonise with any Furniture.

AWARDED for EXCELLENCE of TOOLS.

BRONZE MEDAL, 1884.

GOLD MEDAL, 1890.



SEND FOR OUR ILLUSTRATED LISTS, POST FREE.

R^D. MELHUISH & SONS,

84, 85, 87, Fetter Lane, LONDON.

Part 1, ready Feb. 25, price 7d.

OUR OWN COUNTRY.

An Illustrated Historical and Geographical Description of the Chief Places of Interest in Great Britain and Ireland. With about **1,200 Original Illustrations.**

*** *With Part I will be issued a* Large Presentation Plate (size 40 in. × 30 in.), *consisting of an Engraving giving a* "BIRD'S-EYE VIEW OF LONDON FROM A BALLOON."

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

FLUID WATER RESISTING **GLUE** (*Patent*) PATENT TINS.

Invaluable for all Out and Indoor Repairs.

FLUID WATER RESISTING **GLUE** (*Patent*) PATENT TINS.

No Brush—No Boiling—Will securely join Wood, Glass, China, Metals, &c.

By Post, 8d. and 1s. 3d. per tin. Through Ironmongers, Chemists, Chandlers, &c., 6d. and 1s. per tin.

Manufactured only by THE WATERPROOF GLUE CO., 62, Dale St., LIVERPOOL.

MANUALS OF TECHNOLOGY.

Edited by Prof. AYRTON, F.R.S., and RICHARD WORMELL, D.Sc., M.A.

THE DYEING OF TEXTILE FABRICS. By Prof. J. J. HUMMEL, F.C.S. *With Numerous Diagrams. Seventh Thousand.* 5s.

STEEL AND IRON. By WILLIAM HENRY GREENWOOD, F.C.S., M.I.M.E., &c. *With 97 Diagrams. Fifth Edition.* 5s.

SPINNING WOOLLEN AND WORSTED. By W. S. BRIGHT MCLAREN, M.P. *With 69 Diagrams. Second Edition.* 4s. 6d.

CUTTING TOOLS. By Prof. H. R. SMITH. *With 14 Folding Plates and 51 Woodcuts. Third Edition.* 3s. 6d.

PRACTICAL MECHANICS. By Prof. J. PERRY, M.E. *With numerous Illustrations. Third Edition.* 3s. 6d.

DESIGN IN TEXTILE FABRICS. By T. R. ASHENHURST. *With 10 Coloured Plates and 106 Diagrams. Third Edition.* 4s. 6d.

WATCH AND CLOCK MAKING. By D. GLASGOW. 4s. 6d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

CARVING AND FRET SAWING FOR PLEASURE OR PROFIT.

Highest Award Gold Medal for Fretwork and Carving Tools and Designs.

The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION. Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS, at 1/3, 2/6, 3/6, & 5/6 each, *post free.*

Parcels of Assorted Fretwork, 10 feet ... ... *4s.* free.
12 Finely Lithographed full-sized Patterns ... ... *1s.* ,,
Sets of 12 Carving Tools... ... ... *10s.* ,,

None should buy elsewhere before seeing our **New Catalogue** of all Requisites, with instructions. Acknowledged the **Most Complete and Cheapest List** of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

JUST PUBLISHED—THE "FORTH BRIDGE BRACKET."

HARGER BROS., Settle, Yorks.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

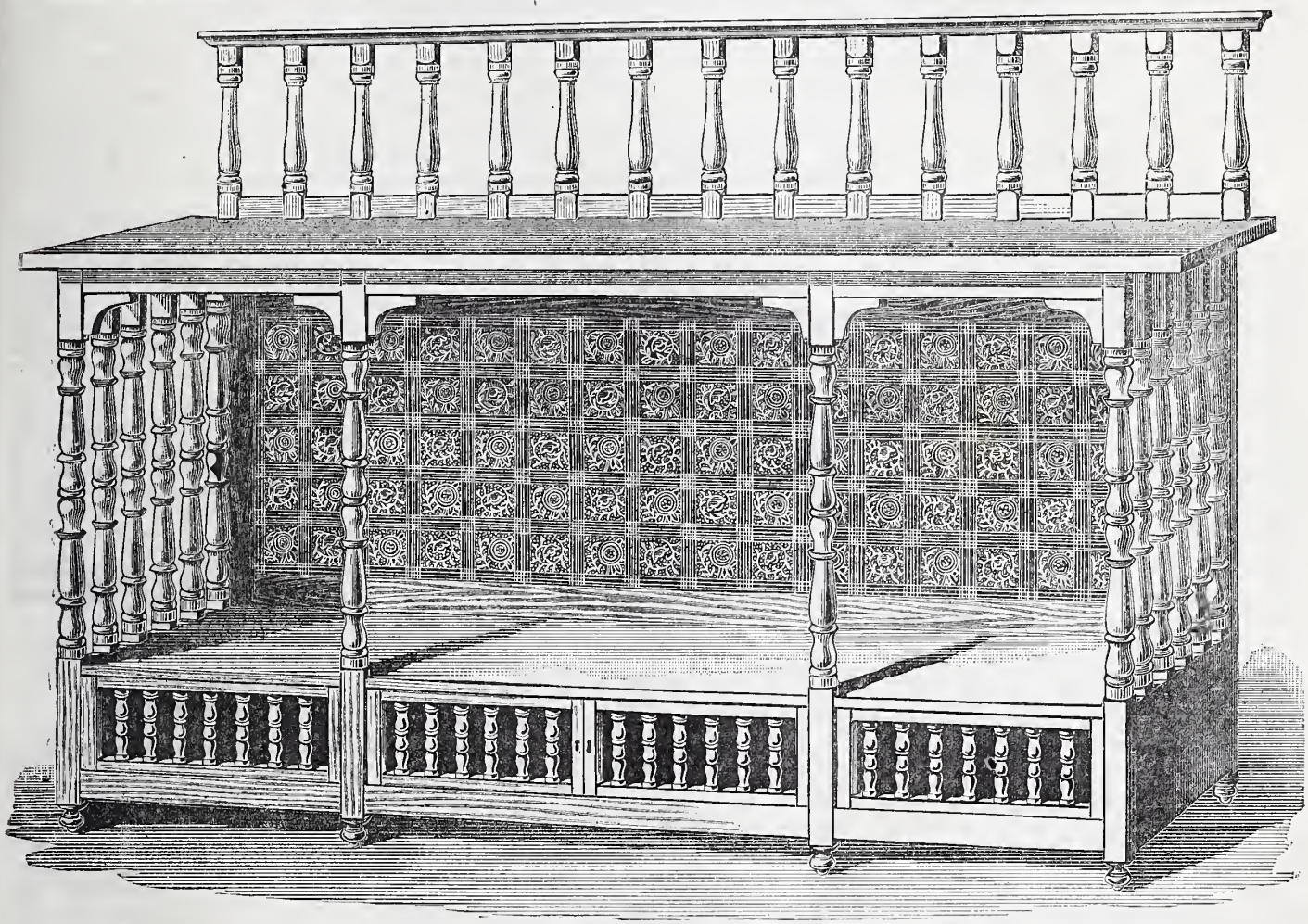
WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 102.] SATURDAY, FEBRUARY 28, 1891. [PRICE ONE PENNY.



An Inexpensive Painted Sideboard or Dinner Waggon, constructed chiefly of Turned Balusters.

AN INEXPENSIVE PAINTED SIDEBOARD.

BY J. W. GLEESON-WHITE.

ELSEWHERE in the pages of WORK, the idea of using the turned balusters sold at so low a price by Messrs. M. C. Duffy, 61, Storks Road, London, E.C., and other firms has been mooted, with suggestions for their treatment. For these admirably worked pillars supply the amateur carpenter with honest decorative material that is easy to work and of lasting value, at a cost but a fraction over the raw material itself.

In the sideboard shown in the sketch, the balusters No. 1 cost in deal but 1s. 6d. the dozen, each one yielding two pieces the required length for the top. Fourteen of No. 43, costing 2s. the dozen, supply all the turning for the main storey. The cupboard doors are filled with spindles, costing 8s. to 12s. for the gross of twelve dozen, turned to one's own pattern. Thus taking the place of a greater quantity of solid material, they are practically as cheap as the lowest possible price for the rudest carpentry, yet the result is a piece of furniture that, if neatly finished, either ebonised, painted, or enamelled, is not unworthy a place in a middle class room.

On Messrs. Duffy's sheet of designs some 101 patterns are figured. All these are made also in pitch-pine or mahogany, the pitch-pine being double the cost of deal, the mahogany, which applies only to the larger numbers 73 to 101, costing, of course, considerably more.

The sideboard—or dinner waggon, for it lacks the larger cupboards which are usually embodied in a dining-room sideboard—offers no special difficulties of construction. In the papers on constructing various pieces of furniture that have already appeared in WORK, the mysteries of joints and fittings have been made clear. As this design is intended as a suggestive one rather than an exact pattern to be followed accurately, it seems needless to adopt the usual method of those who write herein, or to speak definitely and at length upon the framing of the carcase and the different features.

It is enough to show the rough idea of a piece of furniture that is chiefly built up with these balusters, and beyond lincrusta for a filling at the back, requires merely simple plain wood and a few machine-made mouldings to complete it.

The doors below, framed as for a panel, are filled with small turned spindles, either set in the round and lined with some material to exclude dust, or sawn in half and put on an ordinary panel, as a decorative

feature to carry out the idea of the whole thing.

If it is desired to add a second series of shelves below the main shelf, whether for the whole length or for the side pieces only, the designs kept in stock show many with a feature left unturned for such a purpose.

Where the cost of a few additional pence is not deemed an obstacle, much more elaborate patterns, such as Nos. 65 to 72, might be employed. These cost from 3½d. to 1s. 8d. each in deal, and 9½d. to 2s. 8½d. in pitch-pine, but these pieces are far more solid ones—1¾ in. to 2 in. in place of 1¼ in., as for the selected numbers; so that the six at each end would become unsightly, and half a dozen, at most, would replace the fourteen required.

But as the whole idea of the design is to obtain lightness, in a manner rather out of the hackneyed style, it is needless to go into details of alternative plans.

A HOME-MADE FISHING-ROD.

BY CONWAY LLANBEDR.

ALTHOUGH fishing-rods of good quality may be purchased for reasonable, and often very trifling, sums, there are, doubtless, many who would prefer to make their own. There is the man who likes to be able to say, "I made it myself, you know," and takes a double measure of enjoyment in using things which have been fashioned by himself, even though they may not be so handsome-looking as the ordinary articles of trade. Of course, a regular A1 fishing-rod is not the kind of thing I have in my mind while writing this, but still, a good serviceable rod will be the result, one which will do as well as anything else for pond or trout-fishing. It, or something similar, might answer for salmon-fishing, but I do not know, as I have never tried. I should also say that the rod is not intended to be portable, or, rather, that it does not take to pieces, though with a little ingenuity it might be made to satisfy requirements in this direction. However, as it stands, it is just the kind of thing which will be very useful to anyone living in the country, and not requiring to travel about with it. It is also a capital rod for boys, and as it only takes a short time to make, and the cost is almost *nil*, pater will easily be able to gratify the wishes of his young hopefuls who want to practise the gentle art.

Apart from the wood, about which more anon, the materials and tools are few and simple. Indeed, tools, in the ordinary sense, are not required, though they might be brought into use. I have, however, done very well with a penknife and glass-paper. Some thread or cotton is necessary for binding the parts together. Perhaps the best material is a kind of yarn or thread used by shoemakers, though it may not look as neat as silk. A piece of shoemakers' wax is also indispensable, and it can be got anywhere. A small piece of wire which can be easily bent will serve for the rings through which the line runs, but ordinary pins will do quite as well, and I have never used anything else in these home-made rods.

The wood of which the rod is made must now have a short space devoted to its consideration. Some pieces of thin flexible stuff will be necessary for the tip end of the rod. Cane, split strips of bamboo, whalebone, or anything of that kind will do admirably. Their length is unimportant, as, however short they are, they can easily be spliced together. The shorter the pieces, the more patience and labour required, that is all. Let us begin by making the tip or thin end. All that is necessary is to taper it down; and, before doing this, it will be just as well to exercise some judgment in selecting a nice flexible bit. It can easily be rounded and tapered off with a knife, and finished with glass-paper. The next piece will be prepared in the same manner, the only care necessary being to preserve the taper so that when the two pieces are joined together, there shall be no abrupt change from one thickness to another.

The joint is managed as follows. Bevel off an inch or two at the thick end of the thinner piece, and a corresponding length at the thin end of the other, so that they fit each other. Take a piece of the waxed thread and wind it evenly round both pieces of the rod covering the splice. The joint may be glued or cemented first, if preferred, but this is by no means necessary, and any risk of slipping may be avoided by just taking a turn or two of the thread round each piece separately at the splice before winding the thread round both together. The succeeding joints are all made in exactly the same manner, but, as the rod becomes thicker, it may be necessary to splice two or more pieces together

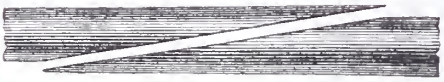


Fig. 1.

Fig. 2.

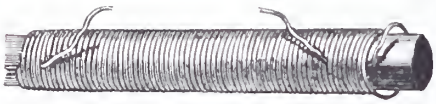


Fig. 3.

Fig. 1.—Ends of Wood bevelled for Splicing.
Fig. 2.—Ends fastened together in Position.
Fig. 3.—Mode of securing Ends of Thread.

throughout their length in order to obtain the necessary thickness. In this case, some cement or glue will be a convenience when tapering, but there is no absolute necessity for it. It will, however, be desirable to whip the pieces together with the waxed thread, at intervals of a few inches. At some of these places the pins, or other wire—pieces of hair-pins will do as well as anything—within which the line is to run can be bound in. The waxed thread will hold them perfectly secure. At the tip end another pin will, of course, be bent and secured in the same way.

It is not necessary for the whole of the rod to be spliced up in the way described. Towards the butt end, a stick of ash, or any other suitable wood, may be used solid, but, of course, tapered down to suit the remainder.

When completed, the rod may be advantageously coated with varnish, and, if sufficient care has been taken, not only a sightly but a useful fishing-rod will be the result. Nothing has been said about a reel, which is generally considered indispensable, but fish may be caught without it. Possibly on some other occasion I may suggest an arrangement to be used instead of a reel, and also give directions for making the rod in portions to render it more convenient for carriage in trains, etc.

Perhaps, to some who would like to make a fishing-rod as suggested, questions may arise as to length, both of the whole and of parts, method of cutting ends for splicing, and the way of fastening off the thread. To such people a few detailed directions, which, with the aid of accompanying illustrations, will no doubt make everything clear, may be given.

The total length of those I have made is from 9 ft. to 10 ft., which I believe is the usual, though I suppose there is no valid reason why it should not be more or less if required. For the waters I have fished in, the length named has, however, suited. The length of each piece has depended entirely on the material, and the way in which it would cut best. Of course, there is no occasion for all the pieces to be of the same length, but the shorter they are the greater the labour in making the rod, on account of the increased number of splices. While mentioning dimensions, it may not be amiss to say that the rod may taper from the thickness of an ordinary penholder, or even less, at one end, to sufficient to allow it to be comfortably grasped in the hand at the other, without making it too heavy or cumbersome.

The ends of the pieces for splicing are cut as shown in Fig. 1, from which it will be seen that the two bevels must fit each other so accurately, that were they placed together as shown in Fig. 2, they would, in fact, form one continuous piece. It may be well to note that a long bevel of, say, 1½ in., is better than a short one, as will easily be understood.

All we have now to do is to imagine the two pieces at the joint being held by the thread previously referred to. The only difficulty that can possibly arise to the veriest tyro is how to fasten the ends, a difficulty which, I think, will at once be removed by reference to Fig. 3, where the method is clearly shown. Of course, on finishing, the ends must be neatly cut off, and there will be no risk of the thread coming loose.

PARAFFIN LAMPS.

BY THOMASO.

SUSPENDING AND WEIGHTING HANGING LAMP—SNAKE LAMP OR HANGING LAMP ON STAND—ANOTHER FORM OF LAMP ON STAND—SNAKE SUPPORTS.

THE next lamp, Fig. 17, differs from Fig. 16 (page 696) only in the manner in which it is suspended. In the first hanging lamp described, I proceeded on the assumption that it was to be suspended from the remains of the gas chandelier. The lamp now under consideration can be suspended anywhere, provided a hook can be screwed into the ceiling.

I have already given directions for determining the proportions of the suspending wires. It is, therefore, only necessary to describe the casting at the top, and the weights.

Fig. 28 gives a view of the top casting half size, and Fig. 29 gives a full-sized view of one of the wheels in position, but the space between each pair of lugs is only approximate, being, of course, regulated by the width of the wheel. Be careful that all the lugs taper on all sides slightly, to allow the pattern to leave the sand easily. The taper (or strip) must be filed off the inner faces of the lugs when you get the casting, in order to prevent the edges of the wheels rubbing. Make the latter by cutting a strip of sheet-brass, rather wider than the chain, and make it into a ring. Solder this ring between two discs of brass of the size shown in Fig. 29, and drill a hole through the centre

of both discs. Drill holes through the lugs where shown; place the wheel in position with a small washer each side, and then insert a piece of stout brass wire through the lot. To prevent it working out, solder one end to the lug. Drill holes through the two lugs on the other side of the casting, and insert two S-shaped hooks, joining them by another hook as shown in Fig. 17.

Now as to the weights. They are generally made of several segments of stamped brass soldered together, and filled with odds and ends of metal to very nearly the required weight, small shot being used for the final balancing.

If you have the chance of picking them up second-hand, by all means do so, as you would probably get them for considerably less than the cost of the brass stampings. Personally, I do not like the stamped brass weights. The pattern is generally one from which a South Sea Islander would turn in disdain; and the whole appearance is what only nasty sarcastic people would call ornamental. I do not mean to say that all the weights are like this, but the majority of those belonging to the cheaper chandeliers are; and they are the sort you are most likely to pick up second-hand. Before buying the weights, get some idea of their size by weighing the lamp, shade, etc.

Whether you buy or make the weights, carefully overhaul the hooks or rings by which they are attached to the chains. Neglect of this precaution may result in a weight crashing through the shade, and letting the whole concern down with a run; a result most astonishing to anyone sitting under it at the time.

So much for the stamped brass weights. They are scarcely suited for the lamp, on account of their tinselly look. Something of a solid appearance is necessary. For Fig. 17, I do not think you can do better than get a pair of "shells" of the same kind as those used for making the reservoir; but, of course, considerably smaller. Cut a 1 in. hole in one half to put the shot in, and make three holes equidistant at ½ in. from the edge of the hole, and also make a hole in the centre of the other half.

Now get four of those little brass eyes used for holding the Venetian blind cord close to the window (Fig. 30); tin the ends; insert them through the holes in the shell, and solder carefully on the inside. We thus have three rings to attach the chain to, and one projecting from the bottom for a smoke consumer to hang from. This pair of shells must be joined in a different way to the others. Tap the edge of the top half inwards; tin both edges; put them together with the edge of the bottom half overlapping that of the top half, and solder firmly.

Fig 16 is weighted in the same manner, with the exception that the balls will be only half the size of that in Fig. 17, and will only need the 1 in. hole. The chain is hooked to a piece of wire bent like Fig. 31, the ends of which are soldered inside the ball.

If any difficulty should be experienced in getting the balls small enough (I know they can be got at Stanton's aforesaid), make the weights of sheet brass, the shape of a lobster tin, or clock weight, but of course, much smaller. If polished up nicely, they look very well. A piece of wire shaped like Fig. 31 is soldered on the inside to attach the chain to. When you are balancing the lamp, do not forget to three-parts fill the reservoir with oil.

The lamp is suspended from a steel screw hook, screwed into the ceiling. It is of no use screwing it into lath and plaster; you must hit on a joist. Notice the way the boards run in the room above, and the joists will be found at right angles. Make trial holes in the ceiling with a long thin awl, until you hit on the joist, and then screw in the hook nearly as far as it will go, for it looks bad to see it only about half-way in. It is not at all a bad idea to wear a pair of spectacles when doing anything to the ceiling; they protect the eyes from falling chips, etc.

Variety is charming when it is not costly. Bearing this in mind, I so designed the hanging lamp that the reservoir, burner, etc., could be taken out of the holder, and put on another form of stand, thus giving a totally different lamp at a slight extra cost.

In Figs. 32 and 33, two forms of the lamp are shown. All that is necessary to effect the change from the hanging lamp is to unscrew the ring at the bottom of the latter, thus releasing the reservoir, which is then put into the other holder or stand, as shown in the figures. Turning the reservoir round a few times screws it into A. The ring from the bottom of the hanging lamp is screwed on where shown in the figures, both to prevent it getting lost and to add to the appearance.

The ring to support the reservoir is made as before. The three legs have to be worked up from a casting. Fig. 34 gives a half size view of one pattern, a sort of conventionalised snake, "squared" for convenience of copying. Make the wood for the pattern of three thicknesses glued together, and dried under pressure. Two of the pieces are to be ¼ in. thick, with the grain running in the direction of the greatest length; and the third piece is to be ⅛ in. thick, with the grain running across it, and is to be glued between the two ¼ in. pieces.

When dry, plane the wood down until it is of the section shown half size at the top of Fig. 34. Transfer the pattern to the wood and cut it out. Trim it up round in section, tapering the tail, which you will observe is joined to the body. The neck is made rather smaller in order to give a natural appearance. The wood not being thick enough for the head, small pieces must be glued on as shown. Make a slight depression to serve for the eye, and in the centre knock a short piece of a good-sized pin with the head on it. This will, of course, come out in the casting as a prominence, and when it is polished up (the rest of the eye being left rough) it looks very fierce indeed. Make a slight groove to indicate the mouth, but do not be tempted to make it with its mouth wide open—a very conventional idea, no doubt, but more suited to a belligerent Tom cat than a snake. Better not put any scale markings on the pattern. Think of the time it would take to finish up. Glue on the lug at the position shown and the pattern is done, except varnishing.

You can have either three or four of these supports to the lamp. With three the lamp stands firm on an uneven surface, and the cost and work in finishing is less; but with four you can use two of the snake's heads as handles to lift it by. This, however, is not the only way of carrying it, as I shall presently show.

A pattern like Fig. 35 must now be made of ¼ in. wood, care being taken to halve the arms into the circular part in the centre, and not to cut it all out of one piece. The length of the arms is got roughly in this manner:—On a piece of paper describe a circle half inch larger all round than the extreme diameter of the ring that supports the reservoir; put your pattern in the centre of this circle, and make the arms touch the circumference. The object of this casting is to steady the legs and provide means for securing the reservoir in place. Be careful that the arms are equidistant, or the legs will have to be bent out of the upright in order to get them to coincide with the arms.

Now make another pattern the size and shape of Fig. 36. It is circular, and will only cost a few pence to have turned if you have no lathe. The brass casting need not be turned unless you like. File and emery cloth will do very well, but it would, of course, be better turned, as the top could be made slightly concave, as shown by the dotted line, in order to correspond with the curved surface of the reservoir. Drill a hole in one end and tap it to fit the screw in the bottom of the reservoir, and cut a thread on the other end, as shown, of the same pitch.

Now finish up Fig. 35 and drill a hole in the centre large enough to admit the male screw of Fig. 36. Tin the surfaces that touch, and solder them together by heating the metal until the solder melts. An easier way would be to screw one into the other.

Drill $\frac{3}{16}$ in. holes in the snakes where shown at H in Fig. 34, taking care that the drill does not go right through, and that all the holes are of the same depth. These holes are to receive the ends of the arms of Fig. 35.

Solder the snakes in place, being very careful that they are all upright. Cut a circle of thin card of such a size that when placed in the position which Fig. 35 is to occupy its edge touches all the snakes just where you made the holes. Now strike three or four circles from the centre of this card disc, and then make a hole in the middle of it. Place Fig. 35 on it exactly in the centre (Fig. 36 having been soldered to Fig. 35, the hole in the card admits the projecting screw of Fig. 36)—the circles you struck will guide you—and then mark how much of the arms projects beyond the edge of the disc. If you find this amounts to more than the depth of the holes drilled in the snakes, you must file off the superfluous metal. Then file a shoulder on the projecting part of the arms as shown at A, Fig. 35, to just fit the holes in the snakes.

Drill holes for the rivets to secure the snakes to the ring; make marks on them and corresponding ones on the ring to prevent confusion, and then unsolder them. Clean off the solder, put Fig 35 in place, and then rivet the snakes on with copper rivets.

Try the reservoir: if it will not screw into Fig. 36 it is because the measurements have been taken carelessly. The only way to remedy it is to bend one of the arms of Fig. 35 slightly, thus throwing Fig. 36 a little out of the upright, and probably allowing the reservoir to be screwed into it.

Drill a small hole through the snakes where the arms of Fig. 35 enter them in such a manner that you drill through both snake and arm. File a piece of brass wire slightly tapering to fit this hole, and tap it in firmly with a light hammer and cut off the projecting ends. This renders the whole thing rigid. Polish and burnish as usual.

A shade can be made in the same manner as described for the hanging lamp, or a glass one can be used. The size is the same as that for the reading lamp first described. If made of tin or card it may be larger, but not as large as the hanging-lamp shade. That would give it a top-heavy look.

Make the rim for the shade of the $\frac{1}{2}$ in. by $\frac{1}{16}$ in. flat wire. In order to get the exact shape of the supporting wires, make a drawing of the upper part of the lamp, in the same manner as you did to get the shape of the arms of the hanging lamp, only instead of drawing *that* arm you will draw the outline of one of the wires that are to support the shade. Cut three lengths of $\frac{1}{8}$ in. brass wire, allowing for the piece that goes into the holes in the top of the reservoir, and also $\frac{1}{8}$ in. to permit of their being riveted into the rim or gallery. Bend all the wires to the shape drawn on the paper, file a shoulder on $\frac{1}{8}$ in. of the upper ends, drill holes in the gallery to admit the shoulders, insert and rivet over on the inside lightly, put the whole into position on the lamp, giving the wires a twist here and there to get them straight, and then, without moving it, solder the wires firmly on the inside of the ring. The shape of the wires does not matter particularly. That shown in the figure looks very well. If you want to use a globe you must make a gallery to support it, by getting a stout piece of sheet brass and cutting a hole in the centre just large enough to allow it to slip over the clips, which must be bent inwards for the purpose, and rest on the projection indicated by the arrow in Fig. 2 (page 480). A strip of brass, which may be fashioned something like that which will be found in Fig. 37 (which shows the whole arrangement), should be soldered all round as shown, soldering on the under side. The globe must fit easily.

Peradventure there are some who dislike snakes both dead and alive. Perhaps Fig. 33 may take their fancy.

The shape of one of the legs will be given in Fig. 38 half size. It is a very easy pattern to make. Cut a piece of wood to the outline, and on each side glue a narrow strip of the same wood. Glue little bits on to form the "toes" and also to make the top round with a bevelled edge. Reduce the size of the leg just under the round part and cut a piece out of the top, as will be shown at A, Fig. 38, to fit the curve of the ring.

It is not intended to have lugs on these legs, but to screw them to the ring from the inside, using two screws to each, having heads like wood screws and well countersunk. The countersinking of the holes inside the ring is easily managed by taking a large size sharp drill bit in the hand and twisting it round in the hole.

Solder the legs on and mark the positions of the holes for the screws. Unsolder them, drill (not quite through) and tap, and after finishing up, screw them on. It is best to only burnish up the edges and other prominent parts of these legs, and blacken the other part carefully with gold size and lamp black, thinned with a little turps.

There are two ways in which Fig 35 can be attached to the legs. You can either make the ends of the arms like B, securing them with a pin through as shown, or you can have a little lump of metal cast on, as will be shown at B, Fig. 38, and make the ends of the arms like A, Fig. 35, securing them as usual. In the former case it will not be necessary to take the legs off to fit Fig. 35.

When carrying the two lamps last described you open your hand palm upwards, thread Fig. 36 between the second and third fingers, and then lift.

MODERN FORGING.

BY J. H.

Formation of Bolts and Swivels.

Bolts and nuts are bought more cheaply than they can be forged in small quantities, and they are consequently seldom made in little workshops, unless they happen to be required of special dimensions, or, not being in stock, are yet urgently wanted. It may therefore seem that their description would be superfluous in these articles. But such is not the case, because, by introducing a description of the methods adopted in their formation, I shall be able to illustrate several facts which find useful application in other classes of work besides these simple examples.

To make bolts there is choice of three available methods. In one, a bar is selected of about the size of the bolt head across the angles, and the stem is drawn down, first roughly by the hammer, and then completed between swages. This method is not often followed, unless the bolt happens to be very short, because of the labour involved in the drawing down from a large bar and finishing neatly to the required diameter. Though, with a steam hammer, such a method would be occasionally resorted to, it would very seldom be adopted by a man who works without its aid.

Another method, also seldom adopted, would be to take a bar of the diameter of the bolt and upset a mass of metal to form the head.

The usual method selected is that by

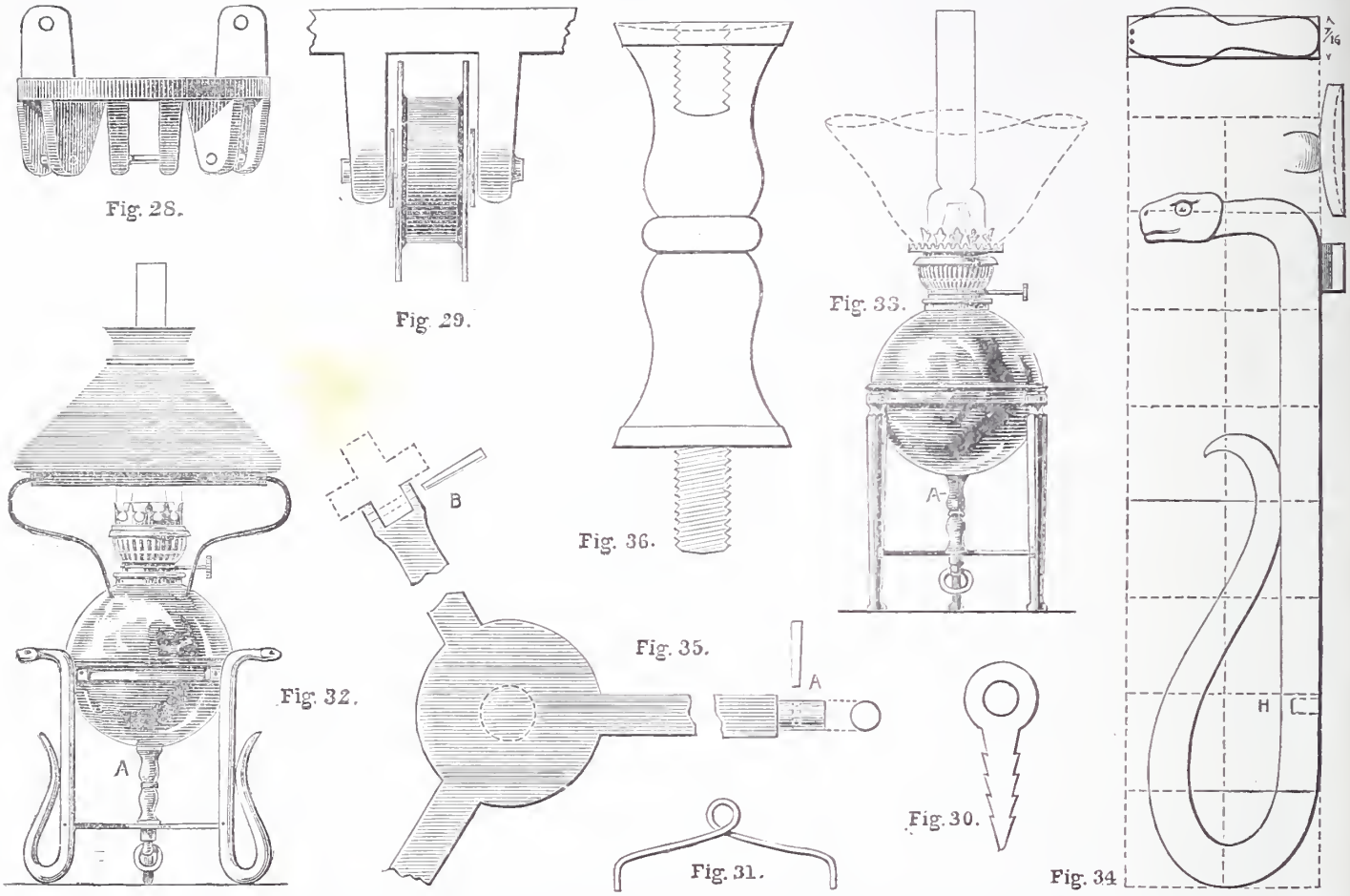
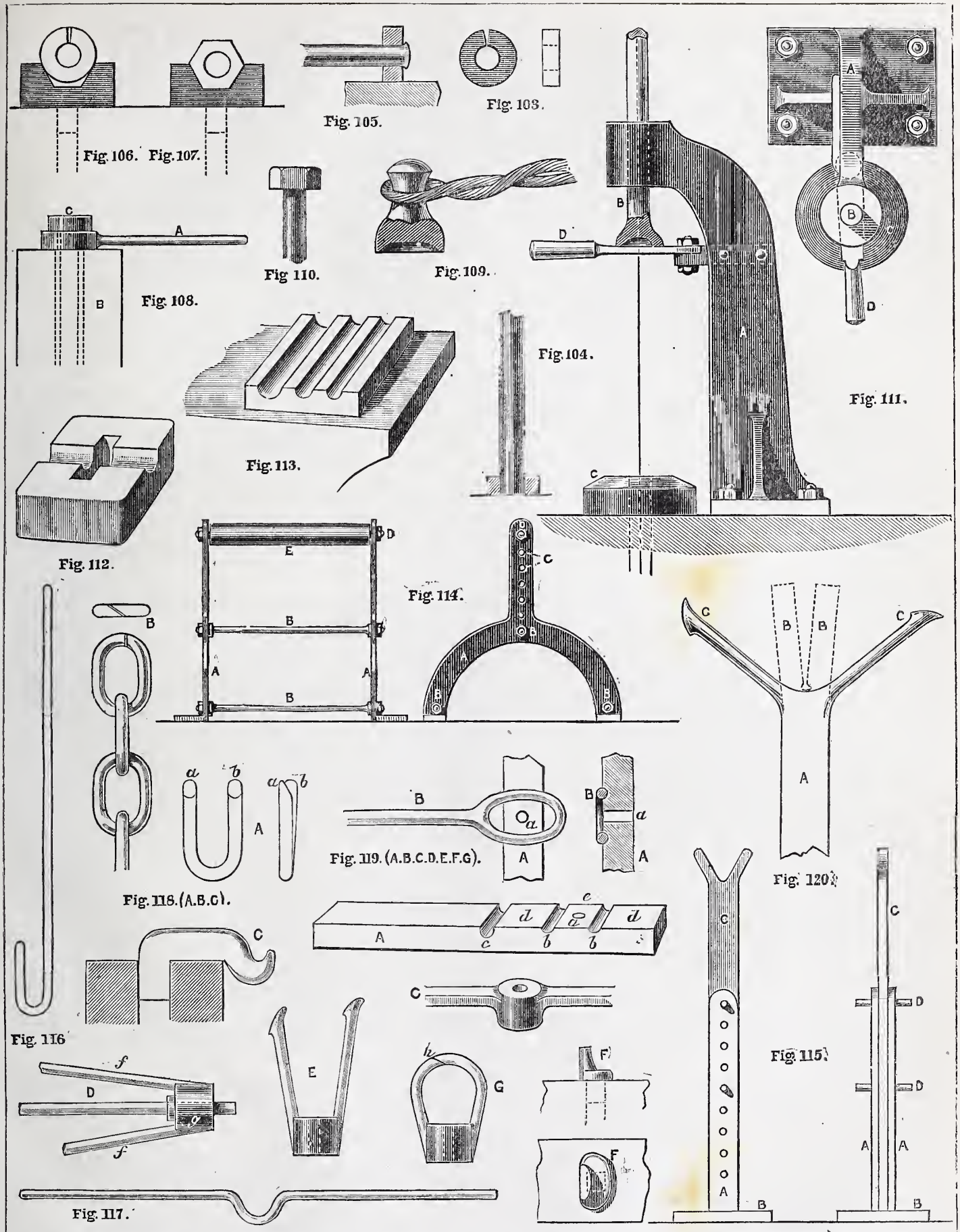


Fig. 28.—Casting at top of Fig. 17 (half size). Fig. 29.—Wheel in Position between Lugs (full size). Fig. 30.—Eye (full size). Fig. 31.—Wire for attachment of Chain. Fig. 32.—Snake Lamp fitted with Shade. Fig. 33.—Alternative Form of Fig. 32, fitted with Gallery to hold Globe. Fig. 34.—Snake Support for Fig. 32 (half size). Fig. 35.—Struts for Figs. 32, 33 (full size). Fig. 36.—Enlarged Diagram of A, Figs. 32, 33.



Figs. 103-110.—Details of the formation of Bolt Heads. Fig. 111.—Appliance for rounding Bolt Heads. Fig. 112.—Swage for Collar Bolts. Fig. 113.—Bottom Swage. Fig. 114.—Adjustable Support for Long Work. Fig. 115.—Another Form of Adjustable Support for Long Work. Fig. 116.—Carrier for Bars. Fig. 117.—Another Form of Carrier for Bars. Fig. 118.—Welding a Shutting Link. Fig. 119.—Details of the formation of Swivels. Fig. 120.—Alternative Method of forming Swivels.

which a ring of metal is turned round and welded upon a bar whose diameter equals that of the bolt.

The details of the process are as follows:—

The heads are prepared as rings (Fig. 103) cut off from rectangular bar and turned round upon the anvil beak or upon a mandrel, but not welded as yet. For the shauks, suitable lengths of round rod are cut off. As many rings and lengths of rod are prepared as there are bolts wanted, to economise time, and then the welding begins. First, then, the end of a rod, made red hot, is driven vertically through its ring (Fig. 104); the ring lying upon the anvil, the rod is brought into a horizontal position, and the ring closed tightly upon it by two or three smart blows of the hammer, and also the end of the rod slightly burred over with the hammer (Fig. 105). This is done to keep the ring from slipping out of place. Then the whole of that end is put into the fire and raised to a welding heat, and sand sprinkled over it just before withdrawal from the fire. On being taken from the fire, the head is laid in a hexagonal bottom tool (Fig. 106), and about half a dozen blows given to it, altering the position of the head after each blow. These suffice to impart a pretty accurate hexagonal form to the head. It is then put into a bolt header (Fig. 108, A), resting on a tall heading block, B, of cast iron, pierced with a central hole, and the top of the bolt head, C, is well beaten over with hammer and flatter. The bolt is then put back in the hexagonal bottom tool (Fig. 107) and hammered once more on each separate face; then back in the bolt header (Fig. 108), and struck twice or thrice with a flatter, and then finished with a cup tool (Fig. 109), which gives the rounding at the edges. Finally, it is put back in the hexagon swage (Fig. 107), and a last blow given with the flatter on each face. All this is done at a single heat, and, when finished (Fig. 110), the bolt head, unless very small, is still at a good red heat.

In a well-appointed smithy, an appliance like that in Fig. 111 is employed for rounding off the heads of bolts; A is a bracket-like casting, bolted firmly to a heavy cast-iron base let into the ground. Through an overhanging boss at the top of A slides the shank of the rounding tool, B. This is plumb over a bolster, C, on the base. The bolt is dropped into the bolster, C, and the tool, B, struck upon it with a sledge hammer. The support, D, is merely for the purpose of supporting the rounding tool while not in use—that is, while the bolt is being slipped into the bolster. It is pivoted to a strap fastened to the side of A, and is turned to one side when the tool is being struck with the hammer.

Many bolts, such as those used for glands and for some forms of plummer blocks, are furnished with collars. These are usually welded on as rings, and finished in a die or swage of the form in Fig. 112.

A bottom swage like Fig. 113 is very useful, both for bolt making and for general work. Using this, a gradual reduction in diameter can be made without the trouble of changing the separate single bottom swages.

To make *nuts* in small quantities, take a flat rectangular bar of the same thickness and width as the nuts, and mark off and nick their lengths with a cold chisel. Centre-pop the centre of each space. Heat the bar and punch all the holes through in succession over a bolster. Then cut off each nut on the anvil chisel, and finish on a mandrel.

Long rods and bars, when being cut off or welded, require some support at the end farthest away from the smith; support is also wanted when two rods are being welded by a man working single-handed—one rod is held by the smith, but the other has to be supported by some mechanical contrivance. Any appliance of this kind should be provided with means of adjustment for varying height, to suit differences in the bulk or thickness of the work. One common contrivance of this kind is shown in Fig. 114; another in Fig. 115, and both, of course, are portable. In the first (Fig. 114), two cheeks, A, of wrought iron, cut to the outline shown in the end view, and maintained at a definite distance apart with the stay bolts, B, B, are pierced with numerous holes, C, at different heights. Into any of these holes the bolt, D, can be inserted, carrying the loose roller, E, that supports the work.

In the second (Fig. 115), two uprights, A, are tenoned and united into a foot, B. Between the uprights the forked piece, C, slides, and the insertion of pins, D, in any of the series of holes is the means by which the height of the fork, and, consequently, of the work, is regulated.

Sometimes the support consists simply of a forked end screwed into a socket, and turned up or down with the hand. But although the adjustment of such a form is more exact than the others, more time is necessarily occupied in effecting a considerable difference in the height.

Another method of supporting heavy work is by means of an endless sling chain dependent from a loose pulley, slung from a light jib overhead. The jib is like a crane jib, but it is not a crane, because there is no mechanical advantage gained, but only the convenience of bringing the sling chain within reach of the work, the extent of adjustment being only limited by the length of the pivoted jib that is free to swivel horizontally, and along which a roller runs, from which the endless sling chain and pulley depend. This contrivance is often used simply for lifting work of considerable bulk from the fire to the anvil, and *vice versâ*. For heavier work a pair of pulley blocks are often slung from a jib, and then there is mechanical gain, and facility for raising and lowering the work as well.

Bars which are too long for the tongs have to be carried about from the fire to the anvil, or to the steam hammer. Two forms of carriers are commonly employed. One (Fig. 116) is used underhand, being carried vertically with the hook lowermost, and the work, or one end of it, slung in the hook. The other (Fig. 117) is used for heavy forgings, being carried by two men. When one end of the work is carried thus, the other may be slung in the crane, or be merely supported or balanced with the tongs or other means.

The manufacture of chains is quite a speciality, but a smith is often called to mend a broken chain. When a broken link is replaced it is usually made a trifle longer than the normal link, for convenience of formation. Also when a link is added to one end of a chain for the purpose of connecting it to any attachment—as a crane hook, for example—the link is made slightly longer. Such an added link is termed a shutting link.

To weld a shutting link, the iron rod is first bent to a U shape (Fig. 118, A), then two opposite faces, *a*, *b*, are drawn off diagonally with the hammer, and the link is bent round to bring these faces nearly close together (B). The link is then put back into the fire, and brought to a welding heat, a little sand strewn upon it, and closed smartly with the hammer, first on the flat upon the anvil, and then upon a tool, C, fixed in the hole in the anvil. To smooth and finish the link a hollow swage tool is worked around it.

Swivels are of common occurrence, and require some art in making. The usual method of making a swivel is shown in the group of figures 119. A is a piece of rectangular bar of the most suitable dimensions available. Properly, its cross section should be rather greater than that of the boss of the swivel, because then no welding on nor upsetting will be necessary. A hole is first punched at *a*, corresponding with the eye of the swivel; then a moulding tool, B, of a type kept in various sizes in the shops, is laid across the red-hot bar, roughly concentric with the punched hole, *a*, and struck a few blows with the steam hammer, leaving the impressions *b*, *b*.

In the absence of a steam hammer, a fullering tool would answer the same purpose as B, but a rather longer time would necessarily be occupied. The tool B not only fullers, but also imparts the desired curved form to the incipient boss simultaneously. After fullering, the bar A is cut off at *c*, and the portions *d*, *d*, are drawn down to a sectional area a trifle larger than that of the arched portions of the swivel. At the same time the boss portion is shaped out of the lump *e* until the forging has the appearance of C. Then a mandrel, D, is passed through the punched hole, *a*, and the drawn down ends are hammered over as at *f*, *f*. At the same time the forging, while on the mandrel, is finished all over, except just where the weld is to be made, the boss *g* and the arms *f*, *f*, with their merging curves, all being gone over in detail with the hollow tools and fullers. The extreme ends of the arms *f*, *f*, are also scarfed and slightly upset, and the forging then has the appearance of E. The next operation is welding. To afford support to the swivel during this process, the beak of the anvil is utilised, or, better still, a special bolster-like tool, F, fitting into the hole in the anvil. The face of this tool is curved roughly to the curve of the swivel, and the work of welding and finishing with hollow tools is readily accomplished upon it, during which period the position of the swivel on its bolster is being continually shifted. The form of the finished swivel is shown at G, and the scarfed weld is at *h*.

Another way of forming such a swivel is shown in Fig. 120. A round rod, A, is divided and forked, as seen by the dotted lines, B, the divided ends still further opened out and drawn down and upset, as at C, C; after which, the process is similar to that shown in the previous group of figures.

AN ARMCHAIR: HOW TO MAKE THE FRAME AND UPHOLSTER IT.

BY DAVID ADAMSON.

First Stuffing—Stringings—Scrim Covering—Stitching—Tack Stitching—Blind Stitching—Top Stitching—Second Stuffing—Completion of Seat—Stuffing Back—Arm Pads.

When the canvas or Hessian has been laid on the webs, as described in my last, the foundation is ready for the stuffing to be laid on it. Perhaps I should say that there are two separate stuffings in a properly upholstered

chair seat of this description. They are known simply as first and second stuffings, from the order in which they are done. Naturally it is this first stuffing which we are taking now, and on the way it is done a good deal of the success of the seat depends. For the novice it is perhaps the most difficult part of the work, and it need hardly be said that if he can get some friendly upholsterer to show him how to proceed, or, at any rate, to look over the work as it progresses, it will be a decided advantage, though I will try to make every part of it as clear as possible, and those who follow the directions closely will have no excuse for going very far wrong. Still, there are little points which one cannot very well describe without running some risk of being misunderstood: or rather, there are details which evade description. For instance, it is almost impossible by mere explanation to convey a notion of the relative hardness or softness of the seat, whereas an experienced upholsterer could tell at once whether it had been too tightly or too softly stuffed, so that I advise all who are in a position to do so to submit their work to competent criticism. It is scarcely likely that the novice will make his first stuffing too hard; but it must not be inferred from this that it is to be as hard as a stone, but, on the other hand, it must certainly not be loose and puffy like a feather pillow. Neither extreme is desirable, but it may be said that a hard seat will keep its shape longer than a loosely filled one, and that the edges should be made as hard and firm as they can be. With the remark that the first stuffing may be regarded mainly as a foundation for the second, we may proceed to see how it is arranged. I may perhaps say here that seats are often upholstered with two qualities of stuffing material, the commoner one being used for the first, and the superior for the second. Thus hair may be used for the latter, flock or alva for the former. Seats so upholstered are said to be stuffed "part hair," it being understood that this material forms the second stuffing.

The first thing will be to fasten strings along the top of each rail. These pieces of string, or "the stringings," as they are called, are merely what may be termed loops for the hair to be tucked under, and held to some extent in place. It does not matter exactly how they are fixed and arranged, but perhaps the following description will show exactly what is needed. Drive a tack partly in on top of the frame, near one of the legs. Fasten one end of a piece of twine to the tack, and drive home. On the same rail, at a distance of, say, 6 in., insert another tack, and before hammering it down twist the twine round it. The stringing between the two must be left loose, and a fair enough guide for the degree of slackness may be got by inserting a couple of fingers between the twine and the wood. Go all round the frame in the same way, then fix stringings diagonally from corner to corner. These will probably be enough, but if desired, one or two may be fastened straight across. The stringings are now completed, and the hair or other stuffing may be worked in. Before putting any of it on the chair, see that it is well loosened and free from lumpiness. Distribute it evenly over the canvas, working it under the stringing; and here a difficulty about knowing when there is enough will probably occur. At this stage of the chair the appearance of the stuffing is apt to delude the novice, and I do not know that I can do better than recommend him to use his own judgment. The first stuffing, when completed, should be, for such a chair, about 2½ in. thick, and the loose hair must be added till it is considered there is enough to form this when pressed down. The great thing, however, is to get the stuffing even, so that the seat shall be equally hard all over.

When this has been satisfactorily managed, a covering of scrim must be put on. This must be cut large, so that it will come quite over the stuffing. It is to be fastened down temporarily to the frame with a few tacks, and then tied down. To effect this, the long upholsterer's needle is run right through the seat to form a few stitches or ties, which should be drawn moderately tight and fastened. The stuffing will thus be to a certain extent compressed, and the scrim may now be permanently tacked down to the outer edges of the top of the frame, which, I have omitted to say, should be slightly bevelled off for the purpose of allowing the tacks to be driven into them conveniently. Before fastening the scrim down, trim it off so as not to leave too great a quantity to be turned in While the scrim is being fastened, work a little more hair in underneath it at the edges, and supposing the tacks are about 1 in. apart, leave the heads of alternate ones projecting a little: *i.e.*, do not drive them quite home. Each tack may be left in this way if preferred, but it is hardly necessary, as every other one will do perfectly well. As will be seen directly, twine will have to be passed under the tack heads, so that the amount to which they must project is not of great importance.

The corners of the scrim must be cut through diagonally, to afford space for the legs, and the superfluous material tucked down. The flat end of the regulator is for such purposes, but almost anything else, such as the flat end of a spoon or a knife-blade, will do very well. At this stage the edges of the stuffing will be loose and baggy. They must be stiffened and made almost straight. The way this is managed is by stitching them up.

To do this part of the work thoroughly well, at least three rows of stitching will be required, the long needle and twine being used. The first stitch, or rather row of stitching, will be what is called the tack stitch, from the fact that the twine passes under the tack heads. Its object is to draw or keep the stuffing well up to the edge. Making a start at the tack nearest one of the legs, the needle is pushed through in a slanting direction, so that it comes through the top three or four inches from the edge. The needle is pulled almost through and then pushed backwards, so that the eye end emerges just above the rail near the next projecting tack-head, and as close to it as possible. The needle is then withdrawn and pushed upwards again close on the other side of the tack, and the operation repeated till the work is done all round the chair. The tacks are then driven home, and, of course, hold the twine securely under them. It will be seen that this stitching is a series of loops within which the stuffing is caught, and in making them the twine should be drawn fairly tight and evenly. The scrim on top must not be included in the stitch, for which reason the needle is not withdrawn on coming through it, it being much quicker just to push it backwards than to draw it out, and re-insert the point without catching any threads of the scrim. When this stitch is made, therefore, beyond being indicated by the slightly altered form of the stuffing, it is not visible on top, and if neatly done, hardly more so by the tacks. While the stitching proceeds the regulator must be freely used to work the hair, and distribute it evenly if it should seem in excess in any place. The regulator is pushed through the scrim, and the stuffing moved about until it seems properly equalised.

The next row is known as blind stitching, but unless a really good firm edge is wanted, it is not always made, but when the edge of the chair is deep enough it is hardly advisable for the novice to omit it. In moderation, of course, the wider the border the more rows of stitching the better. The blind stitch is very similar to the one already described, the object of the two being identical. On the edges it will be a little above the tack stitch, and also a little nearer them on top. As the twine cannot be brought under the tack heads, it is visible on the edges, coming through and catching the scrim, but on top it is precisely like the other. The course of the needle is, however, somewhat different, as, instead of it being always forward or progressive, in order to catch the scrim at the side it must be pushed backwards. The accompanying diagram, however, will make this more explicit than words alone. The thick line represents the scrim on the edge, the course of the twine being indicated by the

Diagram illustrative of Blind Stitch.

arrows. To keep the stitching regular, the twine is generally caught into a kind of loose knot on the edges. There can be no harm in doing so, but it is not always necessary. Those who wish to minimise the amount of labour expended on the chair may omit either the tack or the blind stitch. One alone will do, only the edge will probably not be so fine.

The next rows of stitching, of which there are two, are known as top stitches. In these the scrim is caught both on top and at the edges, so the twine is visible. They form the hard small roll which may be felt through the covering of almost any well-upholstered chair. The top stitches are very similar to the blind stitches—in fact, for all practical purposes it may be said that the difference is that the scrim is included on top as well as at the sides. They may be about 1½ in. from the edge, and should be pulled as tight as they well can be without distorting the seat unduly. As the object is to get a hard firm roll at the edges, the regulator must be used to work the hair well into them. The second row of top stitching is identical with the first, but is formed nearer the edge, which, when completed, should be perfectly firm and even. To make them so will not be altogether an easy matter at first, but the better they are the longer the seat will keep its shape.

The second stuffing comes next. It is comparatively simple, there being no stitched edges, the hair, which should certainly be preferred to any other material for this part of the stuffing, being merely laid on and covered over. Stringings, as before, will have to be laid. As the rails are now covered, they cannot be nailed

down, but must be sewn through the scrim. A circular needle will be the most convenient for this purpose. A much smaller amount of material will be required for this stuffing than for the first, and great care must be taken that it may be evenly distributed; if not, inequalities will be even worse than if they had occurred before. Another matter to which attention may be directed is that the hair should not project over the edges, but be confined to the top. It should also be laid as flatly as possible, and not with an accumulation towards the middle of the seat. This will have quite enough rise without having an extra quantity of padding there, as it will be almost impossible to prevent the hair being a little thinner at the edges, or rather, being more compressed there by the coverings when the chair is new. A much rounded seat is not so desirable as apparently it is sometimes considered to be. A slight convexity of surface may look well in a new chair, because it is natural. An artificial heaping up is neither pleasant or necessary. However, to resume practical work, when the hair is distributed properly it must be covered with calico or any thin similar material. This must be tacked down temporarily to the frame. After sitting down on the chair for a few minutes, it will be very easy to judge whether the hair has been evenly and properly laid. If everything seems right, the calico may be permanently tacked down much in the same manner as the scrim. The tacks, being on the face of the rails, must be driven well home, that they may not be perceptible through the outer or finishing cover.

So far, only the stuffing of the seat has been referred to, but the work involved in the back is altogether simpler, as it much resembles the first stuffing without the stitching. Stringings must be laid as before, and only a thin padding of hair is required: much the same as that for the second stuffing. The calico is then tacked down over the edges, and to keep the hair from falling it should be tied, the stitches going right through and not drawn too tightly. It will readily be perceived that, with the exception of the outer covering, the upholstery is now finished. It seems to call for no special remark, beyond saying that care must be taken that it is neatly tacked down, so that the seat framing is quite covered. In connection with this, the novice's attention may be drawn to the necessity of not making the cuts at the corners by the legs too long. I suppose it is understood that a layer of wadding split open must intervene between the covering and the stuffing, both on the back and on the seat. The covering should be drawn tightly over, otherwise it will soon become baggy and have a slovenly look. When laying the wadding, see that it does not project over the edges. Naturally, to prevent mistakes, which it would be afterwards a difficult if not an impossible matter to rectify, the coverings will be first fastened down temporarily.

Nothing has been said about the arm pads as yet, though they should hardly be passed over without mention. They may be finished with a thin stuffing on top, similar to that of the back, or as shown in Fig. 1 (page 409), which certainly is the better of the two methods, and the only one which may possibly require a few remarks. It is done much in the same way as the first stuffing of the seat, the solid wood of course doing away with any necessity for web or canvas. A tack stitch and blind stitch—*i.e.*, a row of each—are advisable, after which the covering may be fastened down with a small piece of wadding on the top or flat part of the pad, so that it will be seen that they are treated very much as though they were diminutive seats without any second stuffing. The outside of the back also will have to be covered, which should be done before that in front is nailed down: unless, indeed, a separate piece is used for the borders of back, as it very well may be with a saddle-bag covering. In this case, after tacking the back and front coverings down on the edges it will be well to sew the bordering on. This should be done very neatly, and the seam or join may afterwards be hidden by stitching upholsterers' cord, or the ruche binding often used on easy chairs in combination with saddle-bags. There is, however, such infinite scope for taste in trimming upholstery, that beyond making these few suggestions, space cannot at present be devoted to this part of the subject, and the upholsterer who has succeeded in finishing the work otherwise will, no doubt, have his own ideas of what are, after all, only decorative details, and of secondary importance for anything except appearance.

Therefore, with a final wipe over by the polisher, we may consider the description of our great chair of ease as finished.

AN EASY METHOD OF RE-SOLING BOOTS.

BY C. E. MAES.

SELF-HELP being the object and aim of most amateur mechanics, a short space devoted to an easy method of re-soling boots as well as patching up worn soles so as to make them waterproof may not be amiss. A shoemaker perhaps would quote the old adage, "Nothing like leather," on finishing a perusal of the following remarks, and no doubt he would be correct if durability, lightness, and general convenience be taken into consideration; but, at the same time, we are rather apt to forget that leather, even if it be of the substance of which some of it is popularly supposed to be made, viz.: brown paper, is not the only material which may be used for boot and shoe soles. We have for example the unlovely but doubtless dry and durable clog sole of wood, by repute unsurpassed by anything for wife-kicking purposes in Lancashire and in other parts of the realm where the genial, mild-tempered, and altogether admirable labourer has notions of his own for promoting domestic bliss. Clearly our readers have no use for clog soles. Then we have india-rubber, but that is mostly used for goloshes. It, however, is very closely allied to the material which is suggested as a substitute, though possibly an inferior one, for leather—I mean gutta-percha. Now please, dear and thrifty reader, do not turn away in disgust and think you might as well use paper—I can assure you that gutta-percha makes by no means bad soles, and that with it you will find no great difficulty in either patching or entirely re-soling your boots. I do not recommend you to try it on your nice light boots; but if you have an old pair really not worth mending as you think, but which still—with a patch or two, that the cobbler can do, on the uppers, and soles only costing a trifle—can be made into good serviceable understandings for the country, experiment on them. Many an old pair of boots which are looked on as useless can be made thoroughly useful for winter wear, for it must be remembered that gutta-percha is waterproof. It is also light in weight, and, being a non-conductor of heat, is warm to the feet. It is, however, chiefly on the grounds of economy and the ease with which it can be used that gutta-percha is recommended here. I have prolonged the useful life of more than one pair of heavy winter boots with it. At the moment of writing I am wearing an old pair of sea boots the uppers of which have been patched wherever needed by the cobbler and the soles renewed by myself. They are not elegant, but after a long day out of doors on the wet Anglesey coast they are as dry inside as when they were put on. I have just been telling some of the people in the village where I am staying how I manage, and as what I explained was new to them, it may be equally so to many of the more extended circle of readers of this periodical. Hence my struggles with pen, ink, and paper.

The gutta-percha necessary (I do not think it is specially prepared for the purpose) can be got at any india-rubber shop. It is sold in pieces about ¼ in. thick, and of course as much as may be wanted must be bought. The measurement roughly can easily be got. Some cement will also be required; I find that used for fastening the india-rubber tyres on bicycles, etc., excellent for the purpose. I have used cuttings of gutta-percha instead, but do not find it so satisfactory, except perhaps to stick a patch on a worn piece of gutta-percha sole. In this case, though, a cement of any kind is hardly necessary, as the two surfaces being made sticky by heat, they adhere without further medium.

The soles to be repaired must be thoroughly dry before commencing operations. This is a *sine quâ non;* for if they be in the slightest degree damp, the new soles, though they may adhere for a time, will certainly come off ere long. That any dirt or clay must be cleaned off goes without saying. It may be advisable to tear off the bottom layer of leather, in which case a neater-looking job perhaps will result. I often, however, just take the boot as it is and lay the gutta-percha on. In either case the work is the same. It is well to warm the soles of the boots and put the cement on while they are so. The cement may either be melted in a ladle and poured on, spreading it thinly, or be used like sealing-wax by melting it as required and rubbing it on the boot, or bits may be put on the boot and melted and spread with a piece of hot iron—the kitchen poker, an old knife, or anything of the kind will do very well. I am by no means sure that this last method is not the best, as the hot iron seems to work the cement well into the leather, which, by the way, may often be roughened with advantage—any rasp, or even scoring and scratching with a knife will do. The cement should be evenly spread, and while it is hot is extremely tenacious. If it gets cold before the gutta-percha is ready to apply, it may be heated by the hot iron over a gas or lamp flame, or at the fire. The great thing is to bring the gutta-percha and the boots in contact while the cement is quite hot. The gutta-percha also should be hot, on the side of adherence hot enough to be soft and sticky. This can easily be managed by holding it close to the fire for a short time just before putting it on the boot. The gutta-percha should then be firmly but gently pressed to the boot. It will be flexible enough to yield to pressure

and follow the curve of the sole if it has been sufficiently warmed.

When the new sole is firm and hard, as it will soon become if the boot is put in a cool place, the edges may be trimmed off. This can easily be done with a knife, as the gutta-percha can be easily cut. The cuttings should be kept, as they come in useful for repatching the sole as it becomes worn in places, so that there need be little, if any, waste. The final touches may be given by drawing a hot iron of any kind over the edges so as to smooth them down.

The sole as now made will wear a considerable time, though not so long as leather, but its wear-resisting qualities may be much increased by the use of Blakey's, or other boot protectors. These, as is no doubt well known to most readers, are pieces of iron, small in size, for fastening on to the sole in parts most susceptible to wear. They can easily be fixed. The caution that boots with gutta-percha soles should not be placed too near a fire may not be unnecessary, but beyond this no special precaution is necessary any more than in the case of leather.

A ROCKING-BOAT FOR CHILDREN.

BY "OUTIS."

There is at least one experience common to the skilled joiner and the amateur who owns a family, or is a member of one: neither of the two workers need be long "out of employment."

This truth was made very evident to me almost as soon as I had finished my "Child's Chair" (see page 103 of this Volume). From the chair to the boat was, I found—at any rate, in a child's imagination—little more than an easy step. It was useless pleading paucity of ideas, lack of wood, etc., etc. Evidently, according to the juvenile mind, ideas ought to crop up as readily and plentifully as daisies; and the amateur who once boasted of a boat made out of his own head was perfectly justified in adding that he had wood enough left to make another!

The only wood I could find left (in my workshop) to suit the idea that came into my head consisted of the fragments of some old packing-cases, and a few spars which once formed part of a greenhouse platform.

However, with a little care and arrangement, this somewhat unpromising-looking material served my purpose well enough—the rocking-boat made from it being strong and useful, and not at all unsightly. For over twelve months it has well stood the severe test of that rough usage generally accorded to children's playthings; and, beyond a few scratches, it looks little the worse for wear.

It will be noticed that the boat was designed to hold only two children. Of course, a similar one can easily be made to hold four inmates—by lengthening the rockers, and carrying the centre rib up through the floor, sufficiently high to form a support for two children sitting back to back. The older child sits on the raised seat, and swings the boat. The shallow box at the back of the lower seat is meant to hold a weight (in my boat there is a brick), to counterbalance any difference there may be between the weights of the children. The projecting arms, which form the sides of this box, also act as a safeguard against the boat being worked too high.

Detailed directions for making such a rocking-boat will scarcely be needed by anyone who carefully studies the illustrations here given, and knows how to use the most ordinary tools. Full dimensions are supplied, not necessarily to be exactly followed (for in some respects they were determined by circumstance rather than by choice), but as a guide to those amateurs who prefer to rely upon what has stood the test of actual experience.

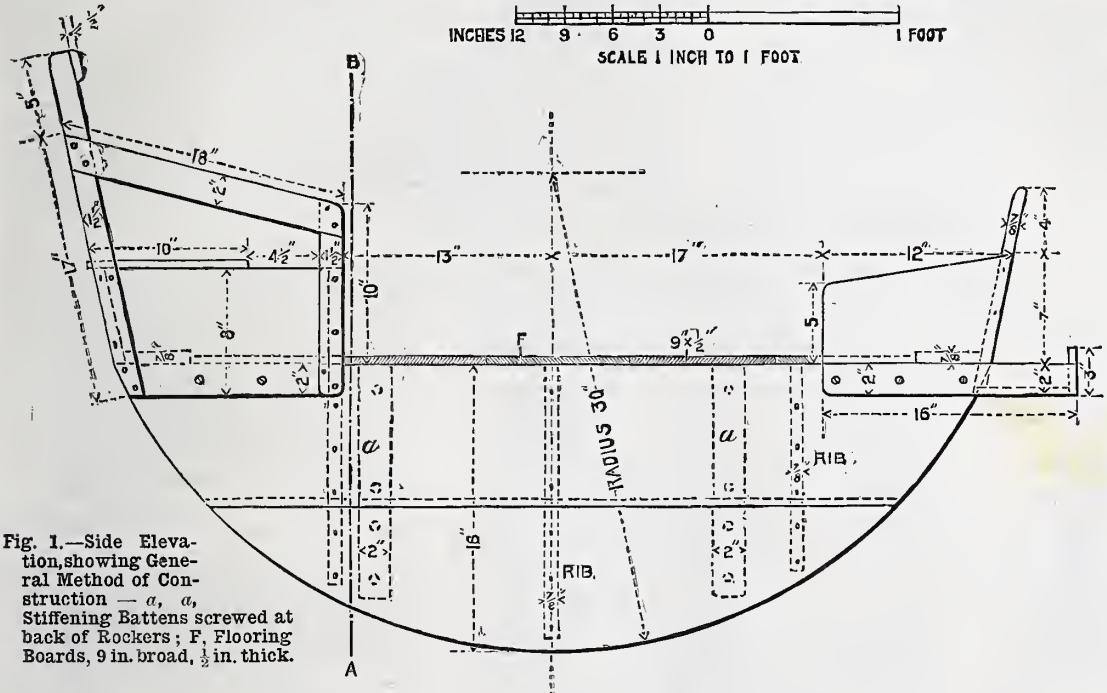


Fig. 1.—Side Elevation, showing General Method of Construction — *a*, *a*, Stiffening Battens screwed at back of Rockers; F, Flooring Boards, 9 in. broad, ½ in. thick.

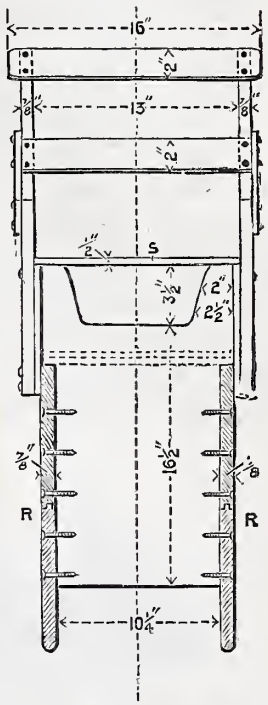


Fig. 3.—Sectional Elevation at A B, showing Rib carried up through Floor of Boat to form Foot Rest for Raised Seat—R, R, Rockers made of two 9 in. Boards, grooved and tongued together, ⅞ in. thick; S, Seat, ½ in. thick.

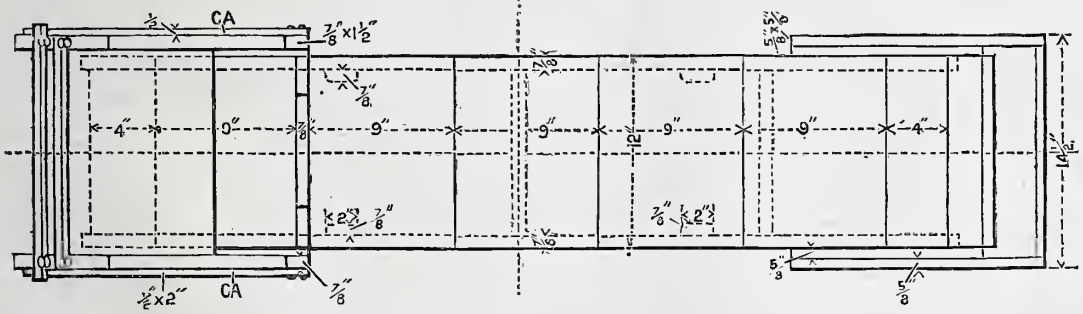


Fig. 2.—Plan, with Rockers, connecting Ribs and Battens, shown in dotted lines—CA, Chair Arm, ½ in. thick.

It may, perhaps, be sufficient to mention that the seats and the floor of the boat I made were covered with old carpet, tacked down by small brass-headed nails, the other parts of the boat being painted to match the carpet.

A strap and buckle should be fixed to the sides of the lower seat, to prevent the child from sliding out, if too young to hold on by the sides. The sides of both seats should be securely fastened to the rockers with strong screws, as shown in sketch.

In addition, the arms of the high seat must be well screwed to the uprights, to which also the bars which form the back-rest should be tightly secured.

One word in conclusion. If, by making such a popular addition to the nursery as the rocking-boat is, and ever has been, any

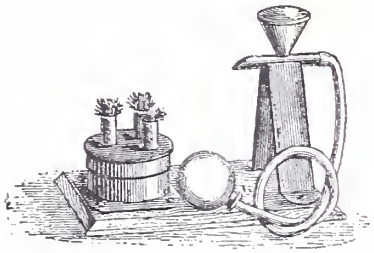
workman (be he professional or amateur) succeeds in diminishing the tears and increasing the smiles of those little mortals whose existence ought to be a source of joy and happiness to themselves and others, he will not lack a real and valuable reward. Certainly he will not find any of his "customers" more gratefully appreciative of his efforts to please, nor, it may be affirmed, more ready to supply him with "further orders."

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

126.—PLATT'S "SIMPLEX" REPEATING FLASH LAMP.

THIS is a lamp manufactured and sold by Mr. E. R. Platt, Birkbeck Works, Birkbeck Road, Ridley Road, Kingsland, London, N.E., at 3s., or 3s. 6d., post free. It is, as its name implies, intended for photographic purposes, and is sent out furnished complete with ball, tube, cotton, and sufficient magnesium powder for fifty exposures. The powder for this number of exposures is stored in the funnel shown in the accompanying illustration. It is claimed that



Platt's "Simplex" Repeating Flash Lamp.

the simple contrivance of this lamp at once shows its superiority and advantages above all others by reason of its containing no complicated parts to turn, and that it can be used at any time by the storage of magnesium powder in the funnel, which renders its use economical as well, other lamps using a funnel-full for a single discharge. On testing the lamp, it proves to be a good workable lamp—indeed, very good, considering the price asked for it; but there seems to be nothing particularly novel about it. It gives a good light with a small supply of magnesium, but possibly, if the spirit flame was rather more distant from the discharge, it might be an improvement. The quantity of magnesium sent with the lamp was exhausted after twenty-six exposures, so possibly it was not the regulation allowance for fifty. It should be said that T-pieces for blowing two or more lamps can be supplied, and that for 5s. a lamp can be had better in appearance than the ordinary lamp at 3s., being better finished and nickel-plated.

127.—LOCKWOOD'S BUILDERS' PRICE BOOK, 1891.

This is the edition for 1891 of Lockwood's "Builders', Architects', Contractors', and Engineers' Price Book," a work which, from its nature, and the copiousness of information on every subject on which it treats, is invaluable to those for whose use it is intended. It is described on the title-page as "A comprehensive handbook of the latest prices of every kind of material and labour in trades connected with building, including also a great variety of the most recent in formation in all matters concerning these trades." In the present edition special attention has been given to the important subject of electric lighting, and sanitary appliances in their newest forms, ventilation, and lighting generally are among the subjects that have been taken up and carefully dealt with in this volume. Moreover, prices for measured work have been calculated on the basis of present prices for labour and materials, and various legal notes and memoranda, specially useful to the builder and contractor, have been added to this edition. These legal notes, with the principal provisions of Acts of Parliament relating to building and sanitary matters, the rules and regulations issued by the London County Council, the Corporation of London, and other public bodies, and the headings for contracts drawn up by the Royal Institute of British Architects and the London Builders' Society, will be found in the appendix, a most valuable part of the work, replete with useful information, which is here brought together from many different sources and focussed, as it were, for the use and benefit of those who use the work. It has been re-written, considerably enlarged, and brought to its present form by the editor, Mr. Francis T. W. Miller, A.R.I.B.A., and is published by Messrs. Crosby Lockwood & Son, 7, Stationers' Hall Court, Ludgate Hill, London, E.C., at the low price of 4s., seeing that the book contains 616 pages of text and 58 pages of advertisements, which in themselves are guides to many a good thing required daily in the building trades.

128.—"FURNITURE AND DECORATION."

This is a useful monthly publication devoted to an exposition of every subject connected directly or indirectly with the internal decoration of our houses and public buildings and the furniture and fittings that are found in them. It is conducted by Messrs. Timms and Webb, and is published in monthly parts at 6d., and handsome yearly volumes, substantially bound in cloth, at 7s. 6d., by Messrs. Smith and Botwright, 6, Eldon Street, London, E.C. There is so much to look at in the various designs with which this attractive publication is profusely illustrated, that it is really a matter of considerable difficulty to make a selection for special praise. I may, however, call attention to an article entitled "Simplicity in Furnishing" in the first number of the second volume—the number bearing date January, 1891—which not only conveys sound and acceptable teaching on true beauty of design, good workmanship, the absence of too elaborate ornamentation, and congruity in the furniture and general decoration of a room, but gives the front elevation, side elevation, and details of one of the handsomest, neatest, and most attractive sideboards it has yet fallen to my lot to see on paper, and which I trust one day to see reproduced in wood for my own use. It is professedly on "simple Chippendale lines." The bottom board of the carcass is placed on a base, supported at the corners by slightly curved legs, each terminating in a foot projecting outwards from the sides. Thus there is a space 9 in. or 10 in. in height under the sideboard, always desirable for cleanliness' sake. Between the bottom and top boards of the carcass are two cupboards with a revolving cellarette between them, and three drawers, which are separated from the cupboards and cellarette below by a small moulding enriched with dentils, the only attempt at ornament throughout the whole structure. From the broad shelf, at the hinder part, rise boldly formed brackets, supporting a narrow shelf, from the rear of which rise, above the brackets, four *quasi* pilasters, these, and the plain woodwork between, forming a back to the smaller shelf. The pilasters form supports for four brass standards, about 18 in. in height, carrying horizontal brass rods, which, in their turn, support hangings, which impart lightness of appearance and character to the whole, and which may be varied both in material and colour, partly in accordance with the season of the year, and partly in reference to the prevailing tints of the wall behind and the drapery and upholstery of the rest of the furniture of the room. It would be difficult, I think, to produce a sideboard that would equal this in point of simplicity and tastefulness. THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

I.—LETTERS FROM CORRESPONDENTS.

Erratum.—T. R. B. (*Blaydon-on-Tyne*) writes:—"In the first column, page 717, Vol. II. of WORK, the words 'Along the steam-port *fence*,' should read 'Along the steam-port face.'"

Violin Bridges.—COMME IL FAUT writes:—"Occasionally, one or two strings on a violin are simply splendid in tone, others tubby and the G tinny. Has the bridge anything to do in the matter? Undoubtedly! Take, for instance, the old style of bridge, Fig. 1; by varying the distance from the top to the cut-out portions, and also by the thickness of the bridge itself, the tone can be altered; but this alone does not always effect the desired result. Look at Fig. 2, and read the following quotation:—'The old form of bridge was never adapted to the requirements of the instrument; it had not been studied as a mechanical medium for the just intonation of one string with the other. For instance, the second and third string come over the broad and least resisting part of the bridge; consequently, there being no yielding medium to set up the vibrations in the belly, we experience the harsh tubby tone so frequent in these strings. Now, it will be seen the new bridge represents a lever, the first string standing over its fulcrum, it being the string with the shortest and quickest vibrations, the second, third, and fourth setting up slower vibrations successively, according to the position of leverage on the bridge.—OASIS.' Now, I have constructed several of the 'Oasis' bridge as described above, with a marked improvement in the tone,

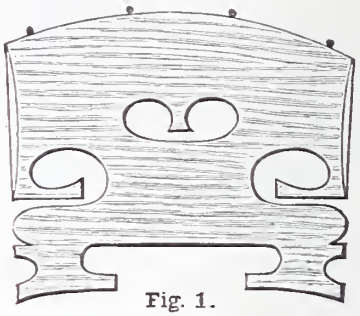


Fig. 1.

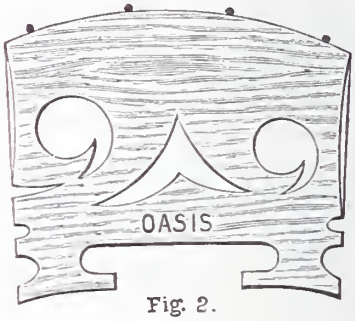


Fig. 2.

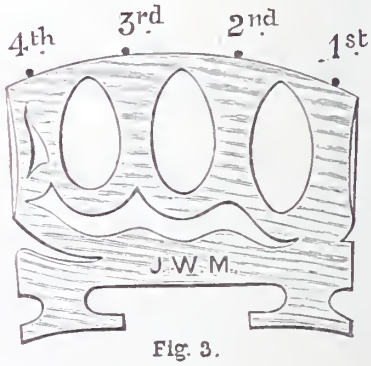


Fig. 3.

Violin Bridges.

especially of the first string, but failed in getting equalised results for the four strings. I, after experimenting with endless forms, at last made a bridge of the form shown at Fig. 3, thus altering the vibrations of the bridge in a most marked manner, the vibrations of each string *principally* affecting the part of the bridge beneath it, thus *in a measure* providing a bridge for each string, the *grain* of the wood to run slightly inclined downwards towards the first string. By alte ing the length and breadth of the cut-out parts, thus leaving more or less wood beneath each string, the tone of each string can be varied without affecting

the others; the bridge should be a trifle thicker than ordinary, and not tapered to be so thin at the top, but left so when rounded gradually off, to be about $\frac{1}{16}$ in. where strings rest on top. Take care that the strings are strung to *exactly* the same piteb when testing different bridges."

Cheap Stair-Eyes.—H. J. L. J. M. (*Ealing, W.*) writes:—"Stair-eyes can be made at home very easily by cutting stout brass wire (12 or 13 B.W.G., or even stouter) into lengths, flattening out the ends, and drilling or punching small holes in the flattened portion. These pieces of wire can be fixed to the stairs by the ordinary escutcheon pins. The simplest way to fix them is to cut a gauge of wood, triangular in shape, to represent the space to be occupied by the rod. By putting the gauge into tbe angle of the head, a support is made for the wire eye while nailing and pinning it in position. As an alternative, the eyes may be cut out of sheet brass, using the thickest metal that can be cut with an ordinary pair of hand snips. The required number of eyes may be marked out on a sheet of brass, and the holes drilled before cutting up the brass into strips. The strips can be as easily beaten into the shape required as tbe wire eyes mentioned above."

Steamy Windows.—H. J. L. J. M. (*Ealing, W.*) writes:—"In these cold days, when so many shop windows look like waterfalls from the condensed vapours that course down them, a means of stopping it may be welcome to some. I saw the plan at work in a ham and beef shop window at Bournemouth, and give it for what it is worth. Along the front pane of each bay-window of the double-fronted shop there was fixed a length of brass ½ in. pipe, with a gas jet every 4 or 5 in. These jets, which were placed as close to the plate glass as possible, consistent with safety to the glass, were lighted, and were kept burning all day, witb the result that the window was perfectly free from steam. The gas seemed turned on only to about half its full extent, and I imagine the gas jets were burners of small size, as otherwise tbe expense would be enormous."

Useful Mallet.—H. J. L. J. M. writes:—"A very useful hammer or mallet can be made of a piece of tubing filled with lead or compo metal, to give it weight and solidity. I have a small one which I made of a piece of brass curtain-pole (which consists of thin iron tubing cased with still thinner brass), about 2 in. long, and 1 in. in diameter. I filled it witb capsules and bottle-tops melted down, so as not to make it too heavy. It is very useful for knocking togetber any pieces of work that would be likely to be damaged by an ordinary hammer, even of half its weight. A tap from this lead hammer will drivo home a pronged chuck into the mandrel nose witb ease; whereas a blow from a hammer would damage tho centre-point of the chuck. The mallet is useful too in *repoussé* work in knocking up large surfaces where a heavier bammer than usual is required."

Chilblains.—H. J. L. J. M. (*Ealing*) writes:—"Medical subjects do not come within the province of WORK, but as I can give the following as a 'means' of curing the unpleasantness known as chilblains, it may be acceptable, especially as chilblains can be bad enough to keep their 'victims' temporarily out of work. The remedy is 10 grains of sulphate of copper and 1 oz. of hot water. Let the sulphate of copper dissolve in the hot water; then dabble the chilblain with the solution, and when dry anoint the part affected with grease or oil of some sort. Vaseline, cold cream, or spermaceti ointment all do equally well; a speedy cure is the result, as I can testify. This remedy is *not* to be applied to broken chilblains."

Browning Gun Barrels.—E. H. H. (*Chatham*) writes:—"The following is the recipe used by the military for browning gun barrels:—Acid, nitric, 1½ oz.; nitre, sweet spirits of, 3 oz.; steel, tincture of, 3½ oz.; vitriol, blue, ½ oz.; wine, spirits of, 2 oz.; water, spring, 12 oz. It would be the wisest plan to take the gun to a gunsmith. The above is sufficient to do fifty guns."

Oak Chair.—E. P. W. (*Warrington*) writes:—"I will try to describe this home-made chair as briefly as I can. The cushions are loose, so tbat I can take them off, and give the chair a rub with linseed oil when I like. It is 1 ft. 6½ in. wide in front inside the legs. You will see by Fig. 2 that the back frame and seat are hinged together; two brass plates are let into the runners under the seat 7 in. long (see Fig. 8), with holes drilled about ⅜ in. apart; two studs are let into the under side of seat so that they will drop; into the holes in the brass plate (see Figs. 9 and 10) two brass plates are screwed into the inside of back legs with a slot 5 in. long (see Fig. 12). Cut a groove in the wood to allow the head of screw (Fig. 11) to slide in. This has a square head; I got these screws at a gunsmith's shop. They are screwed into the stile of the back, and the plate (Fig. 12) into the leg. It will work like a pivot, so that by raising the front of seat about 1 in., you can draw the seat forwards; drop it into any hole you like, and the back falls back at the same time; the seat is tbe same width back as front. The reeds were done with a scratch. You will see that I have got some of my ideas from tbe 'Old Oak Bureau' and the 'Three Prize Bookcases,' which appeared in WORK."

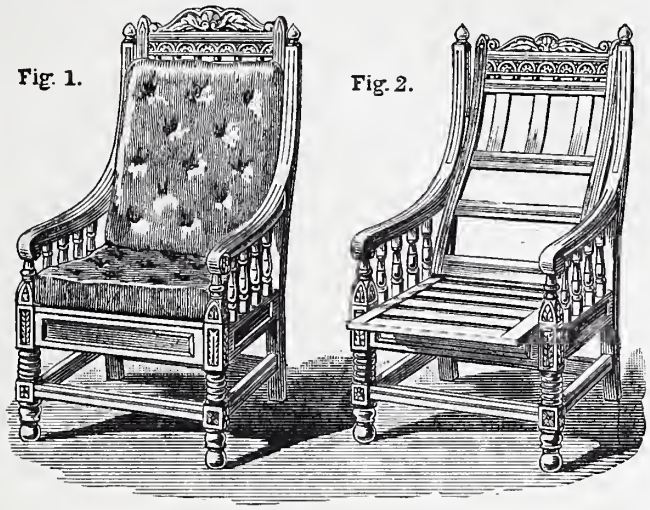


Fig. 1. Fig. 2.

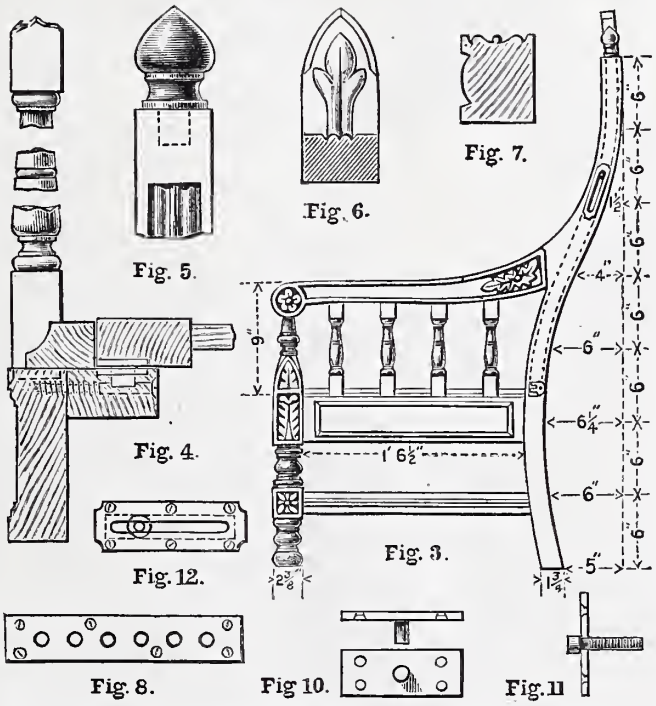


Fig. 1.—View of the Chair with the Back upright. Fig. 2.—Seat drawn forward and Back reclining; Cushions taken off to show Framing. Fig. 3.—Side Elevation. Fig. 4.—Cross Section, showing Line of Leg and Rail and Turned Spindle Scotia scribed to the Spindle, and to be flush with Inside of Leg Runner, Rack, and Seat. Fig. 5.—Turned Knob and Reed Back Leg. Fig. 6.—Top of Stile on Back Framing, showing how the Reed is finished, and Section. Fig. 7.—Section of Arm. Figs. 8, 9, 10, 11, 12.—Not drawn to scale.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Seal Gas Engine.—DEPTFORD.—Apply to J. Seal, 67, Carthew Road, Hammersmith, W., as to the above gas engine.

Carvers' Tools.—J. D. (*Tiverton*).—You can get these from J. Buck, 36, Holborn Viaduct; R. Melhuish & Sons, Fetter Lane, London; or J. H. Skinner, East Dereham.—M.

WORK Exhibition Number.—ERRATUM.—In page 21 of this special number, the inscription to the cut of swimming propeller inserted therein should read, "Gay's Swimming Propeller," instead of "Cowan's Swimming Propeller," as the illustration in question shows; the swimming-plates and shoes invented by Mr. Gay of Northfleet, and not the propeller invented by Mr. Cowan of Glasgow, which consists of three small plates fastened to the leg just above the ankle, there being one plate on each side of the leg, and a third behind.—ED.

Treadle Fret Saw.—S. C. (*Ashton-under-Lyne*).—Your letter should be addressed to the advertiser you refer to. There is nothing to indicate who this is.

Chimney.—W. C. M. (*Sunderland*).—I am quite aware of the trouble in sweeping chimney pot, Fig. 1 (see page 683, Vol. II.), and I do not admire the unsightly appearance, but the two shown were the most suitable pots made in fire-clay for the case submitted to me, and if you refer to page 683 you will see I recommended Fig. 2, although in this district there are many used similar to Fig. 1; and those that have come under my notice do not require any extra sweeping. In your case, if the chimney is raised above the houses at the west side, it will most likely cure it; but if it requires raising to a great height, it is not advisable to do it, as there is a danger of its being blown down in a gale. There is a patent chimney cowl manufactured by Boyle and Sons, Holborn Viaduct, which they recommend for preventing down draught.—M.

Spring Mattress.—HOPEFUL.—As you want to make the mattress in two parts, let me first say that they should not be of equal size, or the division between the two will be too plainly felt. Make one of them about double the size of the other, or, in otber words, the smaller piece should be one-third of the entire length of the bedstead, and should be placed at its foot end. The division is of course to be across the bed and not from head to foot. If you can manage to have the mattress all in one piece it will be all the better, as there are objections to a divided mattress. This latter is, however, more convenient in case of removal, especially if the bedstead is a wide one. You do not say what width you want to make the mattress, so I can only say generally that unless it is a wide one, it will not be worth while to go to the trouble of making it in two parts. First of all, you must make the frame or box—or two of them if the mattress is divided—of 1 in. pine, the width of the stuff being, say, 5 in. to 6 in. Dovetail the corners, or, if preferred, nail them and strengthen inside with blocks glued into the angles. These frames now resemble the sides and ends of a box to which there is neither bottom nor top. By way of bottom, some pieces of pine, about 3 in. wide by 1 in. thick, are now to be fastened across from side to side at a distance of 5 in. or 6 in. apart. They should be let into the edges of the sides so that they lie flush with them, and not merely laid on them. They may be dovetailed, but it will serve every purpose to simply cut spaces in the sides and to fasten with screws. A high degree of finish is not at all necessary, as the woodwork is covered in afterwards. Strength and solidity are the great points to be attended to. On to these bottom laths the springs are to be fastened, as they easily may be, with ordinary wire staples such as can be obtained at most ironmongers'. Three of them will be enough to fasten down each spring with. The springs are of the kind used by upholsterers in chair seats, etc., but they must not be too small nor too weak. As they are made in many sizes and gauges, a suitable spring for you to order will be the 10 in. No. 7 gauge. Reckon a spring for about each 9 in. to ascertain the number of springs required. Fix them at equal distances apart from each other, so that they form straight lines from end to end and from side to side. Now lash them each way with twine, the ends of which are to be fastened to the framing. Where the cords touch in crossing, tie them to prevent wear, and on the whole act as if you were doing a spring-stuffed seat. A covering of canvas (Hessian) is now to be fastened on by tacking round the upper edges of the frame. As the springs will stand higher towards the centre of the mattress than at the edges, a stuffed roll will have to be formed along these. Make it by sewing the edge of a strip of Hessian 11 in. to 15 in. wide, 5 in. to 6 in. from the framing to the covering. Stuff hair under, and tack other edges of strips to frame. Use three rows of stitches, viz., one row top and two rows blind, to firm the roll. When this has been done, proceed to lay the rest of the stuffing all over, tying down at intervals to prevent shifting; cover over with Hessian pulled firmly down. Finally cover over top and wood with ordinary bed ticking, plain or welted according to fancy, and finish off by tufting. For quantity of stuffing required, reckon about 10 lbs. per foot of width if hair or fibre, and other materials accordingly.—D. A.

Zinc Manufacturers. — M. E. (*Birkenhead*).—The following addresses may be useful to you:—Frederick Braby & Sons, Euston Road, London; Croggon & Co., Upper Thames Street, London, E.C. You can get all you require in zinc of these firms as cheap as of anyone. Enclose trade card for trade prices and discounts. It is useless for querists to ask for replies in the next issue, as that would be an impossibility, owing to the pressure on "Shop," and to the fact that in consequence of its large circulation, the paper goes to press a fortnight before it appears.—R. A.

Electric Bells.—LEWIS.—In planning an electric bell system for a house, sketch out each bell circuit on paper and complete it before going on to the others. For instance, beginning with the front door, sketch out the battery, lead one wire from one end of the battery to the front door push, then lead a wire from the push to one terminal of the bell, then lead a wire from the other terminal of the bell back to the other end of the battery. This will complete one circuit. Sketch out all other circuits (each separate push having a separate circuit) until the system is complete. Then use ink of another colour and economise wires where it can be done without interfering with the general working of the system. This done on paper, carry out the ideas in practice. Any alterations to be hereafter made must proceed on the same principle. For instance, taking your own bells (two bells mounted on one base-board): the wire B in the centre of the board connects both bells with the battery; the wire A connects one of the bells with one of the pushers, and the wire C connects the other bell to another push. From each of these pushers a wire goes to the battery, either direct, or as a branch connected to a main wire traversing the whole round of pushes. Only a personal examination of the wires is needed to determine how they run, as you say they are coated in different colours. If you wish to shift the bells, you must alter the wires to suit the new position. Both bells will ring if you connect the middle stud to one end of the battery, and the two other studs to the other end of the battery. Both will ring at the same time if the battery cells are large enough to generate sufficient current. If you cannot now clearly understand how to fix your bells, please ask again and give me full particulars. I shall always be pleased to help you. —G. E. B.

Griscom Motor.—W. D. (*Leeds*).—(1) In the dimensions on p. 92, Vol. II., read 3 in. instead of 6 in., as the diameter of the fields of a Griscom motor. (2) If the F.M.'s are to be connected up in shunt with the brushes, use 1 lb. of No. 24 on the fields. (3) Armature solid for such a small machine. (4) The pole-pieces should fit within $\frac{1}{32}$ of an inch of the armature, but the wired parts must not come so close.—G. E. B.

Lens.—C. H. W. (*Hampstead*).—All lenses mentioned in the articles on "Compound Kaleidoscope" may be obtained from Messrs. J. Lancaster & Son, Opticians, Colmore Row, Birmingham. The reason why the instrument is so constructed as to be capable of rotation on its axis, is so that it may afford variety to the patterns presented to the view when the objective shown in Fig. 12, p. 808, Vol. I., occupies the place of the object-box, when objects in nature or works of art, at a distance or close at hand, are so focussed by means of the lens as to appear within the ends of the reflectors, which are adjusted so that a perfectly symmetrical pattern is produced, when a similar effect is obtained by rotating the instrument to that which results from turning the object-box, and giving rise to a greatly increased number and variety of figures not otherwise attainable. It is not imperative that the bottom edges of reflectors should meet in centre of object-box, but in the case of the eyepiece, it is important to observe that the small pin or screw inserted in the groove which forms a stop for the bayonet-joint of the eyepiece should be so placed that when the tongue abuts against it, the centre line of the slide should bisect the angle formed by the reflectors, so that in using the eyepiece the opening in the diaphragm should occupy the same relative position to the silvered face of each reflector, and be kept as near the angle as possible without exposing the ends of the reflectors to view. —T. R.

Brass Plates. — ENGRAVER. — Will ENGRAVER (*Glasgow*) kindly refer to No. 55, page 46, Vol. II. of WORK? and among the "Brief Acknowledgments" he will find his communication to the Editor duly recorded. I fear you must submit to the ordinary course for acquiring information through the columns of "Shop," and, as all correspondents are answered in their turn, it would be obviously unfair to answer any question except in its proper order. Please to exercise a little patience, as the Editor is doing all in his power to reduce the pressure of correspondence in "Shop" by periodical supplements, the first of which disposed of nearly one hundred questions, in addition to the usual weekly quantity. If it will be any consolation to you, I may inform you that you are not alone in your difficulty, and before this reaches your eye, the answers to your queries will perhaps have appeared.—N. M.

Fishing Rods. — TELESCOPIC. — TELESCOPIC writes:—"Will any of your readers favour me with the information how to make the ordinary fishing-rod ferrules? I have been using a broaching bit having twelve cutting edges; it is $\frac{5}{8}$ in. diameter, with a $\frac{1}{16}$ per in. taper; this 'seizes' when it has passed up the tube about $\frac{1}{2}$ in., and is very difficult to withdraw without damaging the ferrule. I have tried various lubricants without success." The difficulty does not lie in the lubricant, but in the broach. With twelve cutting edges it has no chance of clearance, and consequently it gets jammed. TELESCOPIC will find a five-sided broach much better than the one he is using. Then, again, does TELESCOPIC withdraw the broach frequently whilst boring? If this is done, I do not think there will be any difficulty experienced. TELESCOPIC further asks for the address of a firm who makes ferrules for fishing-rods, as he requires a large number of one size. Possibly this may catch the eye of some maker, and it might pay him to advertise his address. In the meanwhile, I would suggest that in Manchester, where TELESCOPIC resides, there must be multitudes of brass finishers and philosophical instrument makers who have facilities for making what he requires.—O. B.

Rods for Plate Rack.—J. N. (*Erith*).—There is no place, as far as I am aware, at which you could buy rods $\frac{1}{2}$ in. in diameter for a plate rack. Any carpenter will make some for you, but you will find it cheaper, if you can handle a saw and a plane, to make them for yourself. For rods $\frac{1}{2}$ in. in diameter get a piece of wood $\frac{5}{8}$ in. thick and cut it up into square rods, after spacing out your board accordingly. Then plane off the arris at each corner of the rod and work off the edges with the plane till the rods assume a rounded appearance. Then finish up with sand-paper. If you go to work carefully, and not plane the rods down too much, you will find $\frac{1}{2}$ in. stuff thick enough for your purpose.—ED.

Slide Valve.—G. E. A. (*Newport, Maindee*).—(1) I consider that if I extract the cube root to two places of decimals, that that is quite near enough for all practical purposes. If we have a slide valve set to $\frac{1}{100}$ part of an inch, that is surely near enough. (2) Please go over the extraction of the cube root of $\frac{3}{4}$ in. again; it is not ·908 in., nor is ·908 in. equal to $\frac{7}{8}$ in. (3) By taking an indicator diagram, we see at

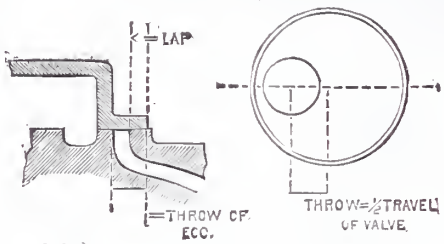


Fig. 1. Fig. 2.

Slide Valve.

once where we cut off; also, if the engine is working in a proper manner or not. (4) Fig. 1 represents common slide with "lap" shown on one of the steam ports; that distance and the width of the steam port is equal to the throw of the eccentric, as shown again in Fig. 2. It must be remembered that the "lead" of a valve has nothing whatever to do with its *travel*. "Lead" can only be got by moving the eccentric forward of the crank on the shaft. Of course, if the valve does not work direct from the eccentric, the difference in its travel will be in proportion to the system through which it works. (5) Double-ported valves are used when a shorter travel is wanted; the area of each port is the same and their combined area equal to the single-ported arrangement, which we have discarded for them. A good area of steam port (single) is area of cylinder in sq. in. ÷ 12. In a double-ported arrangement, the two ports would be equal to that in area. (6) The slide valve that you are puzzled about is called an expansion slide. They are of two kinds—"fixed" and "variable" expansion; and their position varies in proportion to the ratio of expansion they are to work at. In many cases the expansion eccentric is fixed nearly opposite the crank pin. Do not apologise for asking so many questions. I am only too happy to answer them where I can give instruction.—T. R. B.

Glasgow Exhibition.—G. T. (*Holborn, E.C.*).—All the information you seek would be most readily obtained were you to apply to the Glasgow City Authorities, Glasgow.

Angling.—AN ANGLER.—Papers on Fishing Rod Making will be given in Vol. III. of WORK, but there will not be any instructions, or "items," as you put it, on angling.—ED.

Binding WORK. — J. N. (*Erith*). — Cases for binding the volumes of WORK are supplied at 1s. 3d. each; or 1s. 6d., post free. You must get a binder to put your parts or numbers, as the case may be, in the cases.—ED.

Castings.—WESTWARD HO! — It is not cheap for a skilful man to cast his own brass at home. First as to melting. You can melt brass in a large kitchen grate, using coke for fuel, and confining the draught to the bottom bars by suspending sheet iron in front of the rest of the range. Or, better still, you can do as is frequently done: have a brick-lined sheet iron structure measuring, say, from ten to fifteen inches inside the bricks, and having a flue leading into a chimney. This may be rigged up in any room where from ten to fifteen feet of chimney is available. If the room is boarded, you must support the furnace on sheet iron, carried upon bricks. For the fire use ordinary gas coke, though better results are obtained by the employment of hard furnace coke, which costs double or treble the price. You can obtain crucibles of the Morgan Crucible Company, Battersea, of any capacity to suit your requirements, at a trifle over a penny per pound capacity. After the metal is in the crucible and the lid put on, the fire is made up several inches above the crucible, and generally by the time the fire is burnt thoroughly clear, the brass will be found to be melted. I should mention that new crucibles ought always to be annealed before the first time of using, otherwise they are likely to crack. As regards sand, the best advice I can give is to purchase some ready mixed of a friendly founder, and as regards the art of moulding, try and get a moulder for a consideration to come and give you a lesson or two in the methods of ramming, venting, gating, and finishing moulds; practice will do the rest.—J.

Horse-Power of Steam Engine.—IGNORAMUS.—Nominal horse-power is a commercial term by which engines are sold, depending on the size of the cylinder, but not on the power exerted; some engines will work up to five times their nominal h.-p. The term is most misleading, and is being gradually dropped. There is no difference in the power of portable and stationary engines, provided the speed, pressure, and size of cylinders are the same. An engine with two cylinders will exert twice the power as if it had but one of the cylinders. Now for your principal question. You can only obtain the mean pressure on an engine piston by using an indicator to take a diagram, first from one end of the cylinder, and then from the other, and this is the only accurate way of obtaining the power exerted by the steam in the cylinder. Even then you would not have the power the engine was giving out, because some of the "indicated horse-power" is taken up to drive the engine itself. The actual power the engine is giving out can be measured by a dynamometer or friction brake, and the difference between the two is the loss by friction. You can estimate this loss roughly by trying what pressure is required to drive *the engine alone* at its proper speed. You may get something like the average pressure in the cylinder if you know the point of cut-off, and what is the back pressure at the exhaust. For instance, take your engine, and I will suppose it has a common slide valve which cannot cut off till nearly the end of the stroke; then we will suppose it takes 5 lbs. pressure to force the steam through the steam-pipe and passages, and 5 lbs more to run the engine alone. We may then take the mean pressure at about 60 lbs., the boiler pressure being 70 lbs. above atmosphere. Now, there are 95 square inches in your 11 in. piston, and since the stroke is $1\frac{1}{2}$ ft., and 200 strokes per minute (for 100 revolutions), we have the piston speed 200 × $1\frac{1}{2}$ = 300 ft. per minute; 60 lbs. × 95 sq. in. = 5,700 lbs. pressure on the piston: multiplying this by 300, we have 1,710,000 foot pounds, and dividing by 33,000, we get nearly 52 *horse-power effective* when the throttle valve is fully open. You will understand the reasons for this when my papers on the Quarter-Horse Engine appear.—F. A. M.

Case Hardening.—J. W. H. (*Bolton*).—The way we case-harden small levers, link motion, etc., is as follows:—A stout cast-iron pot, about 16 in. in diameter and a foot deep, and having a loosely fitting cast-iron cover—the metal throughout being about $1\frac{1}{2}$ in. in thickness—is used. Into this is put the wrought-iron work, entirely surrounded with strips of leather belting, bones, bone-dust, hoofs, and horns, with a little saltpetre or common salt, or ferro-cyanide of potash. The cover is then luted with wet fire-clay. We place this in a boiler-maker's reverberating furnace; if you cannot obtain the use of such a furnace, you could erect a kiln of bricks, and place the pot in that. A good full red heat is all that is necessary. The period of exposure to the heat will be governed entirely by the depth to which you want the hardened zone to penetrate. Speaking very roughly, ten hours of heat will penetrate to a depth of $\frac{1}{32}$ of an inch; an exposure of twenty hours to a depth of about $\frac{1}{16}$ of an inch, and so on. I am speaking now, of course, of the ordinary temperature of a reverberating furnace; with a lesser heat than that a longer duration will be required. On removal from the furnace, throw the contents of the pot into water.—J.

Cartwrighting. — AMATEUR. — Send to Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., for their list of Handybooks for Handicrafts, and you may find help on joinery and cabinet-making from some of them. As to cartwright work, I do not know of anything I can, with confidence, recommend you. You may get sheets of designs of vehicles of all descriptions from Gadsdon's, Brushfield Street, E., or Callow's, Pembroke Street, N., and if you wish to know how to construct anything on those sheets, I will willingly do all in my power to help you. "I guess," as our American cousins say, you have not taken WORK long; if so, by referring back, you will find a Battlesden car, a wheelmaking frame, a wheelbarrow, and a plain donkey-cart has already been dealt with, and some instructions about a waggon have appeared in "Shop," page 742, Vol. II.—WORKER BEE.

Cutting Out and Making Up Harness.—S. B. C. (*Derby*).—There is no book published on the cutting out and making up of harness. The *Saddlers' Gazette*, 46, Cannon Street, E.C., some years back had articles on the subject. Harness-making, as a trade, is made up of two or more crafts, the same

as saddle-making. The two best trade journals are *Harness Gazette*, Troy, New York, and *Harness*, New York.—J. C. K.

Phonograph.—NOGMAN.—Look up the back numbers of WORK, and you will get a lot of information which will be useful to you. The diameter of your brass cylinder is very small, and the speed, once a minute, would never do; you will require to drive it very much faster. I should say that once a second would be nearer the mark—perhaps that is what you mean. The composition of the wax cylinder has been given quite recently—please look it up. The needle may be mounted on a small piece of light wood or cork, and glued to the diaphragm. The mouthpiece of a speaking-tube could be used with advantage: the large funnel you have made will do very well. I could not well give a sketch of diaphragm and needle to suit you, unless I knew something about the other parts of your machine. An ordinary sewing machine can be used; make the point chisel-shaped, and of such an angle as will not cut away the wax too much.—W. D.

Beam Engine.—LEARNER.—You have not given the initial steam pressure among your data. If you will let me have that, I will work out your cards, and give method and result.—J.

Sheets of German Silver.—B. (*Dundee*).—Barker & Allen, 16, Oozell's Street North, Birmingham, for sheets. I do not know about watch-key castings. You might get what you want of W. Smith, 72, Northwood Street, Birmingham, or of Timmins Bros., 42, Lower Loveday Street.—J.

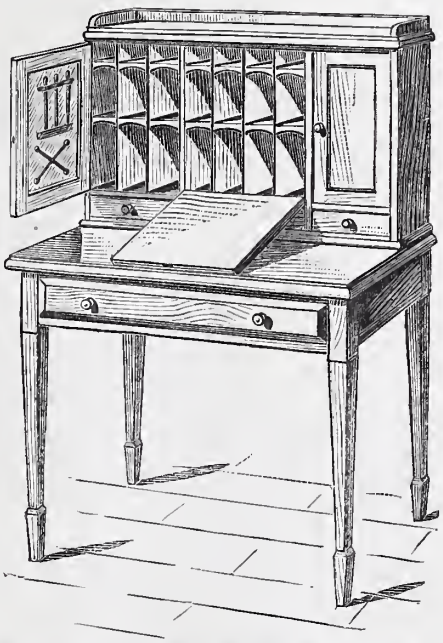
Tempering Chisels.—M. W. (*Bradford*).—Harden at a red heat; let down to a plum colour, and quench in water.—J.

Left-Hand Threads.—WULFRUNA.—You wish to cut a left-hand screw in a chuck, and you have no reversing gear to your lead-screw. Well, you do not need any. All you want is to have your lead-screw revolve in the *opposite* direction to the mandrel, and then the screw you cut will have a pitch in the *opposite* direction to that of the lead-screw. If you connect a change-wheel on mandrel with a wheel on the lead-screw, you have two centres of revolution, and the motion is reversed: if you interpose one intermediate stud, you then have three centres of revolution, and the mandrel and lead-screw revolve the same way when you get right-hand screws, if the lead-screw is right-hand; if you interpose a second stud, a wheel on that gives you four centres of revolution, and mandrel and lead-screw revolve opposite ways. Thus, if number of centres of revolution are even, you get motion reversed, and pitch in opposite direction to that of lead-screw; if centres of revolution are odd, you get motion in the same direction, and pitch same way as in lead-screw. As lead-screw is pretty sure to be right-hand, we may say for the sake of simplicity: Two wheel centres give left-hand pitch, three wheel centres give right-hand, four wheel centres left-hand. Now you will see that all you have to do when you have arranged for the right-hand screw of the correct pitch, is to put in another stud with a small wheel (of no matter what size), called an "idle" or "reversing" wheel, on it. You need not regret the absence of reversing gear; it is more useful for reversing the feed in turning than in screw-cutting, and there are those who would rather be without the extra complication.—F. A. M.

Balloon.—(*No Address*).—The writer asks the size of a balloon that will elevate from 1½ lbs. to 2 lbs. to the height of two miles, and what light (not the electric light) could be used that should be exceedingly brilliant. I have never experimented with a gas balloon, but a short time since I sent up one with a lifting power of about 1 lb., or perhaps 1½ lb. This was about 7 feet in its longest diameter. I would like to ask what guarantee is there, in the very likely event of an accident to such a small affair, that the 2 lbs. weight of matter falling should not be the occasion of a coroner's inquest. Think of 1 lb. falling two miles! I am afraid my friend is proposing an experiment in which there is great risk—that is, supposing it ever takes place. Now with reference to the light. The magnesium is the nearest approach in intensity to the electric light, the only drawback being its disposition to go out. There is one point on which the inquirer has said nothing. What is to be the use of the appliance, and has he considered the cost? If it is intended as a toy for amusement, I am afraid that, unless he has a long purse, he will find the experiment, to say the least, disheartening. The balloon must be of silk. Owing to the rarity of the atmosphere at two miles, the internal pressure of gas would be such as to burst mere paper—indeed, I am afraid long before it reached the height indicated there would be very little gas left. Then a self-acting lamp would be required for the magnesium ribbon, which would be rather expensive. Such an arrangement for military surveying purposes would pay; but if for amusement—well, one would have to pay too much for his whistle, apart from the danger of a body weighing one or two pounds falling from such a height. Take Punch's advice, "don't."—O. B.

Hardness of Water.—S. W. K. S. (*Shaftesbury*).—The hardness of water is usually estimated by Dr. Clark's method, which consists in adding a solution of soap of known strength to a measured quantity of the water until a permanent lather is formed. Seventy cubic centimetres (c.c.) of the water are put into a stoppered bottle, and the standard soap solution is added gradually by means of a burette. After each addition of the soap solution, the bottle containing the water is well shaken, and the point noted when a lather forms capable of persisting for, say, five minutes. The number of c.c. of the soap solution used is read off from the burette, and indicates directly the number of degrees of hardness of the water. The standard soap solution is prepared by dissolving 10 grammes of Castile soap in a litre (1,000 c.c.) of weak alcohol, of about 35 per cent. in strength. One c.c. of this solution represents one degree of hardness. This method is very easily carried out, and requires but few apparatus, which will only cost two or three shillings. For fuller information write again, or read Wanklyn's "Water Analysis," published by Trübner and Co., Ludgate Hill, for, I believe, 5s.—F. B. C.

Writing Table.—CLERK.—The height from the ground to the top of the table proper should not exceed 28 in., and don't extend the back pigeon-hole cupboard higher than 20 in.—*i.e.*, about 3 in. depth for bottom drawers, 8 in. for lower pigeon-holes, 6 in. for middle row of the latter, and 2 in. for topmost ones, and the whole should be about 4½ in. inside, from back to front. The table you should have 3 ft. long and 20 in. wide, with a drawer about 4 in. or 5 in. deep. Adopt the use of two side doors and a falling middle flap, the latter to be used as a writing slab. If the pigeon-holes are about 2 ft. or 2 ft. 6 in. in length, and my other dimensions are adhered to, the writing flap will be about 16½ in. long and 14 in. wide, and its upper edge will fall nearly against the front edge of the table, and require no further adjusting or support. On the inside of the side doors use glued racks to accommodate pens, pencils, etc., and tape tacked



Writing Table. The Writing Flap shuts upwards as a Door, while upon the Insides of Doors are Pen Racks, etc.

crosswise to secure loose papers occasionally. The racks need consist of nothing more than an upper piece pierced with holes, and a lower one at a slight angle enclosed by two end pieces. If the doors interfere with the light, discard them; but they will be useful and will add a pleasing appearance to the table. Mr. Adamson's "Some Lessons from an Old Bureau" will afford instructions how to construct pigeon-holes, drawers, etc. Have the writing flap made as one complete solid board. You could have the flap to extend the whole length of the table, but the present method is the best, as the space immediately underneath it could be utilised. The top case sides must exceed in width the pigeon-hole divisions to allow the doors to be fitted.—J. S.

Violin Varnish.—H. A. T. (*Padiham*).—The best way to take off the old varnish is with methylated spirit; after which the instrument should be well sand-papered, beginning with No. 1, and using Fine 0 for finishing.—B.

Steel Furnace.—C. S. (*Caithness*).—You will require a reverberating furnace in which to place your melting crucibles. I suppose you only intend to melt and cast refined steel. If you wish to *make* the steel, it is a different thing. If you will send full particulars and the space available, I will give you a description of the plant you will require and method of working it. Let me know whether it is for steel castings only or for making ingots to be wrought under the hammer. I do not see what you want an annealing kilu for.—F. C.

Worm Hole in Violin Wood.—S. D. (*Sheffield*).—I should not advise you to use the "stopping" you suggest. You had better cut the bad piece out, and let a piece in its place to mateh the grain as nearly as possible.—B.

Mitre Planing.—DUNCOMBE.—There is, as you think, a special plane for shooting mitres, though its use is not imperative. A new jack plane with the mouth aperture neat and small, and the iron perfectly square, sharpened well on a flat oilstone, would do; the edges of the plane *must* be square with the face. I need scarcely remind DUNCOMBE that these conditions are not likely always to obtain, if the jack plane is used for ordinary purposes. The plane used by picture-frame joiners is a straight block plane, having a wide iron, which lies on the flat surface when in its place, consequently the bevelled sharpened surface is uppermost, and its angle variable. A difference in the angle at which the plane iron is sharpened makes a difference in the cutting angle, and not (as in the ordinary planes) in the clearance behind cutter. The cutter has no cap iron, and being supported to the very edge by the wood of the plane, there is no vibration if the wedge fits well, and therefore less liability to chip the surface of the moulding. DUNCOMBE can get a suitable plane from any good tool shop. The best lesson I can give is to ask him to read J. H.'s articles in WORK on Planes.—B. A. B.

Enamel Inlay.—TINY TIM.—You want to know of some composition or enamel suitable for filling in pearl or ivory after etching or engraving, to represent inlaying in colours, the usual thing, heel-ball, being unsuitable, as would be, I presume, a composition of white wax—powdered colour, and perhaps a little tallow. The next sort of filling would be something made with dry colour and varnish. These should be rubbed up or ground up together, after the style of Aspinall's enamel. How would those preparations do, if thickened by the addition of some more dry colour? Failing that kind of thing, I hardly know what to suggest, unless sealing-wax would meet the case. Japanning could be used for the mother-of-pearl, but I should certainly not risk heating the ivory. The general filling being either heel-ball or the mixture of wax and colour, it is evident that if anything more suitable for general purposes had appeared, the engravers would certainly have used it. The other things I have used to botch up enamel work sometimes: that is why I give them here.—H. S. G.

Tinning Silver Spouts.—H. S. G. (*Battersea*).—(1) Here are two recipes for a composition for protecting one surface of metal whilst the other is being tinned. Take a piece of common glue, about 1 oz., and dissolve it in a gill of water and add a few drops of vinegar; take one table-spoonful of whiting, and about a quarter that quantity of salt; mix them well together dry, and then make into a thick paste with the glue water. Apply it to the articles with a brush, so that it is properly covered; dry with heat before attempting to tin. The composition will come off very easily with hot water. (2) Take a lump of drop-black the size of a walnut and pound it up fine; mix to the consistency of cream with gold size and add a few drops of turpentine. Coat as above, but let it dry of itself for an hour. This is just as good as the white composition for its protective qualities, but it is more trouble to clean off.—R. A.

Cement for Aquarium.—B. A. W. (*No Address*).—It will depend upon the material you use for rockwork as to the cement most suitable. You can make very natural-looking rockwork with pieces of coke dipped in a thin batter of Portland cement, and stuck together roughly with the same cement used thicker. Virgin cork, clinkers, pieces of stone, real rock, etc., may be fastened together with a cement made of pitch, three parts, gutta-percha, one part, melted over a gentle heat with sufficient turps to reduce it to a suitable consistency. This is a very useful cement for a variety of purposes.—C. M. W.

Wire Thread Fret Saws.—D. D. (*Aberdeen*).—With reference to my remarks to you (see page 700, Vol. II.) I have now to add that the theory I then hazarded seems to receive confirmation from the following letter addressed to me by Messrs. Moseley and Son, to whom I sent your letter. They write:—"In reply to yours, we cannot understand the cause of the enclosed letter being sent. We have thousands of catalogues and grains of wire saws which we can despatch at a minute's notice, and only too glad to do so. The writer could not have sent his own address, or he would have had his reply by return. I thank you for the enclosed."

Sawing.—J. R. (*Helmshore*).—If there is but little difference in the gauge of your saws, the 36 in. saw would do the work you mention easier than the 27 in. saw, if spindle in both cases runs at the same speed, as the speed at the point of teeth in the 36 in. saw would be much faster than in the 27 in. saw. But should both saws be driven from 8,000 to 9,000 ft. per minute at the point of teeth, which should be the speed for the work you mention, the 27 in. saw would do the work with much less power than the 36 in. saw, especially if the gauge of saws corresponds with the diameter, and the timber is not more than 7 in. deep, which is less than one-third the diameter of saw. When the timber is above one-third the diameter of saw, the saw is overcrowded, and it may be sawn easier with a little larger saw. You will understand that saws of the right gauge and speed will cut timber one-third their diameter with less power than saws of greater diameter. If a saw is driven much below its speed, and the feed of timber is as fast as when a saw is driven its proper speed, there will be greater strain on the saw-plate, and it soon becomes crippled, and unless the belt is tight it will slip. Consequently, more power will be required, and the work done will be inferior.—A. R.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Mitre Shoot.—J. J. D. (*Dowlais*) writes:—"Will any reader let me know where I can get Hodge's mitre shoot? I have sent to the holder of the patent right, Mr. E. R. Sibley, White's Hill, near Stroud, Gloucestershire, but he has gone away, and I don't know where I can get one, and the price of it."

Violin Materials.—J. E. (*Chatham*) writes:—"Can any reader kindly say where I can buy violin-making tools and materials? I shall also be glad of any information respecting books on same."

Prices in Sign-Writing.—A CONSTANT READER will thank anyone for the prices for sign-writing on wood, glass, and metal letters, embossing, and glass-writing, in London and provinces respectively.

Calico Designs.—J. T. (*Seedley*) will be obliged to any reader who will give him hints and suggestions towards designs for calico.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Violin Mute.—M. (*Bishop Auckland*) writes, in reply to VIOLIN (see page 650, Vol. II.):—"This is made of three pieces of sheet brass, $\frac{1}{16}$ in. thick, soldered or riveted together (see Fig. 1); the oval is cut in the two outside pieces, the holes drilled in

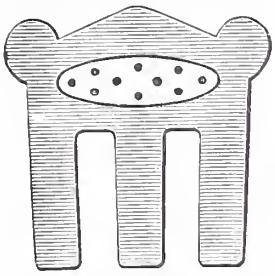


Fig. 1.

Fig. 2.

Fig. 1.—Violin Mute (full size).

Fig. 2.—Section of Violin Mute (full size).

Fig. 3.—Cardboard Mute.

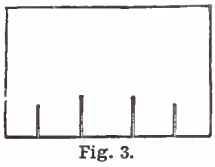


Fig. 3.

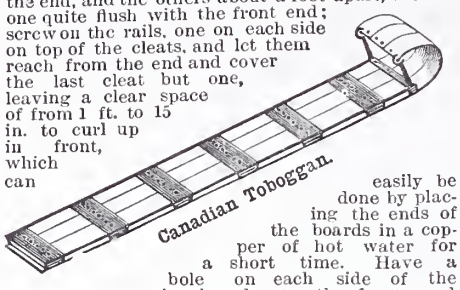
the middle piece, which stops at the top of the notches (see Fig. 2). It is set on the bridge. Or you may make a temporary mute by cutting four notches in a card, and fixing it on the strings close to and above the bridge (see Fig. 3), the card to be about twice as thick as a visiting card."

Banjo.—R. H. H. (*Shutter Oak*) writes, in reply to W. P. (*Burnley*) (see page 602, Vol. II.):—"If you want a banjo for only playing accompaniments, a seven is best; for solos or thimble playing, a five-string, for the reason that you can finger correct chords on five strings all the way up the finger-board, and either roll or sweep them, as in machette playing. Brewster makes ordinary size banjos, but the Grand Orchestra type are much longer in the finger-board, and consequently chords that require a long stretch are more difficult to stop correctly. Also the ordinary size can be tuned to concert pitch to accompany piano or violin. The long finger-boards will not, as the strings would, be always breaking. It is not generally known that professionals tune these banjos one or even two tones lower, and their orchestral accompaniments have to be transposed to the lower. In England the general custom is to lower G to F, and in America to E. You will see the two general sizes given in WORK, No. 83, page 503."

Browning Gun Barrels.—T. W. (*No Address*) writes, in reply to C. B. F. (*Seacombe*) (see page 734, Vol. II.):—"Apply the following to your barrels:—Sulphate of copper, 1 oz.; sulphuric ether, 2 oz.; water, 4 oz. Mix these in a bottle and keep closely corked. Shake well before using."

Frosting.—NORTHERNER writes, in answer to BETA (see page 734, Vol. II.), who inquires how to frost glass:—"I would submit the following: It may not be the orthodox way of doing the work, but it nevertheless produces a good result—at least, on *plate* glass. Get a piece of plate glass, say 4 in., 5 in., or 6 in. square—an old small looking-glass does well—some emery of medium fineness, and a little quantity of elbow grease. Mix the emery to a paste with oil and apply to the glass to be ground, then go over the whole surface in a circular manner with the piece of plate-glass, working it down to the necessary obscurity. It will take some time, perhaps, but here the elbow grease comes in. If it is ordinary window glass, the high positions will come up first, and a longer time will be taken than if it were plate glass that was being ground. In order to hasten the work, BETA might employ rather coarser emery first, but the fine emery must be used to finish off with, or else a mass of scratches will be the result. Finally, go slow, examine work frequently, and adapt means and methods which common sense suggests."

Canadian Toboggan.—J. J. (*Ottawa, Canada*) writes, in answer to W. F. (*Tunbridge Wells*) (see page 552, Vol. II.):—"I think it quite probable that a toboggan could be purchased at one of the ship chandlers in Fenchurch or Bishopsgate Street, London; but if not, W. F. could make one by following the directions here given:—Get three boards 8 ft. long, 6 in. wide, and $\frac{1}{4}$ in. thick (quartered oak or ash); also some short pieces 18 in. long and 2 in. wide, and two pieces of 1 in. square ash, about 7 ft. long, for rails; lay the boards on the floor parallel and true on the end, and screw one of the short pieces across the end, and the others about a foot apart, the last one quite flush with the front end; screw on the rails, one on each side on top of the cleats, and let them reach from the end and cover the last cleat but one, leaving a clear space of from 1 ft. to 15 in. to curl up in front, which can easily be done by placing the ends of the boards in a copper of hot water for a short time. Have a hole on each side of the main board at the front end through it and the cleat (a $\frac{1}{4}$ in. hole will do, which should be made about $\frac{3}{4}$ in. from the front), and have ready two lengths of whipcord, which pass through the hole around the end and around the rail just behind the last cleat that it covers, to keep the curve in its proper shape. The cord will need to be passed through and around a number of times, and finish off by taking half hitches around it, so as to bind it together neatly. The Indians use raw hide thongs for making theirs, but the pale faces are making them with screws here now. W. F. will need a piece of $\frac{1}{2}$ in. rope to haul it up the hill after sliding down."



Blackboards.—C. A. P. (*London, N.*) writes, in reply to A. J. L. (*Paddington*) (see page 718, Vol. II.):—"There are several different ways of doing this. A simple plan is to give it a couple of coats of good black paint, with plenty of driers in it, which will dry with a glossy surface; after which, a third coat is given with ivory drop black ground in turpentine, to which a small quantity of japanner's gold size has been added—just sufficient to cause it to dry with a good flat or dead black, each coat being allowed to become thoroughly dry before the next is applied. Another method is to give the board a couple of coats of black mixed with boiled oil and driers, smoothing it when dry with flour paper, and afterwards giving it another coat of black with turpentine in place of oil. A third plan, which permanently stains the board, consists in first brushing it over with a solution of sulphate of iron, and allowing this to soak into the wood, and then sponging it with a solution of galls until the desired depth of black has been obtained."

Browning Gun Barrels.—C. A. P. (*London, N.*) writes, in reply to C. B. X. (*Seacombe*) (see page 734, Vol. II.):—"First make the barrels perfectly clean and entirely free from grease by rubbing them with powdered quicklime and water; then prepare the following:—Sulphate of copper, 2 oz.; perchloride of iron, $\frac{1}{2}$ oz.; sweet spirits of nitre, $\frac{1}{2}$ oz.; aquafortis, $\frac{1}{2}$ oz.; and water, 40 oz. The sulphate is first dissolved in the water by the aid of heat, after which the other ingredients are added as soon as the solution has become cold. It is then applied to the barrels, and allowed to remain for twenty-four hours, when the barrels are brushed with a stiff brush, and afterwards polished by means of a piece of smooth hard wood, and finally protected by a varnish composed of gum shellac, 1 oz., spirits of wine, 2 pints, the barrels being heated previous to the application of the varnish."

Preserving Rabbit Skins.—E. H. H. (*New Brompton*) writes, in answer to IDEM SONANTIA (see No. 91, page 634):—"I have preserved them by simply stretching and tacking them fur downward on a board, and scraping all superfluous fat, etc., away, and pasting with two or three coats of alum and water. I did some for footstools, etc., four or five years ago, and except for wear, they are all right."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—ANXIOUS; BRITANNIA CO.; O. B. R. (*New York, U.S.A.*); W. S. (*Inverness*); R.M.; J. M. (*London, S.W.*); H. G. (*Coventry*); CONSTANT READER; F. V.; CONSTANT READER; Z. L. (*Newhaven*); B. J. H. (*Dorking*); H. F. F. (*Hackney, E.*); FALERO; J. M. (*Manchester*); A SUBSCRIBER; WELL-WISHER OF "WORK"; G. J. W. (*Ballymena*); J. F. (*Hyde*); T. B. (*Dodworth*); J. S. (*Ipswich*); H. W. (*Addlestone*); W. M. (*Plaistow*); J. H. W. (*Chatham*); H. P. (*Brighton*); H. W. C. (*London, S.E.*); J. S. B.; EARNEST READER; R. J. (*Rawtenstall*); MAC, W. J. P. (*Congleton*); WORKITE; HOLLY READER; D. (*Sunderland*); LABEL; D. H. (*North Shields*); INDEX; S. J. (*Compstall*); ELECTRIC; J. B. (*Poplar, E.*); X. M. T. C. C. (*Derby*); W. L. (*Kingsland*); A. B. (*Accrington*); D. W. K. (*Dumfries, N.B.*); G. E. B.; J. K. (*Bury*); ELECTRO; J. A. (*Sheffield*); W. A. P.; J. W. (*Belfast*); TUNER; SPOT STROKE; A. H. (*Stratford, E.*); J. S. (*Bath*); BENEDICT; J. S. (*London, N.*); AUXILIARY; OLRAC; TURBINE (*Preston*); K., OLD SUBSCRIBER; No. 305; TERRA-COTTA; T. U. (*Manchester*); TREFALDWYN; B. W.; A. D. (*New Cross, S.E.*); H. B. S. (*Liverpool*); AMATEUR; ANXIOUS INQUIRER; STEAM ENGINE; ONE IN TROUBLE; NOVOCASTREN; READER FROM THE FIRST; PUZZLED; JOINT; A VERY OLD SUBSCRIBER; W. K. S. (*Liverpool*); J. R. P. (*Stafford*); IRONSIDES; J. S. G. (*Norwich*).

"WORK" EXHIBITION PRIZE DISTRIBUTION.

ARRANGEMENTS are being made for holding a Meeting, at which Prizes, Medals, and Certificates will be presented. Full particulars will be announced in an early number of WORK.

Price **3d.**; post free, **4d.**

"WORK" SPECIAL EXHIBITION NUMBER.

Containing an **Illustrated Descriptive Account** of the most remarkable Exhibits.

"No one interested in the 'Work' Exhibition should fail to secure the 'Special Exhibition Number' of WORK, which Messrs. Cassell have issued at the cost of 3d. The articles, on a variety of cognate subjects, are especially valuable."—*Literary World.*

NOTICE.

Numerous applications having reached the publishers for the

"Work" Exhibition Official Catalogue,

they beg to say that a few copies can still be had, price 2d. each; or post free, 2½d.

CASSELL & COMPANY, *Ludgate Hill, London.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	..	..	..	1s. 8d.
6 months, "	..	..	..	3s. 3d.
12 months, "	..	..	..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [14 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

2,000 Lots of Second-hand Lathes, Drilling Machines, Gas and Steam Engines, and miscellaneous items. Call at 100, Houndsditch, London, or send 4 stamps for Register.—BRITANNIA CO. Tool Factory, Colchester. [12 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E.

Forty Fretwork Designs, 7d., free.—TAYLOR'S FRETWORKERIES, Blackpool. [15 R

Lettering and Sign-Writing made Easy.—Also full-size diagrams for marking out eight alphabets, only 1s.—F. COULTHARD, Terrace Road, Bournemouth. Note.—100 Decorators' Stencils (60 large sheets), 2s. 6d.

Fret, Carving, and Repousse Patterns.—100 of either, full-size, 1s.; 300 Turning designs, 1s.; 400 small Stencils, 1s.; 500 Shields, Monograms, &c., 1s., postage free.—F. COULTHARD, Terrace Rd., Bournemouth. [2 S

Tools of every description at CLARKE'S, 165, Fore Street, Exeter. New illustrated catalogue, 1 stamp. [17 R

Turning Designs, accurately drawn. 1st and 2nd Series, 1s. 7d. each, free.—WALKER, 41, St. Helen's, Ipswich. [1 S

Bentwood Shafts (Mail Cart).—VICTOR CYCLE COMPANY, Grimsby. [4 S

Water Motors from 5s. each: cheapest power known. List free.—WALTON, 9 Queen Anne Street, Stoke, Staffs. [3 S

Seasoned Boxwood for Turning.—What offers?—DUNSBY, Woodstock. [5 S

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill**, with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design **SENT GRATIS** with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

Whittaker's Practical Handbooks.

BONNEY'S ELECTRO-PLATERS' HANDBOOK. 3s. [*Just published.*

PRACTICAL IRONFOUNDING. 4s.
"Contains much useful information for practical men."—*Industries.*

METAL TURNING. 4s. [*Just published.*

BOTTONE'S ELECTRO-MOTORS. 3s. [*Just published.*

BOTTONE'S ELECTRICAL INSTRUMENT MAKING. 4th Edit. 3s.

BOTTONE'S ELECTRIC BELLS. 3rd Edition. 3s.

SALOMON'S ELECTRIC LIGHT INSTALLATIONS. 6th Edit. 6s.
"Contains a vast amount of really useful information."—*Electrical Review.*

GRAY'S ELECTRIC INFLUENCE MACHINES. 4s. 6d.

WALKER'S ELECTRICITY IN OUR HOMES AND WORKSHOPS. 2nd Edition. 5s.

LELAND'S WOOD CARVING. 5s.
"A clearly written, beautifully and effectively illustrated, and well-printed guide."—*Work.*

LELAND'S DRAWING AND DESIGNING. 1s. sewed; 1s. 6d. cl.

London: WHITTAKER & CO., PATERNOSTER SQUARE.

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER. **MASON'S WINE ESSENCES.**

These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. One Tablespoonful of Mason's Extract of Herbs makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, *Nottingham.*

Cassell's Classified Catalogue, containing particulars of upwards of One Thousand Volumes published by Messrs. CASSELL & COMPANY, ranging in price from ***Threepence to Fifty Guineas,*** will be sent on request post free to any address. CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NOTICE.

A THIRD EDITION OF PART I. OF

CASSELL'S STOREHOUSE OF GENERAL INFORMATION

Has already been called for to meet the large and continuous demand.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

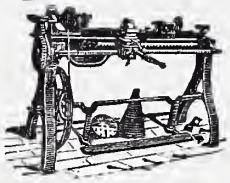
Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES FOR SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

An Atlas of Unexampled Completeness within the reach of all.

Messrs. CASSELL & COMPANY have the pleasure to announce that they have undertaken, on behalf of the ATLAS PUBLISHING COMPANY, LIMITED, the Publication, in SERIAL FORM, of

THE UNIVERSAL ATLAS.

A New and Complete

GENERAL ATLAS OF THE WORLD,

WITH

117 Pages of Maps, handsomely produced in Colours, and a complete Index to over 100,000 Names.

Part 1 ready MARCH 26, price ONE SHILLING.

TO BE COMPLETED IN 28 PARTS.

*** Prospectuses at all Booksellers', or post free from

CASSELL & CO., LIMITED, *Ludgate Hill, London.*

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helens, Lancashire, in Boxes 1s. 1½d. and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

Marvellous Purifier — Matchless Preserver — Pure Antiseptic.

"CALIFORNIAN"

TRADE MARK.

REGISTERED.

"The Household Treasure" Borax,

Specially Prepared for Personal, Domestic, and Sanitary Uses.

Packets, 6d., 3d., and 1d. each.

Sold by all Grocers and at Stores.

PATENT BORAX CO., *Sole Makers. Works: BIRMINGHAM.*

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.

The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

C. BRANDAUER & Co's CIRCULAR POINTED PENS

NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6d. OR FOR 7 STAMPS
BIRMINGHAM.

[33

London Warehouse: **124, NEWGATE ST.**

FRETWORK PATTERNS.

FRETWORKERS who appreciate First-class Designs should write for our Catalogue of nearly 400 Patterns, admitted to be the best in the Trade. Catalogue sent post free on receipt of 4d., stamps. List of Tools and Materials is also enclosed.

BOOTH BROTHERS,
TOOL MAKERS,
DUBLIN.

CHEAP EDITION, price **1s.**; or post free, **1s. 2d.**

HOW TO AVOID LAW.

By ARTHUR J. WILLIAMS, M.P.

"Will be found simply invaluable. Should be in the hands of landlord and tenant, of master and servant, of tradesman and purchaser—in short, of every man and woman of mature age."—*Manchester Guardian.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FIFTH EDITION. Price *7s. 6d.*

PRACTICAL ELECTRICITY: A Laboratory and Lecture Course, for First Year Students of Electrical Engineering, based on the Practical Definitions of the Electrical Units. By Prof. W. E. AYRTON, F.R.S., Assoc. Mem. Inst. C.E. With numerous Illustrations.

"In Prof. Ayrton's 'Practical Electricity' the student will find far more useful information upon instruments used by practical men than in any other work in this or any other language."—*Electrician.*

CASSELL & COMPANY, LIMITED. *Ludgate Hill, London.*

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 103.] SATURDAY, MARCH 7, 1891. [PRICE ONE PENNY.

DOMESTIC SOAP MAKING.

BY HERBERT CLARK.

AN old adage tells us that "a penny saved is as good as a penny gained." Sometimes, however, the cost of saving the penny runs away with the profit, and occasionally the passion for "saving" takes so firm a hold on its victim that—in the very expressive, if somewhat figurative, language of an old landlady of the writer's—the said victim of overstrained economy does not hesitate to "skin a flint for a halfpenny and spoil a fourpenny knife on the job." Domestic soap making is not open to such an objection, and, if carried out on the lines herein laid down, will be found a "game" well "worth the candle."

The profitable utilisation of otherwise waste material has laid the foundation of many a fortune, but, generally, the "waste" requires to be dealt with in large quantities. For instance, the rags produced in any one household taken alone are almost valueless, but when the rags of a nation are collected and suitably dealt with, they are found to yield profitable employment to considerable numbers in our manufacturing centres, and to contribute very materially to the cheapening of clothing, etc. But soap, as no doubt all my readers are aware, is not made of rags, but fat, etc., the "etc." being oftentimes the most important shareholder in the concern. Fat, nevertheless, *is* used, and fat, in greater or less quantity, is a waste material in many households, and differs from rags in this respect among others—that there is seldom, if ever, any market for it; and though candles as well as soap are made from fat, very few would care to engage in the domestic manufacture of candles, which, in most cases, would prove a greater nuisance than the raw material from which they were made.

Until somewhat recently, the domestic manufacture of soap must have been looked upon as a very troublesome, if not costly, "economy," on account, principally, of the prolonged boiling to which the fat and alkali had to be subjected in order to bring about their conversion into soap. This drawback has been overcome by the introduction by the Greenbank Alkali Works Co., of St. Helen's, Lancashire, of a highly concentrated caustic soda, known as "98 per cent. caustic soda," which is supplied in packages adapted to the requirements of the domestic soap maker. The writer has had some practical experience in this connection, and can confidently recommend such of the readers of WORK as may be so disposed to give the process described in this article a trial. As an inducement to make such a trial, it may be mentioned that the process is at once simple, effective, and cheap; at the same time it secures several important advantages, such as purity and the retention of the glycerine. This latter is evidently a very important point, for, in the ordinary "boiling" process, the glycerine, which is a bye-product of the process, and well known and valued as an emollient, is lost to the consumer of the soap.

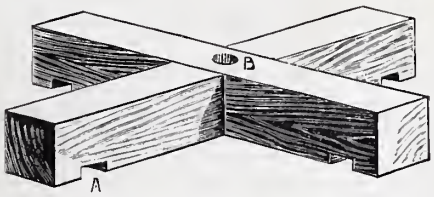


Fig. 5.—Support for Stirrer.

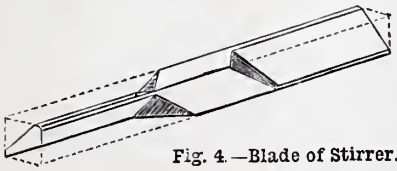


Fig. 4.—Blade of Stirrer.

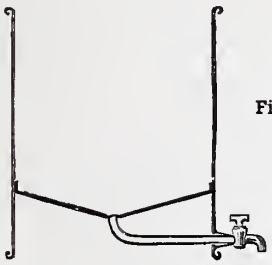


Fig. 1.—Ley Tank.

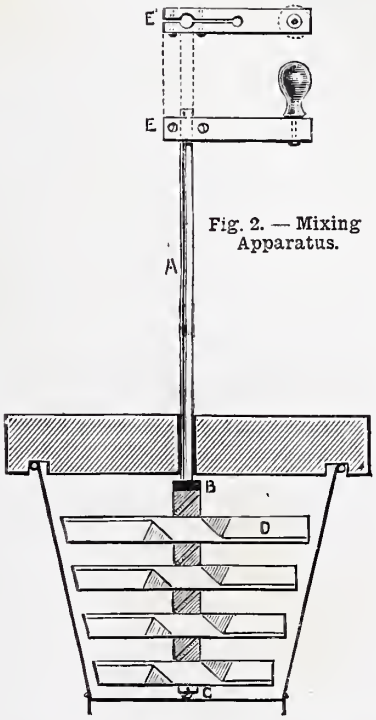


Fig. 2. — Mixing Apparatus.

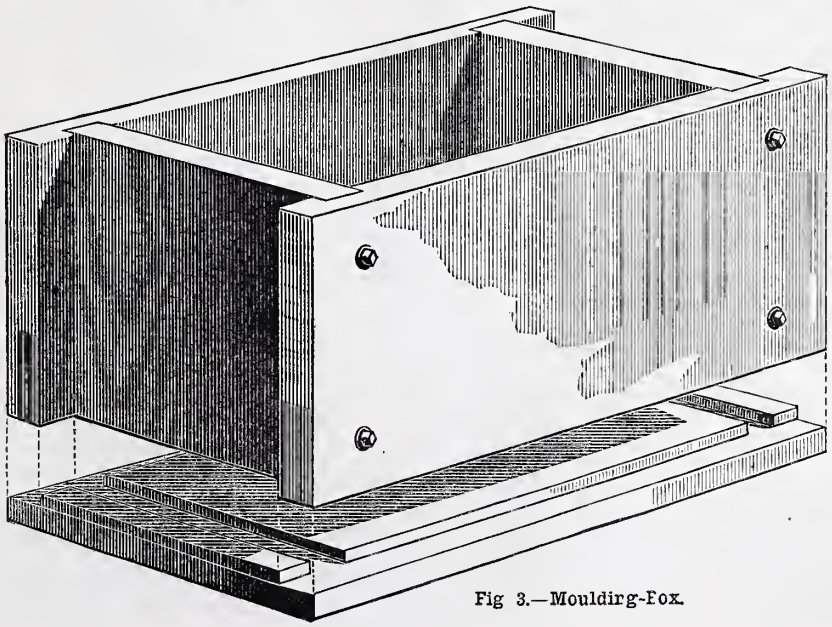


Fig 3.—Moulding-Box.

The materials required consist, as already stated, of fat and alkali.

The necessary apparatus consists of a vessel for melting and purifying the fat, a vessel for dissolving the alkali, a vessel in which to mix the fat and the alkali, a thermometer, a stirrer, and a rectangular box in which to mature the soap.

Any fat may be used so long as it is *free from salt*—this condition is absolutely essential to success. The alkali may be obtained in ten-pound tins, direct from the Greenbank Alkali Works Co., at five shillings and sixpence per tin; it may also be obtained from

most respectable oilmen and druggists in sixpenny tins, containing half a pound each. A half-pound tin is sufficient for three pounds of fat, but seventy pounds of fat may be converted into soap by means of the contents of a ten-pound tin.

A large kitchen saucepan will do very well for the purpose of purifying the fat, and a large earthenware jug cannot well be beaten as a container for the alkali solution; a common galvanised pail may be conveniently used as a mixing vessel; a bath thermometer, with its wood case removed, will be found "just the thing," since it will float upright in either the melted fat or the alkali solution; and a stirrer, shaped like a cricket bat, may be quickly formed out of any bit of flat board which may be at hand. Any common box of a suitable size, lined immediately before use with wet calico, will answer admirably for a mould.

As it is perhaps best that at the first attempt only a small quantity of materials should be operated on, we will assume that it is intended to saponify only three pounds of fat, for which purpose a half-pound tin of alkali will be required.

Having materials and apparatus in readiness, we commence operations by preparing the "ley"—that is, the solution of alkali. To do this we carefully measure one and a half pints of water and dissolve the half-pound of alkali therein. The alkali will dissolve very readily, and the solution will become quite hot. This must be left to cool while we prepare the fat. If any doubt exists as to the purity of the fat and its freedom from salt, it should be melted and thoroughly agitated with boiling water, and after allowing sufficient time for the fat to rise to the surface, the water should be drawn off by means of a syphon made of a piece of glass or lead tubing, after which the liquid may be again agitated with hot water and allowed to settle as before. This time the fat should be drawn off into the mixing vessel.

The temperature of both fat and "ley" should now be observed, and, if necessary, regulated so that the ley stands at about 80° and the fat at about 110° to 120° Fahrenheit, according as it is of a "soft" or "hard" description. The temperatures given may be regarded as standards, from which, however, slight departures may be permitted without detriment to the result; for example, the ley may have cooled to 75° F. before the fat has been got ready; in this case we may work our fat as high as 125° F., our object being to secure an average temperature of 95° to 100° F. All being in readiness for the mixing, we take the jug of ley in the left hand and the stirrer in the right hand, and very carefully pour the ley into the fat in a small continuous stream, stirring all the while, so that no unmixed ley may reach the bottom of the mixing vessel. This is the critical part of the operation, as if any unmixed ley reaches the bottom of the mixing vessel, it will be found impracticable to secure its admixture with the fat afterwards. With ordinary care, no difficulty will arise. When the mixing is complete, the mixture must be poured into the moulding-box, previously lined with wet calico to prevent the soap sticking to the wood. The box of soap should then be well wrapped in an old blanket or rug and put in a warm place for twenty-four hours, when the box will be found to contain nearly six pounds of hard soap of excellent quality. The block of soap may be cut into bars by means of a wire or knife, and allowed to dry in a current of air for two or three weeks, by which the quality will be further improved.

The soapmaker will now, in all probability, be encouraged to follow the example of the writer, and operate on larger quantities. Those inclined to do this are recommended to procure a ten-pound tin of the caustic alkali, and, after putting one-half the contents aside in an air-tight vessel, such as a large glass bottle, for future use, dissolve the remaining five pounds in exactly two gallons of water, to form the required ley. Thirty-five pounds of fat or tallow will be required in this case, and to provide this, our domestic supply may be supplemented by waste fat, to be purchased at a low rate from the family butcher. This, being free from salt, will only need to be melted and strained from the "greaves," which will form an acceptable meal for the watch-dog.

The simple apparatus already described will do in this case also, but it will be found convenient to provide a few special pieces of apparatus, as illustrated by the accompanying drawings, namely, a ley tank fitted with a tap (Fig. 1), a stirrer (Fig. 2), and a moulding-box (Fig. 3). The writer strongly advises the use of a stirrer constructed as herein described, even if all the rest of the apparatus used be of the "makeshift" type.

The vessel (Fig. 1) should hold about six pints. Its bottom is made to fall towards the centre so that it may completely empty itself, and is fitted with a tap so that it may be regulated to deliver the ley evenly and at the requisite speed with the least possible attention. It may be made of tin.

The construction of the stirrer will be readily understood by reference to Fig. 2, in which it is shown standing in a pail ready for use. The spindle, A, may be made of a piece of $\frac{1}{8}$ in. iron gas-pipe about 2 ft. long, having a "collar" brazed or soldered on at B, $8\frac{1}{2}$ in. from the bottom, where it is screwed and fitted with a nut, C. The blades, D, of which there are eight, are formed of strips of wood 1 in. square in the manner shown in Fig. 4, in which the dotted lines indicate the original square shape of the strip, and the solid lines the shape of the finished blade. A hole is bored through the centre of each blade to suit the spindle, A. These blades are graduated in length to suit their respective positions in the particular pail in which they are to be used, and which should be of not less than two-gallons capacity. Each blade should clear the side of the pail when in use by not more than $\frac{1}{2}$ in. When all the blades have been prepared, they should be placed on the spindle and alternately set at right angles; they should then be firmly fixed in this position by the screw-nut, C. A cross is now made of $2\frac{1}{2}$ in. wood, as shown in Fig. 5, and provided with notches, A, adapted to the pail, and furnished with a central hole, B, through which the spindle of the stirrer will pass freely, but without much "shake." The stirrer is fitted with a crank handle, E, which is attached to the spindle, as shown in plan at E'. This crank is formed of a piece of wood 1 in. square, through which two holes are drilled to suit the spindle; a saw-cut is then run from E' down the centre of the wood into the farthest hole, as shown; two screws are then inserted from the side, as shown, and by their means the crank, when in position, can be securely fastened to the spindle. The construction of the moulding-box is clearly indicated in Fig. 3, which shows the ends grooved into the sides and the sides and ends together grooved into the bottom, the whole being held together by "coach" screws $2\frac{1}{2}$ in. or 3 in. in length. The internal dimensions are 15 in. long, 10 in. wide, and 12 in. deep, and the whole may be made of $1\frac{1}{4}$ in. or $1\frac{1}{2}$ in. wood.

Our large mixing should be proceeded with thus:—*Weigh* out $8\frac{1}{4}$ lbs. of ley, and place it in the tank; weigh also $11\frac{1}{4}$ lbs. of the melted fat, and place it in the mixing pail. Place the stirrer in position, and set the ley tank so that on opening the tap the ley will flow into the pail. Set the tap so as to deliver a stream about the thickness of a thin penholder, and *immediately* commence turning the stirrer at a moderate speed in the direction of the motion of the hands of a watch. As the stirrer is revolved, the blades, owing to their peculiar shape, will constantly lift the materials from the bottom towards the top of the pail, thus counteracting the tendency of the ley to fall to the bottom, and securing a very perfect admixture of the whole mass. When the first portion has been mixed, empty it into the moulding-box, and proceed to treat another portion in a similar manner. Weighing may be dispensed with at the third and last mixing, unless waste of some portion of the materials has been incurred. Should this, unfortunately, have been the case, care must be taken to use the proper proportions of fat and ley—viz., 7 lbs. of fat to 5 lbs. of ley, and so on.

Memoranda.—Hard wood, such as beech or birch, to be used for all apparatus.

Dry alkali and ley to be carefully kept from contact with flesh and clothing.

Fat to be weighed *when ready for use.*

Stirring not to be continued longer than necessary to secure perfect mixing, or *separation* will commence.

Soap may be *scented*, if desired, by the addition of any approved perfume to the fat just before mixing.

The mixture to be kept as warm as possible for at least twenty-four hours.

TOWN ROADWAYS: THEIR CONSTRUCTION AND MAINTENANCE.

BY J. CHARLES KING.

ROAD-MAKING was an art well understood and practised by the Romans in this country. The roads of that early epoch, by their remains, testify to their substantial and enduring character, and obviously served the purpose intended: to resist the wear of cattle, horses, and wheeled vehicles in traffic, which was doubtless heavy for stone and timber. As an art, road-making does not seem to be understood by modern road surveyors and contractors; while of workmen as road-makers, it may be said they are animated beings, used to obey the orders of Vestries and Councils, whether the orders are flagrantly wrong or not.

The macadam and granite block orders of roadways are found to create so much mud and noise in towns and cities, that substitutes are sought in other materials free from these objections.

The two chief substitutes in general use in London, and other cities of the United Kingdom, are wood and asphalte. These yield a clean and quiet pavement for wheeled traffic, but from defective arrangements in the concrete foundation on which these materials rest, the roadways of wood and asphalte fail, rapidly yielding *beneath* the concrete under heavy-weighted traffic, producing a "billowy" surface to the roads and rapid wear in the hollow places.

For asphalte when newly laid, why sleek and smooth the surface to a bright polish

as is done? Roll the still warm and soft surface with a diamond-ridged roller: that would impart a network of fine channels to the surface, and ensure a better foothold for horses, without harming the serviceable character of asphalte as a pavement.

Another evil is the too smooth surface of the roads for the grip of horses' feet on wood and asphalte, when they become slimy by watering, or by rainfall mingled with dirt which accumulates on them. That it is a costly paving is admitted; ratepayers pay heavy road rates, and injuries to horses and vehicles by horse owners' losses show that these pavements are *made not* to fulfil the purposes for which they are both so admirably adapted. I say "made not to fulfil" deliberately, because contractors, road surveyors, and parish authorities, through ignorance of or indifference to the simplest facts in mechanics—or worse motives—make bad roads, with surfaces that cause frightful injuries to horses by their falling heavily with loads, or by strains in slipping, when such need not occur if the surfaces are adapted to take the grip of the horses' feet. Thus, Fleet Street, London, E.C., to wit. How are these bad roads made? The foundation of a road, however hard it may be—when wood or asphalte is to be laid—is broken up, not to a uniform depth, but at haphazard, at *varying depths*, and *without rammings;* this loosened surface is smoothed level, and concrete laid over it as a bedding for the wood or asphalte. Under heavy or continuous traffic, this crust of concrete becomes broken down where the substratum of loose ground was loosest, with the result that the superincumbent roadway sinks with the substratum. To obviate this settlement, some of the roads are made at great cost with greater depth of concrete—to be broken up at great cost—and the substratum loosened every time the road is paved with wood or asphalte. Having shown how the foundation of roads is made bad, the obvious remedy is *not to do it*, but to thoroughly ram the substratum on which the concrete is to rest, so as to make it level and solid.

Now, as to slippery surfaces. The same display of official ignorance of the simplest laws of mechanics prevails both for wood and asphalte surfaces.

The wood blocks are laid variously as to joints, some close, some about $\frac{3}{8}$ in. apart at side joints. In Fleet Street, close, where they should be wide open. How are these joints filled? Variously. In some cases tar is swept in, as in Fleet Street; in some liquid lime; in some river-drift is used. These mostly serve to top-surface all wood pavements.

These substances, by being worked up with water, become slimy slush. The joints which should form a check to slipping are unavailing for that purpose if close, hence the numerous accidents to horses and vehicles; and if jointed with slime and mortar are always greasy.

As the slimy sludge is the cause of slipping, keep it off the pavements made of wood, and substitute a simple effective gripping material in every side and end-joint of the wood blocks forming the pavements.

Make every joint not less than $\frac{3}{8}$ in. apart. Have the wood blocks tarred and the tar quite dry before laying the blocks in place, then ram broken granite, not less in size than $\frac{1}{4}$ in. polygons, into each joint, *without lime* or river-drift. Pass a steam roller over this surface, and see that the granite "keying" of the wood is well up to the surface, to give a bite to the iron shoe of the horse. As it becomes solidified, it would form a ridge of granite, which as it wore would aid to roughen the surface of the wood pavement.

The difference in length of a block of deal (of which wood pavements are generally made), under the influence of the atmosphere, wet or dry, is about $\frac{1}{4}$ of an inch; on a 50 feet wide roadway the expansion of wood, when wet, is over 12 inches: here is the hydraulic pressure which lifts up the side walks which are on each side of such a road surface. The effect is various, according to the lay of the road and the fulcrum bearing of the blocks on the curb-edge of the pavements.

The expansion of the wood in most cases lifts the curbing and paving-stones up at the points of contact, making the contiguous pavement beyond, which is undisturbed, lower than the curbing, and causing rain to settle there in shallow pools, as in the front of the new Law Courts and other parts of the Strand, Fleet Street, and the main streets of the City of London.

Sometimes the roadway itself is lifted up, and the novel sight of "wooden billows," as the boys call them, are formed; the vehicles, depressing them in one part, causing them to rise in another part of the road. This

Fig. 1.—Section of Roadway with Blocks worn.

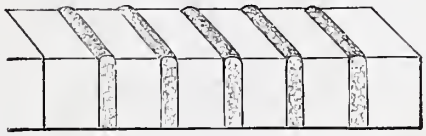


Fig. 2.—Section of Wood Paving with Joints packed with Coarse Polygon Granite.

occurs in patches of 8 or 10 feet in length by 4 or 5 feet in width.

The 'busmen and carters call these roads "parish jobs," and will tell you the same things have been going on for twenty years.

Fig. 1 exhibits a section of a roadway which shows how the wood blocks are when worn out—*i.e.*, one-third of their depth only.

The tar which was swept on to the surface finds its way partially down the sides of the blocks. It does not preserve them, cement them together, or serve any purpose but to make black slime when mixed with mud. The mortar-wash that is swept on has the same effect; and the sand, which is thrown on last, finds its way only into the upper part of each joint, and soon becomes useless as grit for the grip of horse-shoes.

An experiment was tried of having the wood blocks about $1\frac{1}{2}$ in. apart, but not having suitable grit between the blocks to fill the joints, they became simply mud-gutters, and had to be cleaned out to prevent the horses from slipping when hauling heavy loads.

On some of the slight inclines in the City channels are V-adzed in the joints: these channels hold mud and cause slipping, with the added objection that it mars the effect of a level surface of wood, it being made bumpy, and producing a rumbling noise upon the passage of vehicles over it. Fig. 2, a sketch showing a section of wood paving with coarse polygon granite, will illustrate the simple efficacy of such form of joint-packing to prevent slipping and allow for hydraulic pressure of expanding blocks in wet weather, as the stone polygon becomes pressed into the soft-yielding wood surfaces.

The use of soft deal for heavy traffic is objectionable because of its rapid wear. In the west of London hard red-wood is used, and no doubt is far superior to deal.

Road-making seems at present to be a means of levying rates which Vestries and Boards of Works will not relinquish into capable hands. This is an item of cost which goes far to make up the £300,000,000 indebtedness of parochial and municipal authorities of England, Scotland, and Wales.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

BENNETT'S SELF-HIVER—ALLEY'S SELF-HIVER—QUEEN CAGES—DRIVING IRONS—BINGHAM UNCAPPING KNIFE—WINTER PASSAGE CUTTER—TRANSFERRING RACK—CONCLUSION.

WHAT a happy mind a bee-keeper would have if he could be certain that none of his swarms would escape; if he knew that when his hives swarmed the new stocks would of themselves find out comfortable quarters prepared and made ready for their reception; if, in short, he had a self-hiver!

Such an arrangement has been invented by Mr. R. Bennett, of Halesworth; and although in practice it has not come up to the expectations of the most sanguine, yet it is decidedly a very useful apparatus. Fig. 1 will show its general appearance, and its position with reference to the hives.

It must be understood that one of the hives shown contains the stock of bees which is expected to swarm, while the other is the empty hives containing frames, foundation, quilts, and possibly comb and honey, into which it is desired to lead the swarm.

I may be permitted to quote Mr. Bennett's own words, as they very clearly describe how it can be made:—

"First, get a thin board of $\frac{1}{2}$ in. stuff, 2 feet long and 6 in. wide (any size can be adopted at the discretion of the maker); next a piece of queen excluder zinc, same length as the board, and 9 in. wide; bend $1\frac{3}{4}$ in. on each side, along the whole length of the zinc, and tack the bottoms of the bent sides along the edges of the board; then nail along each of these sides a thin strip of wood $\frac{3}{4}$ in. wide, and you have a sort of square tunnel—2 feet long, 6 in. wide, and $1\frac{1}{4}$ in. deep, with both ends open, and a sort of miniature alighting board along its sides. Place an empty hive in front of the one expected to swarm, draw apart the slides to form an entrance 6 in. wide, and put the above cage or tunnel on the entrance board of each hive, the open ends of the cage being in front of the entrances of both hives, and the thing is complete."

With regard to the practical working of the self-hiver, one gentleman reports that it did famously, the swarms settling down quietly in their new homes. In another case the swarm went off, leaving the queen in the tunnel vainly trying to follow. When she found that she could not leave, she returned to the parent hive, and the swarm joined her there.

When the same swarm issued again, and the queen tried to get through the excluder

zinc, the owner removed the empty hive and tunnel, and stopped up the open end of the latter with paper, so that the queen had perforce to enter the empty hive. The swarm soon joined her there, and took to their new quarters readily. I mention these cases as hints and encouragements to would-be manufacturers. I have not been able to try the plan myself, as there were no swarms this year among my bees, and the thing is quite new.

Alley's self-hiver is on the same principle, the only difference being that the tunnel leads to another hive at the side of the swarming one, instead of in front. It does not promise, however, as well as Bennett's, there being so many corners and angles in it; moreover, it is patented, and its manufacture might bring a person within the clutches of the law.

Queen cages are a necessity; the simplest of them is, perhaps, the pipe-cover queen cage, shown at Fig. 3. It can be manufactured as follows:—Get a strip of tin 6½ in. long and 1 in. wide; make it into a ring and solder the ends together; then procure a circular piece of wire gauze or perforated tin, 2 in. in diameter, and solder it on as a top, and the cage is complete. A disadvantage in this cage is that the bees must be disturbed in releasing the queen. This is overcome in the cage shown at Fig. 4. It consists of a rectangular cage, formed of perforated tin or wire gauze. Its dimensions are: Length, 4 or 5 in.; width, 1¼ in.; thickness, ½ in. A piece of stuff 3¾ in., and as long as the cage, bent over a piece of wood 1¼ in. by ½ in., will just make it. A flange is then made of plain tin for the top. This may be about 2½ in. by 1½ in., having a hole 1¼ in. by ½ in. in its centre, into which the cage fits, and is soldered, leaving a little bit projecting at the back, which is turned over a pin and acts as a hinge for the top door. This may now be made of tin 1½ in. by ¾ in.—a hinge formed at the back by turning up the tin over a fine piece of wire or a pin, and fitted to the part of the cage projecting above the flange.

A door for the bottom can be made of wire, bent like 4A, the two wires being ⅙ in. apart, and the distance from centre to centre of the loops being 1¼ in.—*i.e.*, from the single loop at the left to the line joining the pair of loops to the right. This door may now be fastened to the cage by passing a pin through the lower right-hand corner of the cage, so as also to pass through the two loops of the door. Some provision should be made, either by washers or a couple of twists of fine wire, to keep the door in the centre of the cage; otherwise it might move against the side, and allow the bees to have access to the imprisoned queen. A light wire hooked on to the front loop, and passing with slight friction through a hole in the flange, completes the cage. The queen is released by pressing down this wire, which projects about an inch above the flange, and ends in a loop.

Driving irons are like Fig. 5. I make a great number of sets, as they appear constantly to get lost. They are made of wire nearly ¼ in. thick; the loops in *a* are 9 in. apart, and the ends about 1½ in. long, roughly pointed with a file. About 20 in. of wire are required for *a*, and two like that and one like *b* complete a set; *b* is about 9 in. long, and the loop 2 in. diameter. It requires 15 in. of wire.

A Bingham knife (Fig. 6) is not to be undertaken, except the manufacturer has special facilities for that kind of work.

The blade is made of good saw steel, 6 or 7 in. long and from 2 to 3 in. wide, shaped to the patterns shown in the figure, and sharpened all round like a chisel, from the under side only. A tang is made of ⅜ in. iron or steel, one end being pointed to fit the handle and the other flattened so as to be easily fastened to the blade, to which it is secured by two rivets. These should be countersunk into the under side of the blade and ground flush with its surface; when the blade is laid flat on a board, the handle is raised about an inch from it, and the tang should be bent in such a manner as to secure this. The whole thing is not unlike a mason's trowel.

Fig. 7 shows an affair for cutting passages through the combs on the approach of winter. It is simply a tin cylinder about an inch in diameter and 4 or 5 in. long, having one end serrated so as to cut the comb more easily.

Towards the other end a couple of lugs of wire may be soldered, to afford a better hold to the fingers, as shown in the engraving.

A Cheshire transferring board is shown at Fig. 8. Its object is to afford facilities for transferring the combs cut from a skep to a bar-framed hive.

The table proper consists of sixteen tongues projecting from a back support about 10 in. To make it, a piece of wood about 16 in. long, 3 in. wide, and 1 in. thick should first be procured. This must now be planed quite flat and out of winding, the under surface being especially true. The tongues are next to be prepared. They can be all cut out of a piece of yellow pine 13 in. long, 1 in. thick, and about 11 in. wide. Fig. 9 is an end view of this piece of wood, showing how the tongues could be cut out. Of course, it will require care to cut the bevels to the proper angle, but any want of

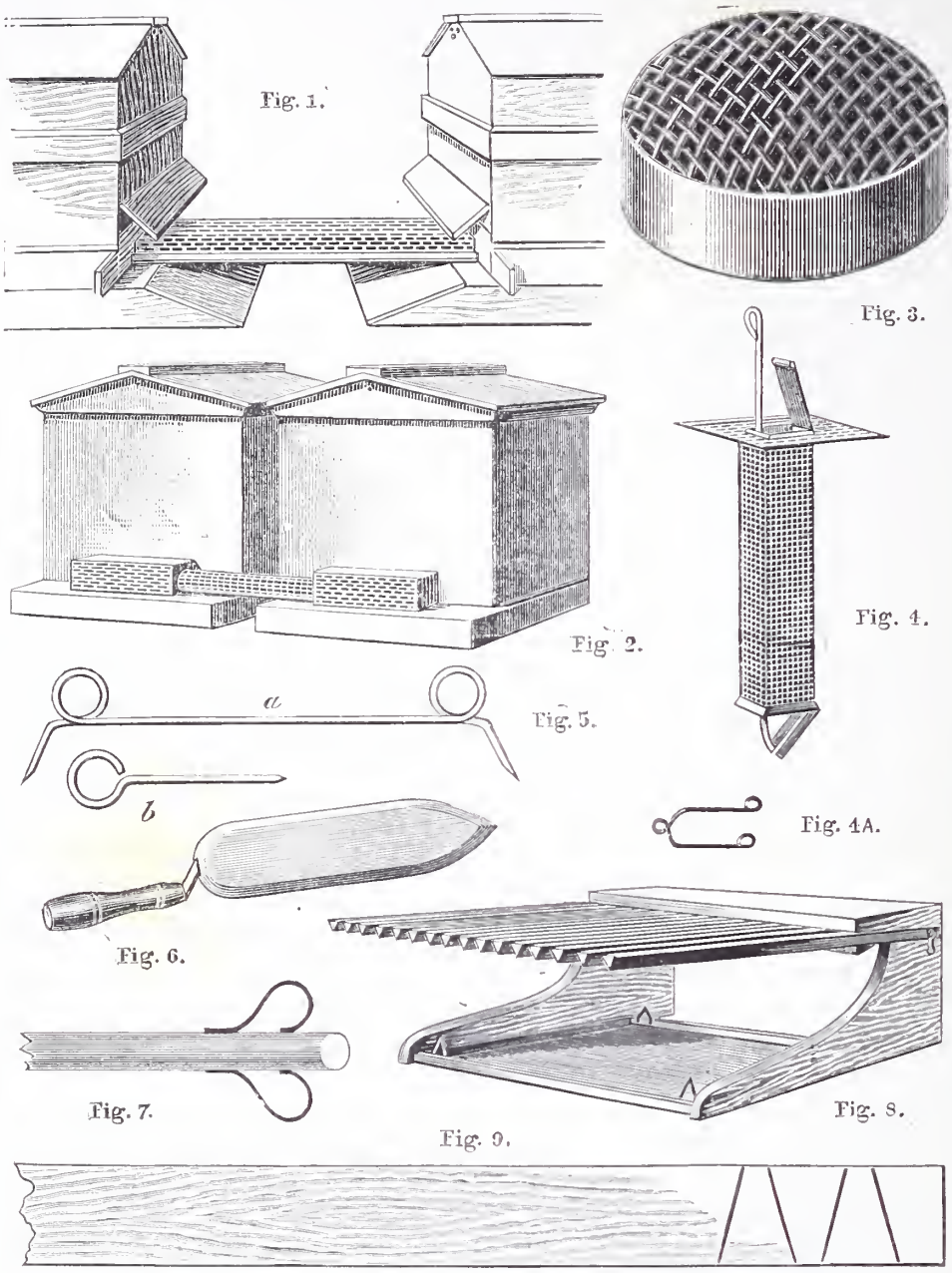


Fig. 1.—Bennett's Self-Hiver. Fig. 2.—Alley's Self-Hiver. Fig. 3.—Pipe-Cover Queen Cage. Fig. 4.—Modification of Queen Cage. Fig. 4A.—Lower Door of Fig 4. Fig. 5.—Driving Irons. Fig. 6.—Bingham Knife. Fig. 7.—Winter Way Cutter. Fig. 8.—Cheshire Transferring Board. Fig. 9.—End View of Board, showing how Tongues may be cut.

accuracy in the saw can be rectified by the trying plane. The dimensions of each tongue, when finished, will be: length, 13 in.; top width, $\frac{3}{4}$ in.; bottom width, $\frac{1}{4}$ in.; depth, 1 in.

These tongues must now be fastened to the back piece either with nails or screws, preferably the latter, each tongue being at right angles to the back, and the edges $\frac{1}{4}$ in. apart. The spaces between the tongues immediately underneath the support of the back it would be well to fill up with pieces of wood nicely fitted in, but by many this would be neglected altogether, as being somewhat troublesome. The legs now demand attention, and these may be either fixed or folding. In any case they will be cut to the shape shown at Fig. 8, the height being 6 or 8 in.; length from front to back, 12 in.; and thickness of the wood, 1 in. If they are folding, hinges should secure them to the back support, strap or butt hinges 3 in. wide doing the business very well.

The outside surface of the legs is quite flush with the outer edge of the last tongue, and to prevent the leg shutting up when not wanted, a hook and eye, such as is used to hold the first door of a cupboard, is fitted, the hook being secured to the leg and the eye screwed into the surface of the tongue. This is shown at the right-hand side towards the back of Fig. 8.

A tin tray the complete size of the space between the legs is necessary to catch any honey which may drop from the combs during manipulation.

As this piece of apparatus will be always exposed to the smearing of honey, it would be well to give it several coats of a hard varnish, which will make the surface washable, a condition of things which the apiarist should always remember and act upon.

I have now written a fairly complete description of the various apparatus which are to be found in a well-appointed modern apiary; but I feel that there are many points which were overlooked or had to be neglected through want of space. The observatory hive, which I promised in an early chapter, and which has been asked for by some correspondents since, will have a chapter devoted to itself in the next volume, if I am permitted to write it; and my circular saw table will be treated in the same manner.

Bee-sheds, or houses, as distinct from hives, form a very interesting study; and if a demand arises for a description of some very useful and workable styles, I will be glad to supply it.

In the meantime I will bid my readers adieu, thanking them for the indulgence they have shown me, and hoping that what I have written will help many to carry on with economy and success that fascinating pursuit which all bee-keepers enjoy so much.

That bee-keeping is an employment that brings pecuniary reward with it as well as pleasure, no one can doubt or will dispute, as honey always commands a ready sale. To the clergy located in country districts it may be specially recommended as a profitable hobby well worthy their attention.

THE ART AND PRACTICE OF SCENE PAINTING.

BY WILLIAM CORBOULD.

LEAVES IN FOREGROUND—HIGH LIGHTS—DARK MARKINGS—FOREGROUND ROCKS, LARGE STONES, BROKEN GROUND, ETC.—FINAL TOUCHES.

Leaves in Foreground.—When the artist is painting the foreground and wishes to represent leaves such as the blackberry briar with its leaves sometimes beautifully variegated, let him take his flat fitch—the large one—and lay it one side in green, and then turn it over and lay the other side in lake or burnt sienna. Now let him hold the brush, hair downwards, and touch the tips of the hair in a bright colour, either orange or lemon chrome. Hold the brush up and press (not the flat side, but the edge) sideways, as shown in Fig. 2, and press it firmly against the canvas, taking it away quickly. This has to be done three times for each blackberry leaf, as the leaf is in three distinct parts, as shown in Fig. 3. It will be found that the leaf will have the different tints required and the form as well without touching it again. The brush, if well charged with colour, will do several leaves without replenishing, and they are boldly put on in a moment. If anyone were to try to do the same thing with small brushes, he might niggle at the work for an hour without success. When it is desired to represent grass, take the large foliage brush or the oval brush, dip it into two or three colours, such as green, burnt sienna, or lake, or any of the yellows. This will give the different tints required. Press the brush against the canvas firmly; in drawing the brush away, which must be done sharply, flick it upwards, and this movement will give the markings of the grass. Continue this, working downwards, but do not go over the same twice until it is dry. As the painting reaches the foreground, any large brush, filled with colours, if pressed and punched in any form against the canvas, will have a better effect than laying it flatly on. When this is all quite dry, you may glaze and scumble over it, giving the finishing boldly, using large fitches and foliage brushes for the large leaves immediately in the foreground, such as dock leaves, thistles, ferns, etc., etc. You may glaze over as often as you like with sunlight or shadow colours. By these means depth and richness are obtained, and it will be found that the finishing touches stand out well against the glazings, particularly the dark shadows under hedgerows. The different grasses, rushes, nettles, etc., will be natural when seen a little distance away, if manipulated in a proper manner; and, as I have said before, in this as in other things, earnest study will overcome all difficulty.

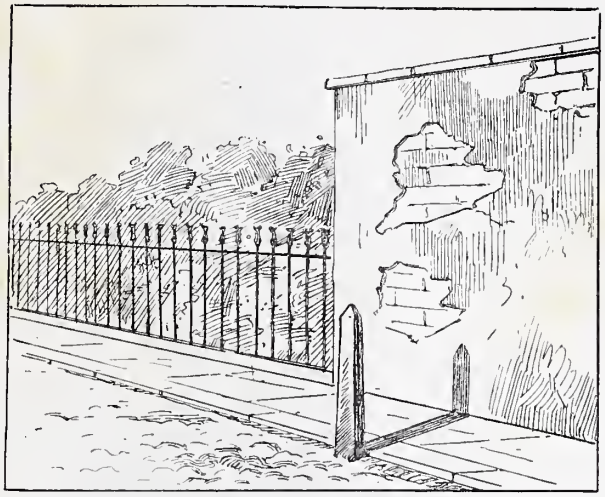


Fig. 1.—Sketch exemplifying Treatment of Shadows.

High Lights.—The last touches are the highest lights, and the colour for these must rest with the time of day the scene represents. Should it be early morning, or evening with a glorious sunset, the "high light" colours must be of the same tint as the brightest in the sky; if the scene is mid-day, with a clear sky and fleecy clouds, the high lights would be nearly white.

Dark Markings.—For the dark markings under hedgerows, bushes, etc., such as the stems and branches, use brown lake. For the blackberry briar, dip your brush in brown lake, then in azure blue; also dip in a little vermilion sometimes. In drawing the brush while forming the briar, the different tints in the brush will leave distinct markings such as are met with in Nature. These little tricky ways of getting the different effects, when mastered, lead to others which stamp the master hand, and shows each man's work as different from the other as is the handwriting of each, but may be only noticed by the connoisseur in the art.

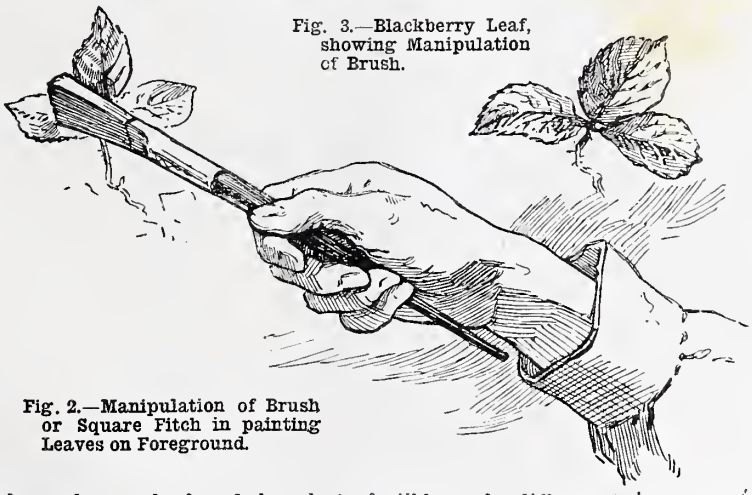


Fig. 3.—Blackberry Leaf, showing Manipulation of Brush.

Fig. 2.—Manipulation of Brush or Square Fitch in painting Leaves on Foreground.

Foreground Rocks, Large Stones, Broken Ground, etc.—Rocks and large stones in the foreground are among the most beautiful things in Nature to depict, being so varied in form and colours; some bright, others subdued by pearly greys; sometimes almost positive blue, at other times covered with green lichens, mosses, ferns ever various in tint and also in form: no two alike, sometimes rugged and angular, sometimes round and smooth; perhaps towering upwards, overhanging the path or roadway in all sorts of grotesque forms, making fine subjects for the scenic artist's skill.

In the first painting or laying in of rocks, whatever colours may be used, it would be best to have a brush for each colour. Lay the colour on anyhow, the rougher the

better; do not work it about too much. Let the different colours join or overlap each other, but do not mix them about, or you lose transparency, the colours becoming muddy. Let the artist go to work in this way: he has his outlines drawn sharp and angular, and all colours come in at one time or another for rocks. Let him take, say, first Venetian red, and lay it on one part; then yellow ochre: these may run one into the other at their edges; or he may use brown lake in different degrees of strength. After these are dry, he may scumble or drag other colours over the ones first laid on; for instance, he may scumble yellow ochre over the brown lake, or umber if used, or brown lake over yellow ochre and Venetian red. He may now use some blue, either celestial or azure, mixed with white; scumble, drag, and lightly touch over the other colours. This will give the rocks the aged, hoary, and rough appearance of Nature. It is surprising how many tints you may discover in rocks, stones, old stone or brick walls, if you can only learn to look with the eye of an artist. Sometimes rocks will be covered with vegetation, grasses, lichens, mosses, bright bits of green and yellow, besides all the different tints in the rocks themselves. Even where they are washed by the sea, and to an ordinary person appear white, there are many tints of pearly greys, and heather stains, and other soft tints which must be thought of to make up the whole.

After the first colours have been laid in, as I have described, if the painter stands back from his work and looks at it, he will find the different tints shape themselves into irregular masses. Mark out these forms with vandyke brown as the eye guides, for, as I have said before, the hand is but the servant to the eye. Use the shadow colour to darken all the under-parts of the rocks. Where masses are piled one on the other, mark out with vandyke brown and glaze with shadow colour until sufficient depth be obtained to throw the light parts into bold relief, the high lights of course partaking according to the directions already given of the tints in the sky. The time of day and the position of the sun in the sky must combine to govern the shadows as well with respect to their length and depth. It is obvious that if the sun is high in the sky, the shadows will be short; while, on the other hand, if the sun is low in the sky, the shadows in correspondence would be long. A line drawn from the supposed position of the sun to the top of any object in the scene, continued in a straight line to the ground, will give the length of its shadow. Should the shadow of one object fall on another, as the shadow of a post, tree, bush, or a piece of rock, a large stone, etc., which might be near a wall, or some larger object, the shadow of the smaller object would be bent upwards, where it comes in contact with the larger one, as the shadow of the post on the flat pavement and upright wall in Fig. 1.

Final Touches.—By this time the scene will look pretty well finished, but there is still something to be done. Let the artist at this stage take a good look at his work, and where he thinks a shadow or a touch of bright colour, as the high light colour, would give additional brightness, put it in boldly. When finished, I hope it will be to the painter's satisfaction; if he has a fair amount of talent, he will not fail to please others as well as himself.

Remember this is only one simple lesson, but, if this be well studied, it will make all others easier. The artist gradually gets master of his colours, and is able to mix them to obtain the different tints required for the work.

The scenic artist has to depict anything and almost everything at different times, one day painting a scene may be from India, America, Australia, China, Japan, Egypt—in fact, every country in the world—and on another the beautiful and varied scenery of our own country. Then there are architectural scenes, interiors, street scenes, as well as seascapes in calm and storm, all requiring separate study and treatment. I hope to treat of all these subjects in their proper form at another time.

Change of Colours in Artificial Light.—All reds deepen in tone when seen in artificial light, but it is quite the reverse with yellows, which all appear much lighter; pale yellow, indeed, would be almost white. Blues and greens will deepen in tone. Green will brighten up with good artificial light; but dark blues are subdued, and sometimes appear almost black. Care should be taken not to get the shadow colour too deep: to avoid this, it must be put on thinly. If it is desired to make a good black, use brown lake and celestial blue in about equal proportions. When rubbing in clouds, the painter must not use any other yellow but yellow ochre, because when coming in contact with the sky blue it will not turn green so readily as any other yellow. This only applies to the rubbing in of clouds. Other yellows are used for laying in horizon tints and sweeping across the sky, as I have already mentioned in my remarks on the use of positive colours in cloud painting.

If the scenic artist resides in or near London, Messrs. Brodie & Middleton, of Long Acre, London, are about as good a firm as I can recommend for brushes, colours, and, in fact, every requisite for scenic painting. For canvas or cloth for painting on I would recommend that supplied by Mr. Alderson, Westminster Bridge Road, London: it is of double width, will not shrink, and runs about a shilling per yard.

In conclusion, I wish to say I have embodied in what I have already written the first rudiments of "The Art and Practice of Scene Painting," which I hope will be instructive to all readers of WORK who may have a taste and liking for this pursuit. At a future, but I trust not far distant, time, I hope to give some practical lessons on stage perspective and carpentry, especially in connection with scenery and scene painting, such as the making of profile wings, set pieces, borders, water borders, and how to set them in perspective, practical doors and windows, how to light the stage, mechanical effects, etc.

MEANS, MODES, AND METHODS.

AN EASY AND ACCURATE WAY OF GETTING CENTRES FOR DOWELLING.

OFTEN things want dowelling together that it would be almost impossible to measure for, to say nothing about the time and trouble, and the possibility of getting wrong after all. Take for example a couch leg that wants dowelling on. Get some fine brass gimp pins, as many dowels as you want, and lay them with the heads (on the couch frame) where you want the dowels to come; now place the leg on top of the pins where you want it to come, give a sharp tap with a hammer on top of the leg, and lifting it off, you have centres marked on both surfaces at once by the heads of the pins. This method can be employed in nearly all kinds of dowelling. H. H.

MODE OF STRIKING OUT ELLIPTIC HEADS FOR DOORS, ETC.

To mark out an ellipse with compasses is rather a lengthy proceeding; to sketch one by the rack of the eye (as workmen term it), half at once, and then turn it over and mark the other half, is rather a primitive way when a true ellipse of any given size can be struck in a few minutes by following out the instructions given below. Get a strip of wood half the whole length of the desired ellipse and notch it out the whole height you want the ellipse (see Fig. 1). Proceed as follows:—Get the wood on which you want an ellipse, and with a square mark a line up the centre, and place a strip of wood down the edge of the

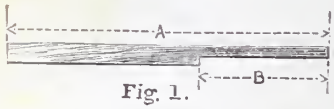


Fig. 1.

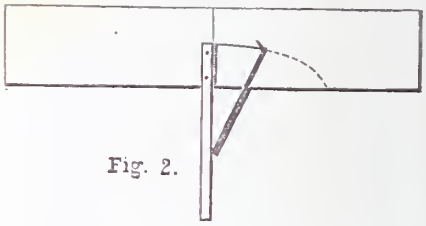


Fig. 2.

Fig. 1.—Shape of Strip of Wood for striking Ellipse. Fig. 2.—Mode of using Strip to strike Ellipse.

line; secure it in its place by means of two sprigs slightly driven in, or thumb cramp, or anything handy, and placing the notched strip of wood up the side of it, it will at once give you the height. Now, with pencil held on the top end of the strip, and the other hand to guide the other end, work it carefully along, keeping it close to the strip that is fastened down with your left hand, and with the right hand working it from you and keeping it close to the bottom edge of board at the same time, and it will describe half the ellipse (see Fig 2).

By reversing the strip of wood to the other side of the centre line, and working the notched stick the other way, you will have an ellipse quite true. A little practice will enable anyone to mark out all sizes by simply altering the notch and length of stick.

I have frequently made use myself of the method of striking an ellipse as described above, and I trust that many readers of WORK will find it as desirable and serviceable as I have. H. H.

HANDY APPARATUS FOR HOME BOOKBINDING.

BY JOHN MORRISON.

OBSERVING that papers on the "Practical Details of Bookbinding" have appeared in WORK from time to time, and that, as a consequence, a numerous section of its readers seem desirous of giving practical effect to them, judging from inquiries regarding bookbinding tools, etc., I propose to give a short description and sketch of some tools suitable for home make and use which will, I am sure, start a few to bind their weeklies and monthlies that at present are either lying as so much waste paper, because unsuitable for handling, or are put into the fire as soon as skimmed over, and

much valuable, interesting, and useful information lost which would otherwise have graced their bookcase in a handy and compact form, suitable for reference at any time, both for information and amusement.

Of all the different subjects treated upon in Work suitable for "hobbies," I think bookbinding will commend itself to the greatest number, because most readers will have lots of material to start upon: perhaps not worth paying 3s. 6d. a volume for in the regular way, but still, worthy of a place on the shelf. One thing which damps the ardour of a beginner is the almost prohibitory price of bookbinding (professional) tools. If one grudged the price of getting their papers done by someone else, to buy tools and do so himself looked like jumping out of the frying-pan into the fire. Of course, if one goes in for binding in calf, morocco, gold, etc., etc., the expense of outfit is all the more. But I think what the average reader requires is an outfit which will enable him to bind his matter in a strong, handy, and convenient form, not so much for ornament as for use, but, of course, at the same time to have a presentable appearance in his bookcase. I have bound all my own in this style, the sewing, banding, and hingeing being of the strongest kind, and for covering I have used nothing but good cloth (imitation leather). I would advise those who try it to go in for good large-grained (embossed) cloth, as the cheaper kinds are not so easily manipulated.

Well, to proceed with our handy binding apparatus—one of our first wants is a screw-press of some kind to put our numbers into less bulk after we have folded them neatly, and knocked them up as well as we are able. It is not so difficult to make a press in the ordinary way, but as we have to do many things with this appliance—pressing, cutting, backing, etc., screwing-out and screwing-in—and as it is not very heavy, it is always shifting on our table, or whatever we have it across, and this is likely to make us grumble. Well, to remedy all these inconveniences, and give us some extra conveniences, I ask you, in the first place, to get a box. Either make it, or you may be able to get one at the grocer's—size, say, $2\frac{1}{2}$ ft. to 3 ft. long, 2 ft. ends, and 2 ft. deep. Next, from the joiner's, get two bars of wood, A, B, same length as inside measurement of box, and place as shown in Fig. 2. These are to make our screwing, ploughing, etc., etc., press; and observe they must be of hard wood: beech, properly dried and seasoned, is, I think, preferable to any other. They must be 5 in. deep and 4 in. broad, and they must be planed straight and squared up. If you get a joiner to finish them up for you, he may bore holes for the screws, C, say $1\frac{1}{4}$ in. diameter. Inside of box, on ends, nail two bars of wood, D (as shown by dotted lines in Fig. 2), 5 in. from top, so that press bars, A, B, when placed on them, will come level with top of box. The next thing to be done will be to get screws and nuts to fit, and these we can get the blacksmith to make for us, say 1 in. or $1\frac{1}{4}$ in. diameter, of a shape as shown at C, and on the nuts have tails with two holes for screw-nails to fasten into the press bar, cutting hole in wood to insert the nut flat. Now, when we put in our screws right through front of box and bars, we have a press that will suit all our purposes.

Our next requisite is a sewing-frame, which you will see, from Fig. 3, is very simple, and need not cost much. I need not enter into detail, as you will see it is simply a flat bottom with two screwed uprights, and cross-bar with nuts below for the purpose of keeping bands or strings tight while we are sewing book. It will be observed that there is a slit immediately below cross-bar and between the uprights, to allow of strings going through and being fastened on the bottom with a tack or anything handy. A wooden screw upright is preferable, and the ends need not be glued into the bottom, but fitted so that they can be taken out for convenience, and the whole stowed into the box while not in use.

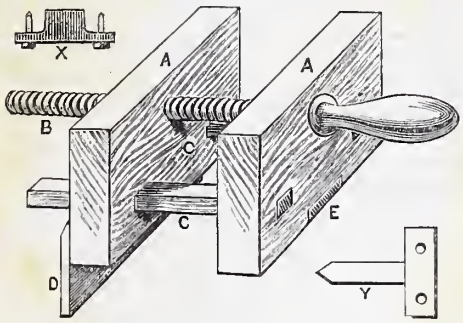


Fig. 1.—Plough for cutting Edges of Books—X, Iron Carrying Knife; Y, Shape of Knife.

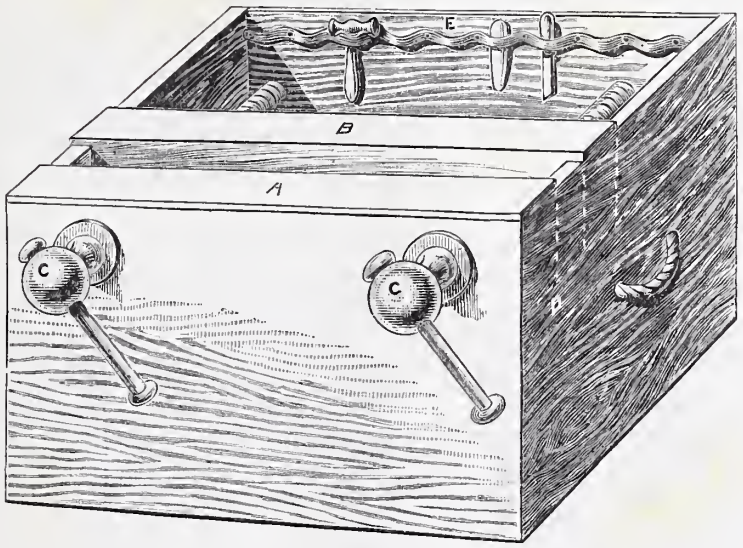


Fig. 2.—Combined Press and Bookbinder's Box.

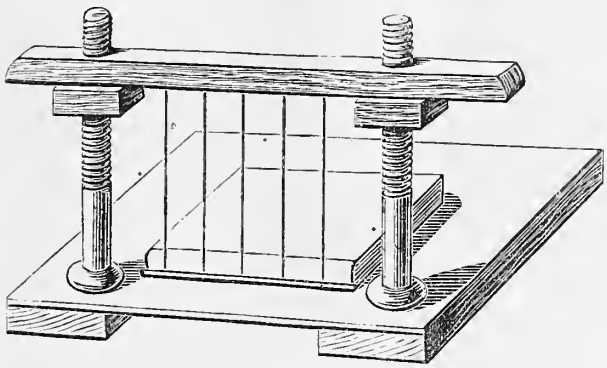


Fig. 3.—Sewing-Frame.

Our next necessity is a plough for cutting the edges of our books after being sewn and glued up. Procure from the joiner again two pieces of seasoned beech for sides of plough, A, A (in Fig. 1), size 8 in. long, 4 in. deep, and $1\frac{1}{4}$ in. or $1\frac{1}{2}$ in. thick—all fair and square: we also require a screw for this tool, which may be $\frac{3}{4}$ in. iron, and nut with tail same as for press, to insert in one of the sides—namely, opposite side from handle. It would be much better, but not, as a rule, so easily got, to get a joiner to make you wooden screws, and, at the same time, to tap or screw hole in side piece to receive it, which would save trouble of inserting iron nut to receive iron screw. Two guides, C, C, say 10 in. long and 1 in. square, are fixed in handle side, say $1\frac{1}{2}$ in. from bottom side, square holes being opposite in other, to allow same to slide. The cutting knife is also on this side, a notch being made to receive it, as shown at E in sketch, so that when put on with two screw-nails it is flat with wood, as will be seen from a look at drawing; right side piece bears up on handle, and to ensure it screwing back as well as forward, a hole is bored inside through screw spindle for pin and washer. This side we may say is now all of one piece, and will go out or in as required. But we have a slip of wood or iron to put on the other yet, so that it may hold on to press bar, B, while we are working it backwards and forwards to cut our edge held in press. This slip is shown at D, and is a piece of hard wood. We could have a runner on the top of our press; but we wish to avoid that, as it would be an obstruction in the way of our other jobs, which are many and varied, and it gives us a flat top for all purposes. I may mention here that when cutting book edge we require to grip it between two small boards of wood, allowing one side to stand above the level of press, so that when knife is finishing, the last of the leaves are cut up against this part of the board.

We have now got our tools finished, and we take another look at the press box. If it has been made of rough boards, without attention to joints, etc., we can, if we want it to have a better look, cover it with some nice pattern of wall-paper, putting white inside, then we can nail some strips of leather inside, and put in all our jobbing tools. Bore two holes in each end, and put in two pieces of rope, for convenience of lifting, its great advantage being that, when lifted on to chest, for instance, we have all we require inside: our sewing-frame, plough, millboard, cloth covering, etc., etc. Our litter and cuttings, instead of scattered about all over the room, will also find a convenient receptacle for the time being; and when we have done for the night, our box is lifted down and stowed away with its miscellaneous collection till such other time as required.

I may add that, instead of ropes, two cleats may be nailed to the sides of the box to afford means of lifting it.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

PAINTED IMITATIONS OF MARQUETRY—FURTHER METHODS OF EXECUTING GRAINED AND STAINED INLAYS, WITH SUGGESTIONS FOR THEIR PRACTICAL USE.

BEFORE considering, separately, the different treatments connected with the accompanying illustrations, it may be advisable for a brief space to gather up the "threads" of the preceding paper, so far as their bearing upon this concluding lesson is of present importance. In the former article I explained the processes usually adopted when simple combinations of woods are worked; whilst I endeavoured, by an illustration of ornamental effects, to secure the student's practical interest in this pleasing branch of decorative graining. Although arrangements of several different varieties of woods were therein explained, both of light upon dark, and *vice versâ*, the *principle* of working, whereby portions of a surface are temporarily protected—technically called "bound down," or "stopped out"—was, however, but briefly analysed. This point of interest and importance, as also that relating to colour-contrast between the component divisions of a design, will now profitably engage a little more attention.

The "Stopping-out" Process is the means to an end which, in its application to inlay imitations, rather puzzles the learner. He can usually discover how a dark ornament can be bound down upon a light ground, by simply stencilling the pattern over the walnut distemper graining with a thin coating of transparent varnish or gold size, and then cleaning off the remaining part with water; but to get the pattern light upon a dark wood, is altogether beyond his ken. The first point is to understand that the ground colour for the *lightest* variety of wood to be imitated must necessarily be the ground colour of them *all*, since any attempt to paint in the various creams, buffs, reds, etc., required for graining large surfaces would at once make the desired finished appearance of inlay a virtual impossibility. The next stage of enlightenment is reached when the student fully grasps the difference between graining the varieties in *oil* and in *water*. If we figure, in oil colour, a surface in light oak, and then, when dry, work over it an imitation of knotted oak, also by the oil process, with the notion of subsequently removing some parts of the latter, we should attempt a difficult task. Assuming that we could preserve the design by stopping it out with some vehicle, we should, in trying to remove the surrounding parts, have to use a solvent (turpentine), which would at once loosen also the light oak beneath. Hence, by using water colours, we are enabled to clean off the surface with water only; whilst the stopping-out varnish covering the portion to be ultimately displayed is not in the least affected at that stage. This principle is not at all an uncommon one in decorative and kindred practices. With glass embossing, for instance, we paint over —*i.e.*, "stop out"—that portion of the surface into which the acid is not required to eat. When the latter has done its work, we find that the Brunswick black is not affected by the acid, although by the use of turpentine we can readily clean the black off the glass, now that its purpose has been served. Other examples might be noted, but doubtless enough has been written thereon for the least experienced of my readers.

"*Stopping*" *Varnishes* of several different natures may be used, and the solvents for their subsequent removal must naturally be of kindred variety. Simple wood naphtha varnish will answer the purpose, and can be cleaned off with the same spirit. An ordinary spirit varnish of the "white hard" kind will, of course, require methylated spirit for its removal; whilst any painter's vehicle into which turpentine largely enters, will also answer the purpose. Those which I can confidently advise the learner to use are white hard spirit varnish for staining inlays upon real wood surface, and the finest Brunswick black for working upon oil-painted grounds. Canada balsam may be used for the more delicate and intricate of painted designs, but the above black varnish is as reliable for this work as it is for embossing. Turpentine, the solvent for the two varnishes last mentioned, is far less liable to damage a painted surface than the more "fiery" spirit solvents; hence their better suitability.

In manipulating the solvents some care and patience are necessary to remove the varnish. The former should be well flooded over the design, and the soft camel's-hair "dabber"—such as gilders and polishers use—should be employed, more for mopping up the solvent than for rubbing the varnish. If the spirit or turpentine is allowed to thoroughly loosen the varnish, no great difficulty will be experienced in removing it; but if much pressure and friction be used, the water-graining—held together only by the glutinous nature of the beer-fluid—will probably be loosened also. Before executing any permanent ornamental work, the novice should well practise this operation, and also aim to temper his varnishes with a little turpentine or white polish, respectively, in order to use them only of that strength necessary to protect the graining, and be the least trouble to clean off.

Colour-Combinations and Harmonious Contrasts of the Various Woods contained in any design is a branch of the subject requiring special study. One of the best sources of knowledge thereon is, naturally, the real marquetry work of a good make. If, added to this eye-training, the student will fix in his mind the few subjoined colour-notes, the artistic effect of his completed effort will be worthy his best executive labour. Although in painted imitation inlays the decorative effect should be almost wholly the result of ornamental lines and form, as brought out by contrast of shade—light against dark—we find that *stained* imitations of marquetry upon a plain wood surface give more legitimate scope for harmonious colour-effect. A large portion of real inlaid work is of the latter kind, in which the ornament consists of dyed woods of various light tints let into a dark surface of richly coloured wood. Even in combinations of grained woods, however, a slight knowledge of colour will enable us to get an enhanced effect without sacrificing the naturalness of the grain imitation:—*Complementary colours* are those which heighten the effect of each other by contrast when juxtaposed. True complementaries are such that balance each other, and which, if their colours be united, combine to reproduce white light. Sensations of colour which in their entirety are equivalent to white light are usually conceded to be *harmonious* combinations—that is to say, agreeable and pleasing to the educated mind of humanity. From this it follows that complementary colours are the basis of harmonious or correct colour-effects. Now, according to our modern theories and experiments, the complementary of a pure blue is a pure yellow, the complementary of pure red is a decidedly greenish-blue; whilst orange and blue (of an aërial hue), and lemon-yellow with its complementary violet, are the other chief pairs of opposing and balancing contrasts.

In applying these principles to our work we have therefore a scientific basis to build upon. We thus know that a yellow or golden colour wood will best harmonise with blue tints. Suppose we have, not a pure blue tint, but a violet or warm blue; the yellow, in such an instance, must also be modified by the addition of a little blue, making a greenish or chrome yellow. So also with red and its complementary; for if a purple-red (that is, with a little blue added), then must the complementary be made greener. In short, that combination of pairs which we make "warmer" on the one side, must be "cooled" on the other; hence orange "warmed" or reddened to a vermilion red must be contrasted by a complementary nearer to that of pure red than of yellow—viz., a greenish-blue.

When inlaying for colour-effect upon rosewood, this being a dark purple-red, the foregoing teaches us that greenish-yellow tints are most harmonious. Also we learn that amboyna (orange) hues are heightened by contrast with an "aërial" (or slightly green-hued) blue. Beyond this, it must be broadly laid down that combined shades and tints of the complementary colours can only be used in subordination to the inlay principle, and that the outline and form of ornament must be distinctive before all considerations of pure colour.

Executing Stained Inlays is, to the writer's mind, the most artistic outcome of a knowledge of imitating woods. Having so fully explained the method of "stopping out" in connection with painted imitations, there is no necessity to dwell upon its adaptation to working transparent stains. Any spirit or water stains, washes of grainers' pigments, such as the siennas, vandyke, indigo, aniline dyes, or "Judson's" stains, may be used. The best white sycamore makes probably the most suitable ground to work upon, and if, as is usually the case, we desire to retain some portions of its whiteness, it is best to give it, all over, two coats of clear or "Young's patent" size. These white portions are stopped in, and the size then cleaned off with warm water; when dry, the lightest stains are washed in, covered with varnish, and so on, until the complete design is covered in. The background of design is now stained and put in, perhaps as rosewood or walnut, and the varnish or balsam dissolved away, leaving the work sharp and clean for French polishing, or copal varnishing and hand polishing.

When executing such as the above, there is a natural tendency of the stain to spread beyond the confines of its portion. To remedy this, we may give the wood a preparatory coat of strong clear size, which partly fills the pores of the wood. In this case, however, the wood is not so properly stained. A better treatment, although a more tedious job, is to maintain an imitation inlay margin, or fine line, to the ornament. This can be either pure black or the white, unstained, colour of the wood. If the white line is desired, we paint this in with a fine sable pencil and Canada balsam before we lay in the washes of stain, which latter are then easily worked into their respective places. If a black margin is desired, we coat the surface all over (using a camel's-hair brush) with ivory-black and beer; when dry, paint in the outline with stopping varnish, and then clean all the black off with warm water.

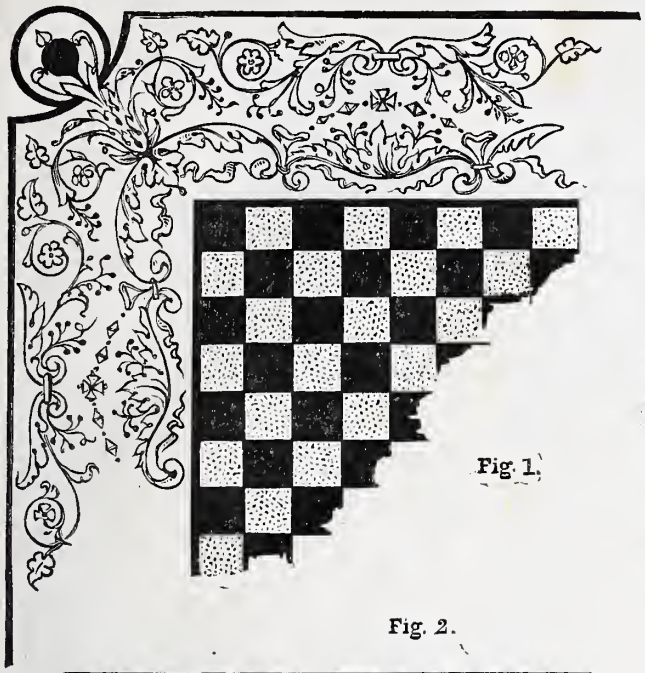


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

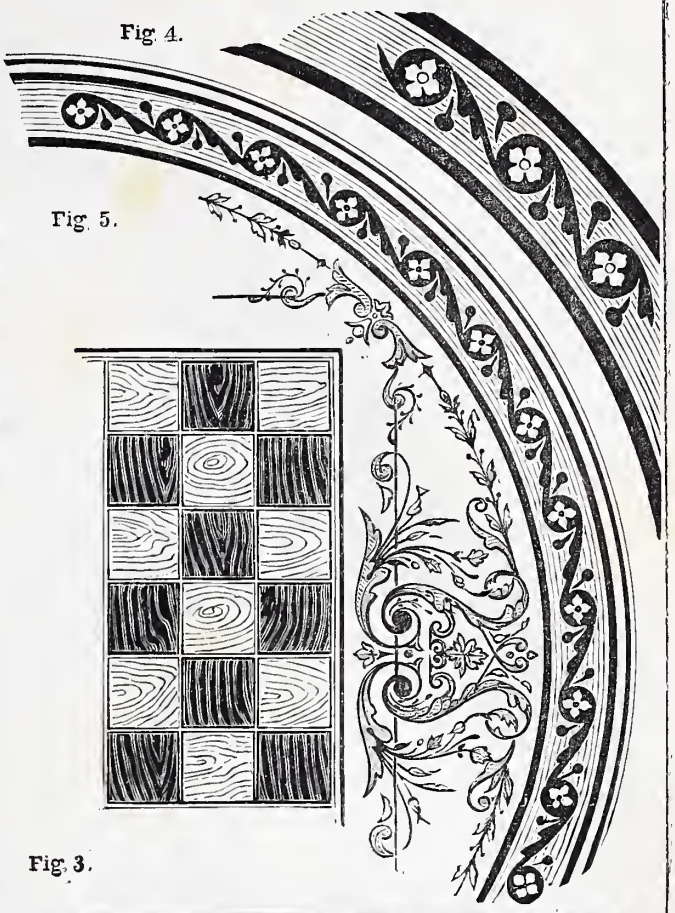


Fig. 9.

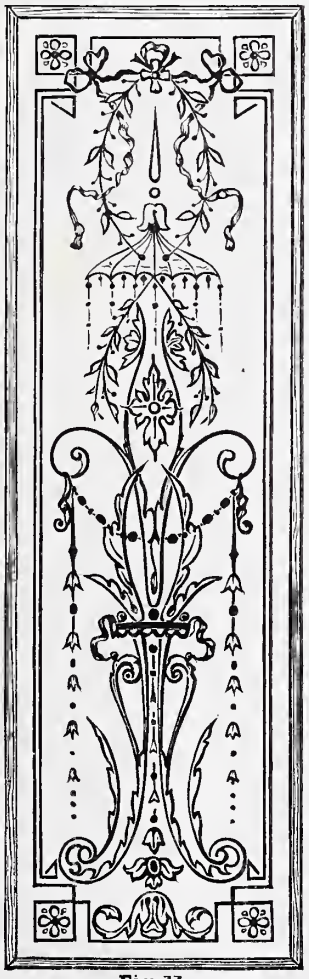


Fig. 11.

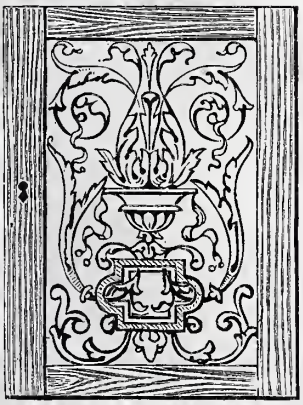


Fig. 10.

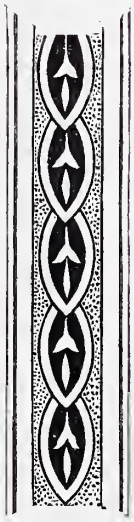


Fig. 8.

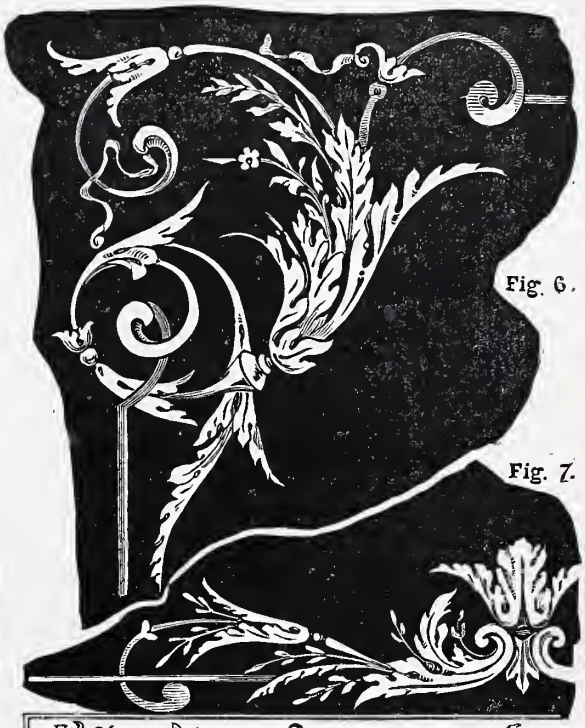


Fig. 6.

Fig. 7.

Fig. 12.

Fig. 1.—Card-Table Top (see WORK, No. 90). Fig. 2.—Suggestion for Drawer Fronts. Fig. 3.—Square Table Leg. Figs. 4 and 5.—Circular Card-Table Top. Figs. 6 and 7.—Corner and Break for Ivory on Ebony. Fig. 8.—Simple Border in Three Woods. Figs. 9 and 11.—Imitation Inlay as Applied to Finger-Plates. Fig. 10.—Bracket Panel. Fig. 12.—Drawer Front for Music Cabinet.

In both cases, it need hardly be said, the double coating of patent size must be temporarily used, and then removed after the outline is stopped in. Were this neglected, it would be impossible to entirely remove the superfluous black stain in the latter instance; whilst in the white outline the sizing prevents the varnish running, and enables a sharp clean pencil-line to be made. Imitation ivory is inlaid upon ebony in this manner also. The ivory ground is nicely got up and finished; the design is then stopped in, and the whole surface carefully coated with the beer-black. The solvent is finally very carefully applied over the design; and when the varnish is thus softened and removed, we have a solid white ivory ornament against ebony ground. The ornament may be hatched and finished by a very fine sable pencil, and fine black from the tube.

Turning now to the illustrations, Fig. 1 shows a suggestion for treating the card-table of Mr. Scott's invention (Vol. II., page 605). The imitation inlaying of the draught-board in ebony and boxwood would provide good practice, and be more attractive than black and white paint. The ornament might be in light harmonious tints upon rosewood or walnut. Fig. 2 is a simple suggestion for treating the drawer fronts and sides; whilst Fig. 3 could be applied to the straight table-legs. Figs. 4 and 5 are for a circular card-table top—the squares in satinwood and rosewood; the ornament surrounding it in light tints upon dark; but the border would be more effective with the order reversed, dark against light. Figs. 6 and 7 are corner and break ornaments for cabinet panels of inlaid ivory on ebony. Fig. 8 is an effective border for three woods. Fig. 9 is a somewhat Elizabethan design applied to a finger-plate. This and Fig. 11 are drawn about one-fourth full size. The former, in satinwood upon walnut or ebony, would make a nice finish on a grained door in satinwood or maple. Fig. 11 should be used on a dark door, and be executed in rosewood upon a light wood. Fig. 10 is an ornamental arrangement that could be easily adapted to the panels of a hanging bracket of similar proportion. Fig. 12 is an ornament for the fronts of a music cabinet; it would look well in either ivory or light harmonious tints upon walnut or rosewood of quiet grain.

All the treatments herein suggested can be modified or entirely rearranged to suit the individual worker. The fine lines should be either executed with a carriage-liner, or with a small artist's bevel-edged fitch. The designs require first careful drawing to the exact size, and then to be pounced or traced upon the ground. For good work, a thorough command of the pencil for outlining is absolutely necessary, since the least want of balance or symmetry in ornament of this Italian type would condemn the whole thing. The execution of these and much better designs should be possible to all who have followed my instructions; whilst any portion of the work requiring further explanation can be attended to in the invaluable columns of "Shop."

With this paper I bring my articles on the "Art of Graining" to a conclusion. I regret very much that the exigencies of space have in some cases prevented me from entering upon matters which are at all events indirectly if not directly connected with my subject, and in others have constrained me to abridge my remarks to a greater extent than I could have wished. I have the satisfaction, however, of knowing, that in no part have I been too diffuse.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any-one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

129.—SOME USEFUL BOOKS AND PAMPHLETS.

"Physique: A Journal of Physical Education."—This is the first number of a new journal dealing with domestic, school, and personal hygiene, gymnastics, athletics, games and sports, published monthly at 6d. by Messrs. George Bell and Sons, York Street, Covent Garden, London, W.C. It contains ably written and interesting papers on "Overcrowding in Towns and its Remedies," "Physical Sports of the Ancient World," "The Claims and Limitations of Physical Education in Schools," "A French View of English Athletics and Games," "A Training College for Teachers of Physical Education," and miscellaneous matter *à propos* to the aim and scope of the magazine, which is sufficiently indicated by the titles of the papers mentioned above.

"Photography in a Nutshell."—This summary of everything which it is desirable that a photographer should know in connection with the art that he practises is written by the "Kernel," and published at 1s. by Messrs. Iliffe & Son, 3, St. Bride Street, London, E.C. It is stated to be the result of personal experience, and modes of procedure gleaned and gathered from the practice of others. It is certainly marvellously comprehensive, and seems to deal with every point on which an amateur would require information. It contains some excellent prints, among which a view in North Wales, by the Woodburytype Company's new process, and a bit of rural scenery, "In the Thames Valley," a Kallitype print by a new printing process, invented by Professor Nicholls, and worked by Messrs. J. Lewis & Co., Birmingham, deserve special mention.

"The Art of Retouching."—This important procedure in the treatment of negatives before printing, with hints on portraiture and flash-light photography, is well dealt with by Mr. J. Hubert, photographer (Silver Medallist), 238, Mare Street, Hackney, in this nicely printed volume, which forms No. 6 of the "Amateur Photographer's Library," and is published by Messrs. Hazell, Watson & Viney, Limited, 1, Creed Lane, Ludgate Hill, London, E.C., at 1s. in stiff paper covers, and 1s. 3d. in limp cloth. The necessity for retouching negatives before printing is demonstrated to the eye of the reader by the frontispiece, which shows two prints, one from the negative not retouched, and the other from the same negative retouched, as practically and as forcibly—if not even more so—than the author's pertinent remarks on the subject.

"Evening Work for Amateur Photographers."—To judge from the number of books that are published on photography nowadays, it seems as if about half the people in the world were photographers and spent most of their time in photographing the other half, and all the choice bits of the world itself. This volume—nicely turned out in a serviceable scarlet livery by Messrs. Hazell, Watson & Viney, Limited, 1, Creed Lane, Ludgate Hill, London, E.C., at what price I am unable to say positively, but probably at 3s. 6d.—is from the pen and practical experience of Mr. T. C. Hepworth, F.C.S., Lecturer at the late Royal Polytechnic and Birkbeck Institutions, and author of "Photography for Amateurs" (Cassell and Co., Limited, 1s., or cloth 1s. 6d.) and "The Book of the Lantern," etc. etc. It is well and abundantly illustrated with camera and pencil by the author. The aim and scope of the book are chiefly to show how the amateur photographer may best employ the time that he can devote to the prosecution of his craft in the winter months, when outdoor work must be given up for a time by all but those who can encounter the rigour of the season in the open air. THE EDITOR.

SHOP:

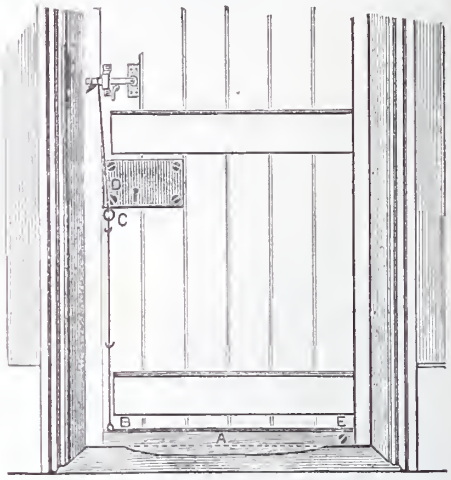
A CORNER FOR THOSE WHO WANT TO TALK IT.

**** In consequence of the great pressure upon the "Shop" columns of WORK, contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.

I.—LETTERS FROM CORRESPONDENTS.

Door Draught Board.—J. W. B. (*Birkdale*) writes:—"The attached is a sketch of a very simple contrivance which I am sure may prove very useful during this inclement season to many of your readers. Many stone door-steps, and especially backdoor steps, are liable to get worn hollow in the middle, thus causing very uncomfortable draughts along the floor. Landlords cannot always be persuaded to remedy such trifles, and the tenant has to resort to mats, etc., which, however, have to be removed each time the door is opened. I have had one in use now for about twelve months, and it answers the purpose admirably, and as to cost, I don't think it cost more than 3d.



Door Draught Board. Simple Contrivance for keeping out Cold Winds when the Step has worn hollow. A, Draught Board; B, Staple for Wire; C, Curtain Ring; D, Bolt-Head; E, Screw.

Get a rail, A, say of ½ in. board, cut to the exact shape of the hollow by scribing (I think the joiners call it), and fixed as in drawing by a screw at E, the other end of course, loose, but attached to a thin wire (such as they tie up flowers with). The wire ends with a curtain-ring, C. When the draught preventer is not needed, simply lift the ring on to the bolt-head, D. In this way the draught-board is raised clear of the floor, and causes no inconvenience. By continuing the connection with a piece of string to the latch-bar, it becomes self-acting, as by lifting the latch and holding it, you also lift the draught board. The upper portion is better made of string, as wire would be too much in the way—but wire should be employed for the lower, because it does not stretch."

Portable Carpentry.—EMIGRANT writes:—"I am about to start for distant lands, and shall leave much behind me, especially many articles of furniture which I have made from descriptions given in WORK. I regret now that all my articles were not upon the 'take to pieces' principle; and possibly it may be worth while to give the 'tip' to readers to go in for portable carpentry, and your writers might enlighten myself and others in respect to a few useful articles upon this principle."

Kettle Spouts.—R. A. (*Salisbury*) writes:—"I notice in 'Shop' (page 715, Vol. II.) a letter from a correspondent signing himself TOM, on the subject of kettle spouts. It is a pity that TOM should have made such a blunder as he has done. He says that a correspondent had pointed out (and rightly) the faulty way in which he had been told to make them. Now, the querist who made the first grumble about the matter, did *not* complain of 'the faulty way he had been told to make them,' but because he had not been told the way to make them at all. Next, the spouts that were inquired for were the ordinary common tea-kettle spouts, not the brazed and bent ones; and copper and brass spouts did not enter into the question. I will just say here that not one tinsmith in twenty could turn out a good finished spout of the description given by TOM *in iron*, and the very few who could do such a job would far rather

buy them at about 4d. each, than take two hours to make and tin one themselves. The last sentence in TOM'S epistle about being 'frilled in the lead, bent and planished,' is beyond my comprehension."

T-Squares.—J. T. B. (*Kirkham*) writes:—"A little additional information on the construction of

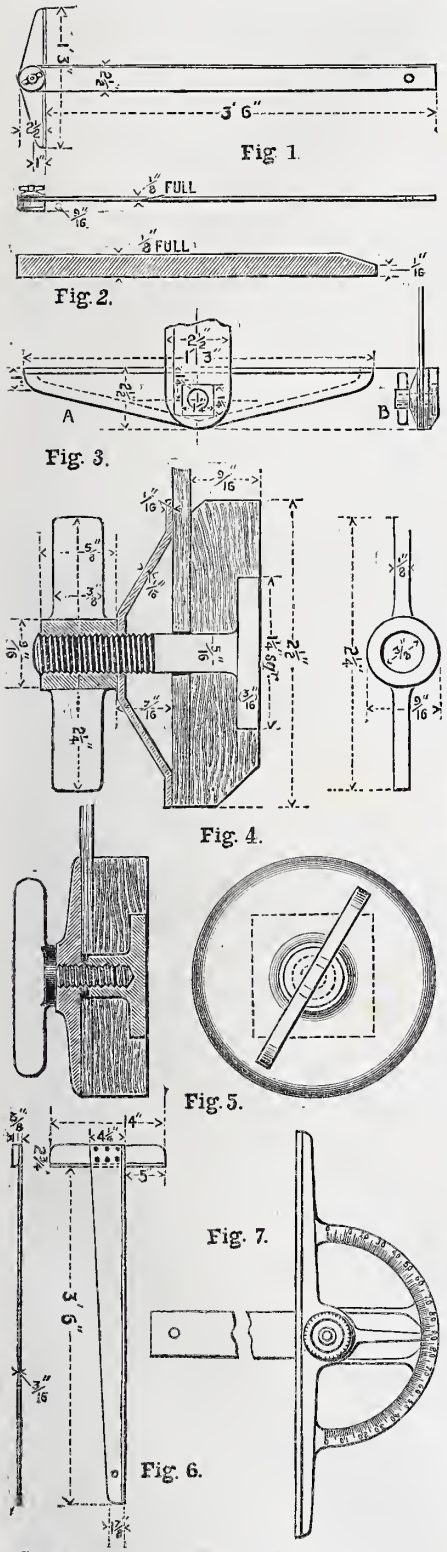


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

T-Square. Fig. 1.—General View. Fig. 2.—Cross Section of Blade. Fig. 3.—Stock, Blade, and Section. Fig. 4.—Wing-Nut. Fig. 5.—Lock. Fig. 6.—Taper Blade. Fig. 7.—American T-Square.

T-squares may be acceptable to many of your readers. I furnish drawing showing a very handy swivelling square, one of which I have used for many years, and much prefer to any fixed blade. Fig. 1 shows general dimensions; Fig. 2 shows cross section of blade; Fig. 3 plan of stock and blade, also cross section giving dimensions of brass-bolt cone washer and wing-nut (the stock, instead of being parallel in width, is cut down at the ends to save weight, and is also chamfered underneath for the fingers); Fig. 4, top view of wing-nut. Fig. 5 shows an alternative locking arrangement. It does not stand so high, but it cannot be so firmly tightened as Fig. 3. Apple or pear tree is excellent wood material for stock and blade. It may be urged as an objection to the swivel blade that, after using on the angle, it requires re-setting to a right angle. Now, as a rule, a draughtsman has his drawing-board with at least the left hand and bottom edges square, so that the blade can be re-adjusted instantly; or again, before angling the blade, he will rule a square line across his paper, to which he re-sets the blade. Where one has frequently to work on the angle, this style of square is very useful; the stock lies flush with top of board, and set-square can be worked over it. It is not so clumsy as the double shifting stock shown in Fig. 7, p. 625. Fig. 6 shows ordinary fixed taper blade and stock. Working edges of blade and stock may be lined with ebony or vulcanite to suit taste. Fig. 7 shows an American T-square with swivel blade and stock prepared for setting out angles up to 180 degrees. Sketch explains itself. Extreme length of head is 8½ in.; diameter of arc is 4½ in. divided to ½ degrees; blade, 1¼ in. wide; the heads are made of bronze, and the blades of steel. Price, with 30 in. blade, £3 7s. 6d.; ditto, with 36 in. blade, £3 12s. Darling, Brown & Sharp, of Providence, R. I., are the makers."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Dynamos and Motors.—J. E. W. (*Wolverhampton*).—Dynamo-electric machines will generate an electric current when driven by any motive power, or they will receive electric current from any other generator and convert a part of it into motive power. All dynamos may be used as electro-motors, but all are not equally efficient when used for this purpose, and the arrangement of brushes must be modified to fit any of them for electro-motive work. If current is sent through a dynamo, it will run backward against the brushes, and thus rough them. Some forms of motors are also provided with reversing levers attached to the brush rockers, and their general form is more compact than that of dynamos, although some makers have both of the same type. The peculiarity you notice in the F.M. cheeks is merely accidental or whimsical, and in no way distinguishes one from the other.—G. E. B.

Electrical Science.—YOUTHFUL ASPIRANT (*Kettering*).—There is no "vagueness about things electrical." They are as sure and as certain, and as amenable to laws, as those "problems based on the good old foot-pound system" you are in favour of. Respecting dynamos and motors, electricians know very well how much iron to put in the carcases of these machines. The F.M.'s must only be half saturated with magnetism. Soft malleable iron will take 2,500 ampères of current per square inch to saturate it—hence the F.M.'s are made massive enough to be only half-saturated when the maximum exciting current is passing through their coils. This determines their size and weight. The proportion between them and the armature should be as 7 to 1. The wire to be wound on both is determined by the voltage and volume of current required from the machine. As you have "Electricity in the Service of Man," and understand formulæ, kindly refer to pages 337, 338, and 339, where you will see this explained. You will also do well to read from page 326 on to page 334, and carefully study the formulæ and diagrams there. The voltage of a lamp is obtained by actual measurement. The resistance, the same, not by tables. "Dynamo-Electric Machinery," by S. P. Thompson, is a costly but good book on the subject. A cheaper, but very good little manual, is "Practical Dynamo-Building for Amateurs," by F. Walker. On pages 18 to 28 of this little book you will find formulæ for calculating the winding of dynamos. If you have a hundred or two pounds saved up, you may enter a school of electrical engineering, or bind yourself apprentice to an electrical engineer for three years. This will gain you an introduction to the branch you inquire about.—G. E. B.

Oil and Paint.—A. M. (*Birkenhead*).—The quantities of driers, oil, and turpentine required to make one cwt. of white lead to the consistency of paint, is a matter that must be varied according to the conditions of the work it is required for. In summer-time, one pound of good driers to fourteen of white lead is ample for out-door purposes; in winter-time, one in ten would be best. The quantity of oils required would be about one and a half gallons for the cwt. of lead. What proportions of linseed-oil and oil of turpentine it is advisable to use, depends entirely upon the purpose we intend it for. For full and practical instructions on this, which is beyond the scope of a "Shop" answer, see papers on "Plain and Decorative House-Painting" in WORK, Vol. I.—F. P.

Clock-Cleaning Articles.—J. T. (*Huddersfield*).—The first article on the above appeared in WORK, No. 98. There have been some papers on "Hints to Watch Wearers," and also many replies in "Shop" on "Watch and Clock Cleaning," which might prove useful to you. Refer to the Indexes of Vols. I. and II. (when ready) of WORK.

Inlaying.—T. W. (*Bradford*).—All the back numbers of WORK are in print, and obtainable of the publishers, Messrs. Cassell & Company, London, E.C. A reference to the Indexes of each volume will enlighten you as to what has appeared on inlaying.

Gutta-Percha.—T. G. S. (*High Wycombe*).—Try the India-Rubber, Gutta-Percha, and Telegraph Co., Limited, 100, Cannon Street, E.C.; or the North British Rubber Co., 57, Moorgate Street, E.C.; or the Victoria Rubber Co., 74 and 75, Fore Street, E.C., for the rubber you want for making small balls.

Electric Belt.—G. F. R. (*Woolwich*).—The most simple electric belt I am acquainted with is made in the following manner:—Get an ordinary body belt, made of canvas, webbing, or flannel: it matters not which material is employed. Next get some round pieces of sheet zinc, any thickness, the size of pennies—about a dozen or so—and an equal number of round pieces of sheet copper the same size. Punch or drill a few small holes around the rims of each zinc and copper disc, and sew them by means of these holes at equal distances on the belt, the zincs inside next the body, and the coppers outside. Now get some silk-covered braided fine copper wire, as used for the flexible cords of telephones, and connect the copper discs outside the belt with the zinc discs inside the belt, by soldering the end of a length of wire braid to a copper disc of one pair; then pass it through the belt, and solder the other end to the zinc plate of the *next* pair, and so on. Connect a zinc at one end and a copper at the other, with metal clasps on the belt to complete the circuit when the belt is put on. Cover the zinc plates with pads of thin flannel, to prevent chafing of the skin.—G. E. B.

Circular Saw Hammering.—H. S. O. (*Hammersmith, W.*).—I know of no book dealing with the whole art of saw hammering, but there is a work by Spon, in which saw hammering is briefly dealt with. I have had a little practice in saw hammering from it, and have information which I have gained of men at the trade. Perhaps the following may be of benefit to you and others. As a rule, circular saws in working become loose at and near the rim; consequently, the centre of saw is tight, which causes the saw to wobble; and even if it makes a true cut, it wastes more timber than is necessary. To get a saw-plate in the above condition true, the dog-head hammer should be used. Fig. 1 gives a rough sketch. It will be seen that the face of this hammer is a little convex, and that the handle should be at an angle of 80° or 85°. The blows

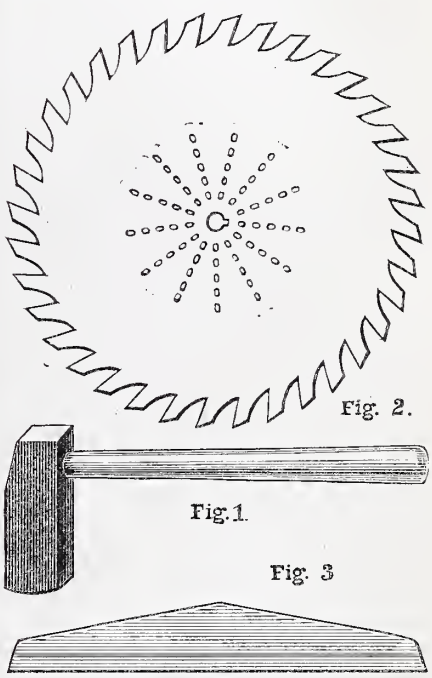


Fig. 2. Fig. 1. Fig. 3

Circular Saw Hammering Plate.

given should be on both sides of the saw-plate, and as indicated by the round marks in Fig. 2. It should be borne in mind that too much hammering should not be done before the straight-edge (Fig. 3) is placed on the plate to see if it is true; as soon as the plate is true with the straight-edge the hammering should cease. The force of blow given with the hammer should vary with the thickness of saws. A saw of stout gauge, of course, will require a heavier blow to have the same effect as on a thin saw; and before you commence to hammer see that your saw is properly bedded—that is, it should lay dead on the anvil.—A. R.

Thermometer.—E. N. (*Herne Hill*).—The subject, "How to Make a Thermometer," will, I have no doubt, find a place in the columns of WORK in due course, but, except a very brief outline indeed, it is much too important a one to be described in "Shop." I confess I never made a thermometer myself, and unless it should be my lot to be cast upon a desert island, I do not think I shall ever try.

At the present moment I have before me a very well made and accurate instrument of this sort, which registers the lowest degree of temperature reached during any given time, besides indicating the temperature of the surrounding air at the moment of inspection. For this thermometer I paid one shilling, therefore, to my mind, it is waste of time to attempt to make one. However, as you ask, and—from your query—seem determined to "have a try," I give you the substance of the best description I can lay hands on at present. Obtain a fine glass tube blown into a bulb at one end; heat the bulb, which will cause the air to expand, and then place the tube in a vessel of mercury, which, as the air cools, will rush in and take its place. It should be so managed that the mercury may stand at a convenient height in the tube at the common temperature. Heat is now applied to the mercury until the column rises to the top of the tube, which is then sealed by heating the glass to redness and closing. As the mercury cools, it falls in the tube, leaving a vacuum. The instrument is now complete as far as construction is concerned, but the great point to be gained is to provide the means of observing what it is doing. To accomplish this, the first step is to ascertain the exact height to which the mercury rises when heated to the temperature of boiling water. The next to observe its position at the freezing point of water. These points being determined and marked, either upon the tube itself or upon a piece of metal or wood, to which it is attached, the intervening space is to be graduated. In this country Fahrenheit's scale is recognised as the standard, in which the interval between the freezing and boiling points is divided into 180 equal parts, or degrees. The freezing point is numbered 32°. Boiling point is therefore 212°. Below the freezing point the degrees are carried to 0, which is called Zero; above the boiling point, they may be carried to any desired height within the limits of the particular instrument.—OPIFEX.

Silvering Glass for Fretwork.—GLASS.—I am pleased to give you instructions for silvering glass, as I know all amateurs like to do as much of an article as they can, but whether you will be able to produce looking-glasses for your frames *cheaper* than you can buy I very much question, taking failures and other things into consideration; however, here are two methods:—Procure a piece of glass the size required, and if it is large, see that it is a nice thick piece, and free from blemishes; cut a piece of tinfoil a little larger all round than the glass, lay upon a level board or table, and smooth out the tinfoil (a roller squeegee, such as is used in photography, answers admirably); pour mercury (quicksilver) over the foil until every part is covered. And now comes the question: What glass are you using, plate or crown? as the subsequent operations vary accordingly. You ask for directions for plate-glass, so we will proceed with that idea. Take your piece of plate-glass, which must be perfectly clean, as the slightest dirt or speck shows very plainly when silvered, and commencing at one end, slide the glass along the tinfoil, pushing out a great deal of the mercury, and taking all air-bubbles and dirt with it; when this is satisfactorily completed, weight the glass as much as possible, so as to force out as much of the mercury as you can, tilting the board or table-helps: let it remain under pressure for, say, a whole night, then tilt one end up, and allow it to remain a day or two longer, laying a piece of foil under the lowest end to draw off all the mercury. Supposing, however, you use a cheaper kind of glass, like crown, or for very small ones window-glass. When you have cut the foil and covered it with mercury, lay a piece of clean paper on the mercury, and the glass upon that; then take hold of the paper with one hand, and hold the glass firm with the other, and by a quick motion draw the paper from underneath; put pressure upon it, and let it lay as with the other glass, only remember it will not bear a heavy weight like plate-glass. There is another method used for common glasses. I give it so that you may try it if you wish; but I think you will like the tinfoil best. Get some nitrate of silver and some ammonia; add the silver gradually until a brown precipitate commences; now filter. Take a piece of glass, wash with water, lay on a table, and rub with a pad wetted with a solution of Rochelle salts (1 in 200 of water). Now take the silver solution, and for every 20 parts of silver add 16 parts of a solution of Rochelle salts; it will soon become turbid, when it must be poured all over the glass. Place in a temperature of about 70°. When sufficient silver has been deposited—which will be in about half an hour—pour off the rest of the solution, wash four or five times, and set up to dry. When dry, it is advisable to varnish the back.—W. E. D.

Glass Painting.—GLASS PAINTER.—We can give no opinion concerning the firm you mention. You should endeavour to get the car of some disinterested person who has been a pupil under similar conditions to your own.

Fire-Pump.—J. R. (*Helmshore*).—If the two pipes you speak of are coupled together as shown in your sketch, it would check the flow of water to a considerable extent. You must get a flanged tapering piece to run from 4 in. to 2 in.; this will improve the working.—R. A.

Cardboard Models.—G. FOLLENFANT writes:—"With reference to the paragraph in WORK, No. 96, p. 718, my correct address is G. Follenfant, 279, Cable Street, St. George's East, London, E. (near Shadwell Railway Station)."

Metal for Toys.—T. T. (*Birmingham*).—I cannot give you a receipt for any metal that will leave the moulds better than the ordinary alloys of tin and lead. I used at one time to cast my own kettle-knobs in brass moulds, and I never had them stick. You say you have blackleaded them, but to no purpose. Try them again by dipping them in the following solution:—Corrosive sublimate 1 oz., vinegar 1 pint; dissolve the corrosive sublimate in the vinegar (it will take some time to dissolve), then rinse the moulds through this solution and then well blacklead them; repeat the process, and I think you will find then that they will last for a long time without wanting to be done again, and that the metal will come out easily. Are you sure your moulds are not undercut anywhere?—R. A.

Banjo.—T. W. (*Hull*).—Your hoop being only 9 in. in diameter, let the bridge stand about 2½ in. from the extreme edge of hoop. Instructions for fretting a banjo have already been given, which, no doubt, you will have seen before this appears.—J. G. W.

Cases for WORK Volumes.—R. L. (*Edinburgh*).—These can be had of any bookseller, price 1s. 3d.

Tool Rack.—L. S. D. (*Brighton*).—First, as to the case. It must not be of a very great depth from the wall. By fixing the bottom board on the slope, instead of horizontally, odds and ends, such as pivots, rings, etc., could be stored therein without a possibility of falling out. Top board could conveniently be similarly treated. To prevent "interference" with tools, have one or two doors, a flap, or a sliding shutter or

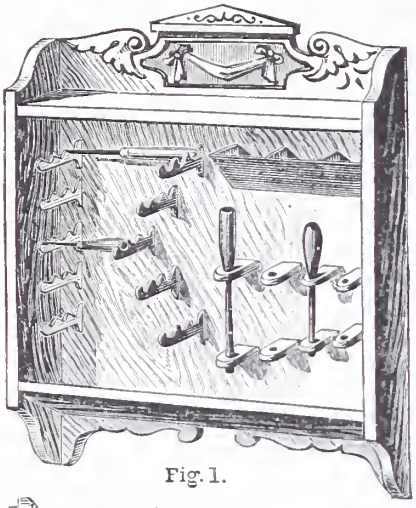


Fig. 1.

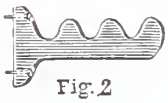


Fig. 2

Fig. 3.

Fig. 1.—Tool Rack. Fig. 2.—Left-hand Side Supporter. Fig. 3.—Right-hand Side Supporter.

board. Fit case solely with supporters shown at the left-hand side of the article. Chisels and gouges could then be laid in or taken out very easily. A side view of one supporter is delineated in Fig. 2. It will be advisable to have a long slanting board with an end and divisions, to form compartments for nails, screws, etc., at the right-hand upper half of the case.—J. S.

Tires to Bicycles.—H. R. W. (*Derby*).—I have to thank H.R.W. for informing me that I do not know how to put on a tire. It is about eleven years since I first began to fix on rubber tires on bicycle wheels. I have put on a good many up to now, and have the satisfaction of knowing that they are put on to stay. Strangely enough, the method your correspondent describes is the one I constantly use. When putting tires on old wheels for a newly-enamelled wheel, it is not allowable to have the cement ooze out by reheating, as it cannot be cleaned off neatly. My method to make a clean job is to revolve the rim, and heat up with a hot rod the bare rim; then to pour in the cement from a spouted ladle, evenly; then with the rod, only hot enough to spread the cement in the hollow without letting it come up over the edges. This done, I place the tire on as quickly as possible, stretching it the required amount, if any, and pressing it into the rim. This, if properly done, will be found to hold well, and requires no reheating with gas, which always, more or less, destroys the enamel, and no cement oozes out to be scraped off. With old wheels it does not matter how you go about it, provided you make them stick.—A. S. P.

Soldering for Goldsmiths.—TINKER asks for a chapter on the way goldsmiths solder their work. I will bear it in mind, and if it ever gets written he will find that there is not much difference in the actual soldering and the method he knows of brazing. The same flux, the same cleanliness, the same smokeless heat, are required, only more so. The differences are in the means taken to temporarily fix the work in position by means of loam, binding wire, gum dragon, etc. The heat also will have to be applied in various ways, and with regard to the different extent to which the various alloys expand, contract, and melt, as well as the thickness of the work. The ordinary blowpipe is used, and for large work one that is attached to bellows. Upon your suggestion I will make notes of the alterations in procedure in the different jobs as they arise at the shop. I have now something else in hand, and to write a companion chapter to Mr. Alexander's is impossible to me without a fair amount of consideration. Still, I thank you for writing as you have, for by letters such as yours one gets to know the subject more wished for. In the meanwhile, any particular thing you want to know I will try and answer. Do not try to solder anything without you are sure that the solder is of a suitable quality. It is with regard to the alloys of gold and of solder that such a paper will chiefly deal, I expect—not of the materials, for they are simple enough.—H. S. G.

Tool.—W. J. B. (*Bermondsey*).—Your sketch is altogether too rough for me to say positively what it is, but from your description it seems to be an arrangement for working a circular saw and drill from a lathe. As you know that the one you have was got at Bucks, why not call and ask them what the appliance is called?—D. D.

Picture Glass.—M. E. M. (*Heywood*).—Picture glass is superior to common window glass, which is only used for show-card purposes; quality of glass depends upon class of work it is for.—G. R.

Mitre Machine.—G. R. D. (*Shipley*).—Messrs. Powis, Bale & Co.'s address is Appold Street, Finsbury.

Lantern.—PATIENCE asks several questions in reference to the lantern he has, and one he proposes making. From description given, the condenser is a 3½ in. compound, though, if the sketch is correct, I can hardly make it out. Either of the sets of front lenses which he mentions I should judge will be suitable. As he says he can get a "good 15-feet picture" with it, I think the result with such a size condenser is all that could be expected. The only way to make the picture more brilliant with the present lantern is to procure a better lamp. The principal difficulty in the case of PATIENCE is that his first lenses are of such short focus, that he is compelled to come too near to the screen to be pleasant. His proposal to cut his ¾ in. front in two and connect them by a sliding tube so as to separate the lenses further to procure a longer focus is not at all feasible. I do not think he can adopt his present lenses. What I recommend is to procure a new front lens, stating to the optician what he requires. He further asks, "Will the same arrangement"—dividing the front, I presume—"answer in the camera for photographing a building when not able to get far enough away to get the whole of building in plate desired?" I should say, certainly not. To photograph buildings under such circumstances a special front is made, and such are advertised in most catalogues. As to the possibility of a lime jet being dangerous to the condenser, there is not much fear of that if the lantern is properly ventilated. Although the lime jet is intensely hot, yet it is but a comparative point, and cannot radiate nearly so much heat as a three or four wick lamp. Something, of course, depends on the length of focus in condenser; the shorter the focus, the nearer the light must be brought to it, consequently, the larger the amount of heat that falls upon it. See that the cell containing the condensers has a hole in it. The other condenser described is not of any use for lantern purposes, though it would be of service for an enlarging lantern.—O. B.

Engine Slack.—FITTER.—Your data are vague, as the evaporative value of engine slack varies considerably, and so does the efficiency of Lancashire boilers. However, I can make certain assumptions and show you the *method* of working out the question. I suppose the pressure, 60 lbs., is gauge pressure (above the atmosphere). We must find the quantity of steam discharged in twelve hours, and the quantity of water which must be evaporated to produce that amount of steam. Water evaporated at 60 lbs. pressure makes 381 times its volume of steam (see Tables of Steam in any Pocket Book), therefore the density of the steam compared with water is $\frac{1}{381}$. The area of a pipe ⅝ in. diameter is $\frac{17}{10000}$ of a square foot.—RULE. To find quantity of steam discharged per minute in cubic feet, divide pressure in lbs. per square inch by density of steam compared with water; multiply the square root of the quotient by area of outlet in square feet, and by 474. 60 lbs. pressure divided by $\frac{1}{381}$, is 60 multiplied by 381, which makes 22,860. The square root of this number is 151, and 151 multiplied by 474 makes 71,574, which, multiplied by 17 and divided by 10,000, gives 121⅔ cubic feet of steam per minute. This, multiplied by sixty minutes and twelve hours, gives 87,600 cubic feet of steam discharged in twelve hours. As one foot of water makes 381 feet of steam, 87,600 divided by 381 gives the quantity of water used 230 cubic feet; this, multiplied by 62½ lbs. (the weight of one cubic foot of water), gives 14,375 lbs. water evaporated in twelve hours. Divide this by the pounds of water evaporated by 1 lb. of fuel, and you have the consumption of fuel. Thus, if your slack will evaporate 6 lbs. water per pound of slack, the fuel consumed in evaporating 14,375 lbs. of water will be 2,396 lbs., or 1 ton 1 cwt. 1 qr. 14 lbs. You must know how much water 1 lb. of fuel will evaporate when burnt in your particular boiler to settle this question. I have assumed the pipe you blow off

through to be short, and have not allowed for friction in it.—F. C.

Waste Moulding with Wax.—J. H. (*Bristol*).—Some remarks on wax for this purpose will be found in No. 91 (p. 685, Vol. II.). Of course the thin inner mould only will be of wax, and the outer one of plaster. The surface of the clay model needs to be drier than for plaster moulding. Its tendency to shrink makes wax a more difficult material to mould in than plaster, but if he has patience for a few trials, we trust that J. H. will accomplish it successfully.—M. M.

Work on Dynamo.—J. C. D. (*Southport*).—Apply to the author of the book:—A. Crofts, 7, Clarendon Place, Dover.

Polish Reviver.—A. T. (*Burnley*).—I cannot state exactly the cause of your failure, as many reasons might be given. Perhaps you have lumped all the ingredients in together, or the polish may have something in it other than shellac and spirit, and so cause it to curdle. The mixture is commonly used, and, with suitable materials, there is no difficulty in making it. I am afraid something must have been wrong with one or other of those you used. If you find you cannot succeed after these hints, try plain methylated spirit instead of polish, or, if you prefer it, a little glaze. Some polishers add a little butter of antimony, but I am not much in favour of it.—D. D.

Finishing Rosewood.—PUCK.—Rosewood being naturally a dark wood, if you want to make anything of a light colour, you will have to use some other material. At the same time, rosewood is not generally black, though some of the darker markings may practically be so. Like other kinds of wood, there are varieties in the colourings of different logs, and you might select the lightest you can come across. If, when polishing, the oil is found to darken the wood more than you like, all that is necessary is to omit the oiling. Use white polish on rosewood. Certainly methylated spirit is better than naphtha to make polish with, otherwise, it would not have been recommended. Naphtha may be used if you prefer it, but ordinarily there are strong objections to it. It was formerly employed to a great extent, but has now been almost, if not entirely, abandoned in favour of methylated spirit. I have never known of its being used—*i.e.*, it has never come within my personal experience, but I have heard old polishers speak very strongly against it. The smell alone is enough to prevent anyone using it if he can get something less unpleasant.—D. D.

Finishing Mahogany.—G. W. (*Blackburn*).—A good many hints have been given in "Shop." You cannot do better than read them. The wood being as smooth and well finished off as possible, if you desire to enrich or darken its colour, go over it with raw linseed oil, applied with a rag. Do not saturate the wood with the oil. After oiling, let the job stand for a time and then fill in the grain. There are many kinds of fillers, but I should recommend you to use one of whiting made into a thin paste with water, turpentine, or spirits, and tinted with rose-pink. Rub this mixture well into the wood and clean off any excess before it gets hard. When the wood is perfectly dry, body up with French polish, applied with a rubber, after having smoothed down any roughness with finest glass paper, if necessary. When bodying up, be careful not to use too much polish at a time on the rubber. The first coating will very probably be found to have sunk after a few hours, so repeat the operation as often as may be necessary, but be careful not to get too thick a coating of the shellac. The final operation is spiriting off by means of a rubber moistened with methylated spirit instead of with polish. The effect of this is to remove the hitherto dull and smeared appearance of the surface, and to produce the fine gloss which ought to characterise French polish. To get the best results is by no means easy. It is, in fact, almost impossible without some practice, so you will be wise not to make your first attempts on anything you value.—D. D.

Batteries for Electric Lighting.—F. E. G. (*Norwich*).—(1) The zinc plates in a single fluid chromic acid or bichromate of potash battery should be removed when the battery is not at work, to prevent waste of zinc. The powerful acids in this form of battery will undermine the coat of mercury, and attack the zinc beneath, if the plates are left in the solution. As you wish to leave the zincs in ready-charged cells, so as to only switch on the lamps when required, you must employ a double fluid bi-celled battery, such as the Fuller or the Granule types. In these the zincs are placed in the porous cells charged with dilute sulphuric acid, sulphate of zinc solution, or chloride of zinc solution, and the carbons only in the chromic acid or bichromate solution. As the internal resistance of these is greater than that of the single fluid battery, more cells must be employed to light up the lamps. (2) I do not know the "Edgware Battery," so cannot give you compared results. (3) The voltage and candle-power of a lamp may be guessed by noting the thickness and length of its carbon filament. A thick filament may have a low voltage, so also may a short filament, whilst long and thin ones have generally a high voltage. You may roughly determine the voltage by actual experiment with a bichromate battery. Estimate each cell as giving two volts, and add cells until the lamp gives out a white light. But the correct value can only be determined by a voltmeter and a photometer. (4) It is not necessary to make the battery box of pine, teak, or mahogany. These are most durable for the purpose, but the box may be made of any other kind of wood. (5) The cells of a Leclanché battery may be filled with solution, but the tops of the porous cells must stand above the solution to allow free escape of gases formed in working. The rule you quote from Gunot's "Physics," errs on the side of extreme efficiency. (6) No porous cell is used or required with the agglomerate form of the Leclanché. No apology needed. Always glad to assist correspondents with advice.—G. E. B.

Overmantel.—CAPUT NIGER.—If the proportions of this drawing are considered satisfactory, you will find that the dimensions given to accommodate it upon a 4 foot 6 in. mantelpiece will be an almost exactly proportionate enlargement, as I have drawn the sketch to scale. Height of room will have an influence upon its appearance. I have allowed sufficient space for your lustre-shades, which you say are 19 in. high. My notes to IMPROVER (Vol. II., No. 80, page 457) will apply in some respects to the construction of the framework of the present overmantel. Top column blocks could run up through clear mortices in moulded top shelf, the parts showing above said shelf being in an entirety with those

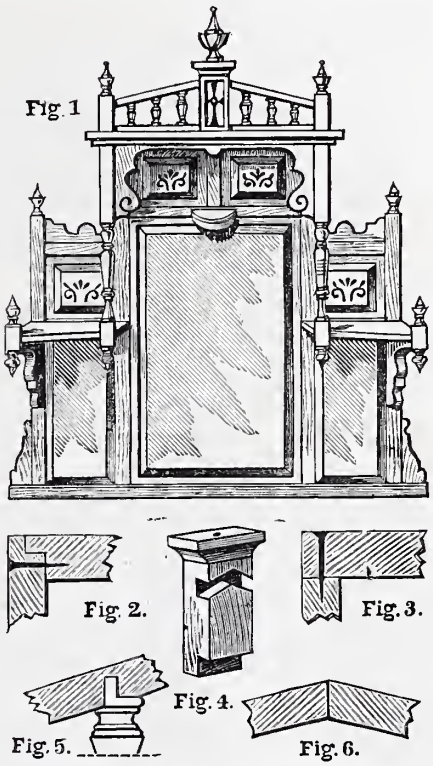


Fig. 1.—Overmantel. Figs. 2 and 3.—Methods of screwing Canopy Shelf to Framework. Fig. 4.—Back View of Top Block. Fig. 5.—How to join Spindles. Fig. 6.—Union of Top Spindle-Rails.

below it respectively. This shelf might be screwed to framework, either as shown in Fig. 2 or as in Fig. 3, shaping it at back corners to permit it to fit round framing properly. Extreme top spindle-rails would be joined to side blocks by morticing and tenoning; while to middle block they would be united by shaping block as in Fig. 4 (back view). Lower rail in connection with these spindles would be similarly treated at side blocks, and would run through middle block. This would bring face of middle block flush with extreme front of moulding on top shelf. Fix spindles as in Fig. 5. Return the spindle gallery in a straight manner at sides, the longer rails of back framework being carried above remainder to allow this to be done. Dowelling or screwing the pillar blocks will answer. Height to top of top shelf, 4 ft. 4 in.; height to top of side rails, 34 in.; height to top of side shelves, 25 in.; height to top of top block, 5 ft.

Coach-Building Books.—YOUNG WHEELER.—I am not aware of any books being in print upon Coach Building or Wheeling. The information found in monthly papers devoted to the trade contains only essays upon the subject, which, if you have a little knowledge of coach building and wheeling, would, I have no doubt, be found to be very useful to you. Follow "Shop" pages for much on this subject.—W. P.

Lamp Design.—TAH (*Whitstable*).—A lamp such as you describe, if fixed a distance of 3 ft. or 3½ ft. from the glass, would concentrate its rays on only a small portion of the window, leaving the rest in darkness. If this is really what you require, I shall be pleased to assist you in constructing it, if you will send dimensions.—J. W.

Camera Articles.—CAMERA.—An article on the above appeared in WORK, No. 13, and can be had from the publishers, post free, for 1½d.

Polish.—W. E. (*Heckmondwike*).—Your letter is interesting, as indicating a possible improvement in the method of French polishing, but I am sorry to say that very few of the discoveries which are brought out from time to time are of any practical value. I do not say this to discourage you, but I must confess that it is difficult to realise that a French polished surface of the best quality can be got by using anything which does its own spiriting off. If I understand you rightly, the bodying-up and spiriting off are done in one operation, or, to put it in other words, that by your medium being used spiriting off afterwards is unnecessary. If you can really get a fine polish up without spiriting off, which is such a troublesome operation with beginners, your invention will be a boon to amateurs at least, and I fancy many professional polishers would be glad to hear of your mixture. In the interest of these and others, there can be no objection to testing the tin which you suggest sending. I would also suggest that you send with it a small piece of wood, which you could enclose in an ordinary letter, in order that an opinion of its appearance may be formed, as it is assumed that, as with every new material, the best results are not got without some practice. This you have doubtless had. You might also say, as you do not know whether work done by your method will stand, how long it is since you discovered the process.—D. D.

Hand Beader.—R. H. W. (*Lewisham*).—The action of the irons is rather of a scraping than a cutting kind. If you begin with moderate pressure the beads should not require much, if any, papering to smooth them. They certainly should not be torn and chipped out; if you get them so, the fault is either in the tool or in your manipulation of it. It is hardly likely to be the former, and I think your best plan would be to get someone to show you how to use it. If you cannot do this, just imagine the tool to be a cutting gauge, and work it as you would this tool, not attempting to form the beads at the first stroke. With a little attention you should soon get over the difficulties which you are sure to find with a new tool. The proper slope at which to fix a cutting-board for inlaying purposes depends entirely on the thickness of saws and wood. All you want a slope for is to enable you to saw upright, making sufficient allowance for the saw-kerf.—D. D.

Leather.—A. F. W. (*Oldham*).—I do not know of any use to which you could put a large quantity of leather such as the sample you enclose, and I am equally unable to tell you of a market for it. Suppose you were to try a dealer in old clothes or a marine store dealer. I understand they will buy any rubbish if it is only cheap enough.—D. D.

Fret Tower.—J. W. McG. (*Manchester*).—I am afraid the breakage of the tenon (A) in your design when put in the mortice (B) can only be attributed to want of skill or clumsy handling. Possibly there may have been a flaw in the wood, but I am inclined to think that you must have had the grain running across the tenon instead of the reverse way. Of course, in that case you could not expect the tenon to stand, but otherwise it ought to have been strong enough to hold with fair usage. Now that you have broken the tenons off, your best plan will be to fasten the pieces together with smaller strips or blocks of wood, glued along inside the inner angles. Unless they are too big, they will not be visible from the outside. Even with the tenons it would have tended to stiffen the joints by using blocks. Glue may also be used along the edges, as well as small wire nails and needle points. You ask for the best way how to proceed with your work, but as you do not name any difficulties but the one referred to above, I am afraid I cannot help you further at present.—D. D.

Fret Monogram.—T. W. A. (*East Dulwich*).—You will find no difficulty in making a monogram if you trace each letter on a piece of ordinary tracing-paper. If you want fancy letters for fret-cutting, you might find those published by Messrs. H. Zilles & Co., Wilson Street, Finsbury, E.C., of use to you.—D. D.

Upholsterer.—YOUNGSTER.—There is no way of treating hair seating so that seats covered with it can be buttoned deep, as in morocco. All you can do is to slightly indent or tuft. Without saying that it cannot be done at all, it is impossible to do what you want satisfactorily. All in good time for the other subject; everything cannot be given at once.—D. D.

Terra-Cotta Cleaning.—HUNTSMAN.—To clean your terra-cotta plaque, make a fairly thick mixture of starch and water. Cover the place with this. When the starch dries it will crack, and be easily removable. The dirt will have been removed along with it.—D. D.

Patterns on Plush.—H. K. (*Stamford Hill*).—The dotted appearance of the designs is owing to their having been transferred by pouncing through a perforated design. There is a machine for perforating the designs, but it is a costly affair, and the usual plan is to prick the holes through the paper with a pin, or something similar.—D. D.

Bell Telephone.—DISTANCEPHONE.—The patents for above have expired, and you can now buy and use them at pleasure. You will get them at any electrical store. They are being very much advertised at present. You should always send name and address with your queries.—W. D.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Horse Hair.—G. J. W. (*Ballymena*) will be much obliged to any reader who will name any firm of whom he could purchase a small quantity of hair cloth for chair covers.

Cardboard.—HECTOR will be obliged for any instructions for making a machine for cutting cardboard.

Firewood Wire.—J. R. (*Belfast*) writes:—"Would a reader kindly describe how the resin-dipped firewood, sold in London, is tied by wire? Are the wire ties better than cord or twine? Who sells the wire, and the price?"

Watch Parts Stamping Machine.—NO FAD writes:—"What kind and weight of press is used to cut the largest plates in watches? A few lines will do for me, as I am somewhat accustomed to the machine shop."

Transfer Pictures.—W. H. F. (*Glasgow*) writes:—"Will any of our kind readers give me the name and address where I could obtain some good transfer coloured pictures for transferring on wood, china, etc. etc.?"

Tin Labels.—LABEL writes:—"Will any reader inform me where I could obtain circular pieces of tin or zinc stamped with holes at the top and bottom for stitches in sewing the labels on sacks? The labels to be had at Berwick-on-Tweed have to be hand-cut and hand-stamped, and their appearance is far from being neat, besides being probably more expensive than if they were cut and stamped with a press. The name of a firm likely to supply the above would oblige."

Sharpening Scissors, etc.—H. F. (*Ramsbottom*) writes:—"Will any of our readers kindly describe the best mode of sharpening scissors, etc.? Or, if there is any special machinery, I should be glad to know the maker's name of same."

Paper Pulp.—W. S. (*Highbury*) writes:—"Can anyone oblige by telling me how to turn paper into pulp, and how to turn the pulp into papier-maché articles, etc.?"

Iron Lasts.—W. S. (*Highbury*) writes:—"Can anyone give address of iron last sellers (in London), and how bought, if by weight or pair?"

Catgut.—A WORKONIAN will be thankful to be informed *how clock gut* is made, with all the various processes it has to go through—such as bleaching and twisting.

Draw-Knife.—W. W. M. (*Glasgow*) writes:—"I would be very much obliged to any reader who could let me know through 'Shop' where I could purchase an instrument called 'Perkin's draw-knife and chamfer gauge,' and if possible, the price."

Milk-Float.—CYMRO will be obliged to any correspondent who will give him a design for a milk-float to suit a large pony or small horse.

Oil-Paper.—W. K. (*Congleton*) will be very glad of a recipe for making oil-paper for packing blacking in.

Indiarubber Type.—'09 writes:—"Will any reader inform me through 'Shop' how to fix india-rubber type (without metal) on a silk ribbon, or give me the address of any firm to whom I could apply?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Dynamo.—G. E. B. (*Lewisham, S.E.*) writes:—"If F. S. (*Normanton*) reads carefully the articles on 'Model Electric Lights,' in Nos. 92, 94, 97, 99, Vol. II. of WORK, I think he will learn how to make a small dynamo. He should have stated the candle-power of the lights desired, and also the horse-power of the motor he has made."

Electricity Classes.—G. E. B. (*Lewisham, S.E.*) writes:—"Write to the secretary of the City and Guilds of London Institute, and ask his advice, at the same time stating that you are an apprentice and cannot afford a high fee."

Window Cleaning.—G. E. B. (*Lewisham, S.E.*) writes:—"Either CHEMICAL or the printer has made a mistake in recommending hydrochloric acid for window cleaning on page 766. The properties ascribed by CHEMICAL to hydrochloric acid are precisely those possessed by hydrofluoric acid. I should hesitate to recommend either acid for the purpose, because of their injurious effect on finger-nails."

Band-Saw Machine.—M. (*Bishop Auckland*) writes, in reply to J. H. (*Sheffield*) (see page 765, Vol. II.):—"You can get a foot-power band-sawing machine from Chas. Churchill & Co., 21, Cross Street, Finsbury, E.C. I believe the price is about £8, but you had better write for particulars."

Joiners' Bits.—A. R. (*Scorrier*) writes, in reply to A. A. W. (*Leicester*) (see page 734, Vol. II.):—"The following will be the names of joiners' bits:—(1) Centre-bit; useful for boring large or small holes. (2) Countersink-bit, of which there are three kinds: there are the rose-head, the snail-horn, and the flat-head. These bits are used for reaming the entrance of holes, so that the head of screw may be below the surface of the wood. (3) Taper-bit, for boring funnel-shaped holes. (4) Sash-bit. (5) Nose-bit. (6) Shell-bit, used for boring small holes for pins, nails, etc. (7) Spoon-bit; useful for boring holes in the end grain. (8) Bobbin-bit, for boring bobbins. (9) Gimlet-bit. (10) Dowling-bit. And there is a half-round; also the square rinder for reaming the holes, should they be required a little larger. I am not acquainted with bits by the name you mention."

Preparation for Blackboards.—A. R. (*Scorrier*) writes, in reply to A. J. L. (*Paddington*) (see page 718, Vol. II.):—"The following receipts will answer your purpose:—(1) To make two quarts of paint for blackboard, take 5 oz. of pulverised and sifted pumice, 3 oz. powdered rotten-stone, ½ lb. of good lampblack, mix with alcohol, to form a thick paste; rub all, or rather grind all, together, then in the remainder of the two quarts of alcohol dissolve 7 oz. of shellac by agitation, after which mix with this the paste. Apply to the board with brush, not forgetting to well stir the paint, the first coat to be well dried before the second is put on. (2) Lampblack and flour of emery mixed with spirit varnish, the thinner the mixture the better; the lampblack should be first ground with a small quantity of alcohol to free it from limps; apply with a paint brush. (3) Wash for blackboard: four pints 95 per cent. alcohol, 8 oz. shellac, 12 dr. lampblack, 20 dr. ultramarine blue, 4 oz. powdered rotten-stone, and 6 oz. powdered pumice. To apply the above the surface must be smooth and free from grease; shake the bottle well, pour into a pot or dish; and apply with a flat brush as quickly as possible; be sure to keep the bottle well corked, and well shake it each time before using it."

Illuminating.—C. P. W. (*London, E.*) writes to GILT (see page 601, Vol. II.):—"Why does GILT use gold leaf at all, when at best it is a somewhat tedious and messy process in the hands of an amateur? I always use the ordinary gold paint, which is sold in mussel-shells and saucers. This keeps its colour, and is susceptible of taking a good surface by burnishing, which is done by placing a piece of highly glazed writing-paper over the portion to be operated upon, and well rubbing it with an agate burnisher. Should GILT, however, still prefer the gold-leaf method, water gold size for the purpose can be procured of Messrs. Barnard and Co., Oxford Street, or Messrs. G. Rowney & Co., Rathbone Place, W., where he could obtain also the agate burnisher."

Cardboard Models.—A. M. (*Glasgow*) writes, in answer to J. F. (*Mullingar*):—"If you write to Messrs. Crosby Lockwood & Co., for 'The Art of Architectural Modelling in Paper,' by T. A. Richardson, you will get many hints as to model making. It deals principally with model houses, but no doubt the instructions could be followed out in other articles. The book is one of Weale's Technical Series, and its price is, I believe, about 1s. 6d."

Brick and Marble Tesseræ.—M. (*Bishop Auckland*) writes, in reply to R. E. (*Kensington*) (see page 669, Vol. II.):—"Try Cappello & Co., 32, Euston Square; Dispoker & Co., 40, Holborn Viaduct; W. B. Simpson & Sons, 100, St. Martin's Lane, W.C., London; or James Nelson, Junction Street, Carlisle."

Band and Circular Sawing Prices.—A. R. (*Scorrier*) writes, in reply to E. E. W. (*Bushey*) (see page 650, Vol. II.):—"You want to know how to charge for work done by the above for wheelwrights, builders, etc. Felloes are charged at 3s. 6d. upward per dozen, shafts from 4s. 6d. per pair, trap wings from 1s. 9d. per pair; brackets, etc., that require extra labour and time, the timber often is charged, then the time taken in sawing charged, or so much each. Circular sawing at the rate of 2s. 6d. per 100 ft. for soft wood; hard wood about double that of soft wood. Staves at so much per mill; a mill measures 10 ft. long and 40 staves high."

Rabbit Skins.—W. H. M. (*Preston*) writes, in reply to IDEM SONANTIA (see page 634, Vol. II.):—"You can cure rabbit skins in the following manner:—The skins should be quite fresh. Remove all 'meat,' fat, etc., and stretch on a board with tacks or pins fur side down. Wash over with strong solution of alum dissolved in hot water, rubbing it into the skin with a piece of rag or sponge tied on the end of a stick. This should be done twice a day for, say, four days, and then the skin should be dried thoroughly in a warm place, as before a fire. Next remove from the board, and rub between the knuckles of both hands and round the handle of a drawer or through a smooth ring, and the skin will become soft and pliable. The fur on rabbit skins is in best condition in winter time."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—BLOCKHEAD; MECHANIC; W. G. (*Edinburgh*); BOVRIL; E. H. (*Bethnal Green*); T. H. C. (*Manchester*); FACTS ON; JEWELLER; REX; W. E. D. (*King's Lynn*); G. B. (*London, N.W.*); CHICKS; C. M. (*Perth*); S. H. (*Walsall*); F. G. B.; J. P. (*Bethnal Green*); H. C. (*Norwich*); F. G. (*Leicester*); W. G. (*Erith*); ONE WHO GETS GOOD TIPS FROM "WORK"; A CONSTANT READER OF "WORK"; F. C. R. (*Liverpool*); NERO; W. G. (*Southport*); HAMMER AND DRIVER; TEAK; COCKER; ELEVEN; G. B. (*Dublin*); DUBLINIENSIS; J. W. H. S. (*Sheffield*); C. W. B. (*Plymouth*); GALA; KENT COAST; H. C. (*Lee, S.E.*); L. K. (*London, S.E.*); P. B. C. & Co. (*London, S.E.*); H. W. (*Notting Hill*); A WEEKLY READER; H. M. W. (*Blackpool*); A. P. S. (*Heaton*); A. E. S. (*Glasgow*); H. F. M. (*Manchester*); W. J. (*Cardiff*); J. J. A. (*Wandsworth*); L. C. (*London*); H. H. (*Cambridge*); NOVICE; A. R. T. (*Tottenham*); J. (*Portsmouth*); A YOUNG WORKMAN IN TROUBLE; G. A. (*Liverpool*); G. P. (*Elgin*); J. G. (*Aberdeen*); A. J. K. (*Sheerness*); J. M. (*Manchester*); S. M. (*Camden Town*); A. R. (*Scorrier Saw Mills*); W. D. H. (*Edinburgh*); W. J. W. (*Leytonstone*); W. H. W. (*Dublin*); VOLTAGE; W. S. (*Rugby*); H. E. (*London, N.W.*); G. A. R. (*Kennington*); K. M. (*Partick*); ANXIOUS; H. F.; T. H. F. (*Cornwall*); J. N. B. (*Liverpool*); TRICHORD; R. E. F. (*Chingford*); A. G. F. (*High Wycombe*); ANTONIO; J. B. (*Lancashire*) ORGAN BUILDER; CARO; COMPO; G. F. (*Sunderland*); J. W. B. (*Huddersfield*); F. S. (*London, W.*); A. V. H. D. (*Holloway, N.*)

"WORK" EXHIBITION PRIZE DISTRIBUTION.

ARRANGEMENTS are being made for holding a Meeting, at which Prizes, Medals, and Certificates will be presented. Full particulars will be announced in an early number of WORK.

Price **3d.**; post free, **4d.**

"WORK" SPECIAL EXHIBITION NUMBER.

Containing an **Illustrated Descriptive Account** of the most remarkable Exhibits.

"No one interested in the 'Work' Exhibition should fail to secure the 'Special Exhibition Number' of WORK, which Messrs. Cassell have issued at the cost of 3d. The articles, on a variety of cognate subjects, are especially valuable."—*Literary World.*

NOTICE.

Numerous applications having reached the publishers for the

"WORK" EXHIBITION OFFICIAL CATALOGUE,

they beg to say that a few copies can still be had, price 2d. each; or post free, 2½d.

CASSELL & COMPANY, *Ludgate Hill, London.*

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	6	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—TAYLOR'S Fretwork Manufactory, Blackpool. [14 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—WILLCOX BROTHERS, 172, Blackfriars Road, London, S.E.

Forty Fretwork Designs, 7d., free.—TAYLOR'S FRETWORKERIES, Blackpool. [15 R

Lettering and Sign-Writing made Easy.—Also full-size diagrams for marking out eight alphabets, only 1s.—F. COULTHARD, Terrace Road, Bournemouth. Note.—100 Decorators' Stencils (60 large sheets), 2s. 6d.

Fret, Carving, and Repousse Patterns.—100 of either, full-size, 1s.; 300 Turning designs, 1s.; 400 small Stencils, 1s.; 500 Shields, Monograms, &c., 1s., post-age free.—F. COULTHARD, Terrace Rd., Bournemouth.

Tools of every description at CLARKE'S, 165, Fore Street, Exeter. New illustrated catalogue, 1 stamp. [17 R

Gas-Engine Castings and Drawings from ¾-man to 1 h.-p.—ENGINEERING SUPPLY CO., Bridge St., Deansgate, Manchester. [1 S

Valuable Bargain.—Fine mellow-toned Violin in perfect preservation; suit lady or gentleman for orchestral or solo playing; complete with bow, baize-lined case, and accessories; take 15s. 6d. for the lot; violin alone worth double; money willingly returned if not approved. A quantity of unsoiled music useless to advertiser will be given in free.—GRAHAM, College Buildings, Ipswich. [2 S

Small Handy Lathe.—Metal bed, pulley, head-stock, poppet, T-rest; wood frame; price £2 10s.—HEATH, 195, Algernon Road, Lewisham. [5 S

A WONDERFUL MEDICINE.

BEECHAM'S PILLS

Are universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, and all Nervous and Trembling Sensations, &c. &c. The first dose will give relief in twenty minutes. This is no fiction, for they have done it in countless cases. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

Worth a Guinea a Box.

FOR FEMALES THESE PILLS ARE

"A priceless boon, a treasure more than wealth; the banisher of pain, the key to health."

These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the nervous and debilitated is,

BEECHAM'S PILLS have the Largest Sale of any Patent Medicine in the World.

Prepared only by the Proprietor, T. BEECHAM, St. Helen's, Lancashire, in Boxes 9½d., 1s. 1½d., and 2s. 9d. each. Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box.*

THE MOST USEFUL STUDY TO TAKE UP.

THE NEW SHORTHAND

7th Edition now Ready, price 2s. 1d.

Had any one predicted that a system of Shorthand would be invented so extremely simple that it could be learnt in one-fiftieth part of the time occupied by any other system in vogue, ninety-nine people out of a hundred would have declared it to be impossible. Nevertheless, such a system *has* been invented, and it is known as **"THE NEW SHORTHAND."** A thorough knowledge of the *easiest* of the old systems will occupy at least a year, whereas THE NEW SHORTHAND can be

Easily Learnt in a Week

by any one of ordinary ability, with two hours' practice per day. The reason why **"THE NEW SHORTHAND"** is so simple is that it is based on an entirely different principle from all other systems, which principle is so remarkably plain and clear that the only wonder is that it has never been thought of before.

To every one engaged in professional or mercantile pursuits, and to all Public Speakers, Clergymen, Literary Workers, Students, Type-Writers, etc., knowledge of Shorthand is nowadays of the highest importance, and has been truly said to be

Well Worth £100,

and now that it can be so readily acquired there ought not to be a single person, either man, woman, or youth, in the whole country in need of such a valuable accomplishment.

The Newspaper Press

are unanimous in their praise, and a host of other high-class journals, far too numerous to mention, recommend it in the most glowing terms, some of them even going so far as to prophesy that in a very short time it will entirely

Eclipse all other Systems,

and be the only one in general use. Even papers devoted to other systems (which might well have been expected to be prejudiced) cannot help recognising the merits of **THE NEW SHORTHAND.** *The Phonographer, The Phonographic Reporter, Phonographic Quarterly Review,* and *Phonographic Notes and Queries,* all give long articles respecting the new system, and speak of it in the highest possible terms; while even the *Phonetic Journal* itself prints a long discussion on its merits.

No Teacher is Required,

it being so easy that no assistance whatever is necessary in learning it.

Writers of Pitman's, Odell's, Gurney's, or any other of the older systems, should not fail to also learn the New Shorthand. It is specially valuable to Reporters and writers for the Press, as *no transcriptions are necessary,* it being so simple that almost all compositors will, in a little time, be able to read it.

Every Lady

should learn it, as an invaluable aid towards securing positions where a good salary is obtainable. It is rapidly becoming fashionable for correspondence to be written in this system.

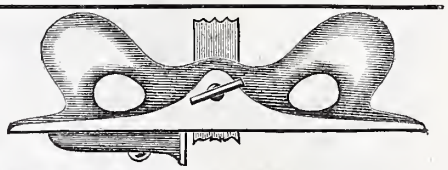
Price, complete in two books, post free, **2s. 1d.**

SPECIAL NOTICE.

The Sole Copyright of this valuable system has been secured by W. Ritchie, Maple Road, Anerley, London, S.E., and the books can only be obtained direct from him.

To be obtained from **W. RITCHIE & CO., MAPLE ROAD, ANERLEY, LONDON, S.E.**

When ordering, please mention WORK.

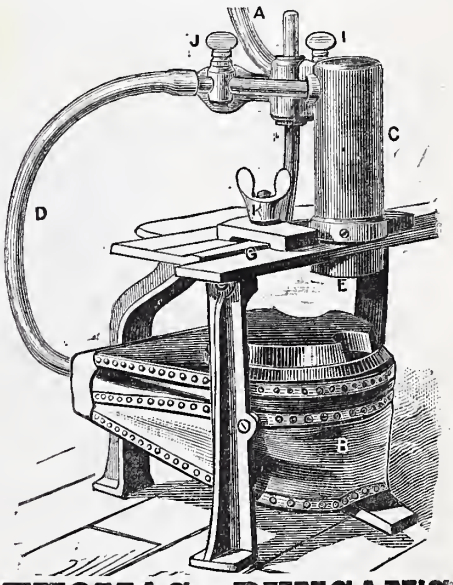


NEW HAND-BEADING TOOL,

which is accompanied by six irons, each having two cutting edges, comprising in the Twelve Cutting Edges thus supplied, Beads, Reeds, Quirks, Rebates, and Hollow and Fancy Reeds. The appliance itself is of japanned iron with a bright front. Its extreme length is about 5¼ in.

POST FREE, 2s. 3d. 200 Page Catalogue, 700 Illustrations, by post, 6d.

MOSELEY & SON, 323, HIGH HOLBORN.



THOMAS DUNCAN'S BAND-SAW BRAZING MACHINE.

305, MANCHESTER STREET, OLDHAM.

Sample of Brazing supplied to any person sending Saws at the rate of 1d. for ¼ in.; ⅜ in. Saws, 3d.; ⅝ in. Saws, 5d. Sender to pay carriage both ways.

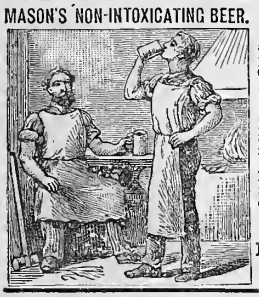
PRICE OF BRAZING MACHINE, *28s.*

Five per cent. allowed for Cash with order.

Further particulars on application to above address.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER. MASON'S WINE ESSENCES.



These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. One Tablespoonful of Mason's Extract of Herbs makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON,
Nottingham.

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Post free on application.

Cassell's Classified Catalogue.

CASSELL'S TECHNICAL MANUALS.

Illustrated throughout with Drawings and Working Diagrams, bound in cloth.

A List of the above Manuals will be sent post free on application.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES.

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill**, with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design **SENT GRATIS** with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

Pure, Palatable, instantly prepared. **Bovril.**

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

FLUID WATER RESISTING **GLUE** (*Patent*) PATENT TINS.

Invaluable for all Out and Indoor Repairs.

FLUID WATER RESISTING **GLUE** (*Patent*) PATENT TINS.

No Brush—No Boiling—Will securely join Wood, Glass, China, Metals, &c.

By Post, 8d. and 1s. 3d. per tin. Through Ironmongers, Chemists, Chandlers, &c., 6d. and 1s. per tin.

Manufactured only by THE WATERPROOF GLUE CO., 62, Dale St., LIVERPOOL.

MANUALS OF TECHNOLOGY.

Edited by Prof. AYRTON, F.R.S., and RICHARD WORMELL, D.Sc., M.A.

THE DYEING OF TEXTILE FABRICS. By Prof. J. J. HUMMEL, F.C.S. *With Numerous Diagrams. Seventh Thousand.* 5s.

STEEL AND IRON. By WILLIAM HENRY GREENWOOD, F.C.S., M.I.M.E., &c. *With 97 Diagrams. Fifth Edition.* 5s.

SPINNING WOOLLEN AND WORSTED. By W. S. BRIGHT MCLAREN, M.P. *With 69 Diagrams. Second Edition.* 4s. 6d.

CUTTING TOOLS. By Prof. H. R. SMITH. *With 14 Folding Plates and 51 Woodcuts. Third Edition.* 3s. 6d.

PRACTICAL MECHANICS. By Prof. J. PERRY, M.E. *With numerous Illustrations. Third Edition.* 3s. 6d.

DESIGN IN TEXTILE FABRICS. By T. R. ASHENHURST. *With 10 Coloured Plates and 106 Diagrams. Third Edition.* 4s. 6d.

WATCH AND CLOCK MAKING. By D. GLASGOW. 4s. 6d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NEW AND ENLARGED EDITION. Cloth, 3s. 6d.

COLOUR. A Scientific and Technical Manual treating of the Optical Principles, Artistic Laws, and Technical Details governing the use of Colours in various Arts. By A. H. CHURCH. Professor of Chemistry in the Royal Academy of Arts, London. With **Six Coloured Plates.**

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NEW AND ENLARGED EDITION, price 1s.; or in cloth, 1s. 6d.

Photography for Amateurs. A Non-Technical Manual for the Use of All. By T. C. HEPWORTH. With **Illustrations.**

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Price 10s. 6d.

Architectural Drawing. By R. PHENÉ SPIERS, F.S.A., F.R.I.B.A., Master of the Architectural School of the Royal Academy. With **Nine Coloured and Fifteen Plain Plates.** Demy 4to.

"**Mr. Phené Spiers's book is without a rival on this subject, and it will be accepted as a standard.** Students are fortunate who are able to begin with so competent and authoritative a guide. The publishers have gone to much expense in the production of the plates, but they issue the volume at a price that must be deemed moderate."—*The Architect.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NOW READY, Part 1, price 7d.

Our Own Country. An Illustrated Historical and Geographical Description of the Chief Places of Interest in Great Britain and Ireland. With about **1,200 Original Illustrations.**

*** *With Part 1 is issued a* LARGE PRESENTATION PLATE (size 40 in. × 30 in.), *consisting of an Engraving giving a* "BIRD'S-EYE VIEW OF LONDON FROM A BALLOON."

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

NOW READY, Part 1, price 6d.

Familiar Trees. By Prof. G. S. BOULGER, F.L.S., F.G.S. With Exquisite **Illustrations in Colour** from **Original Drawings** by W. H. J. BOOT.

"*The trees in their stems and foliage are thoroughly true to nature.*"—THE TIMES.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

[*All Rights reserved.*]

VOL. II.—No. 104.] SATURDAY, MARCH 14, 1891. [PRICE ONE PENNY.

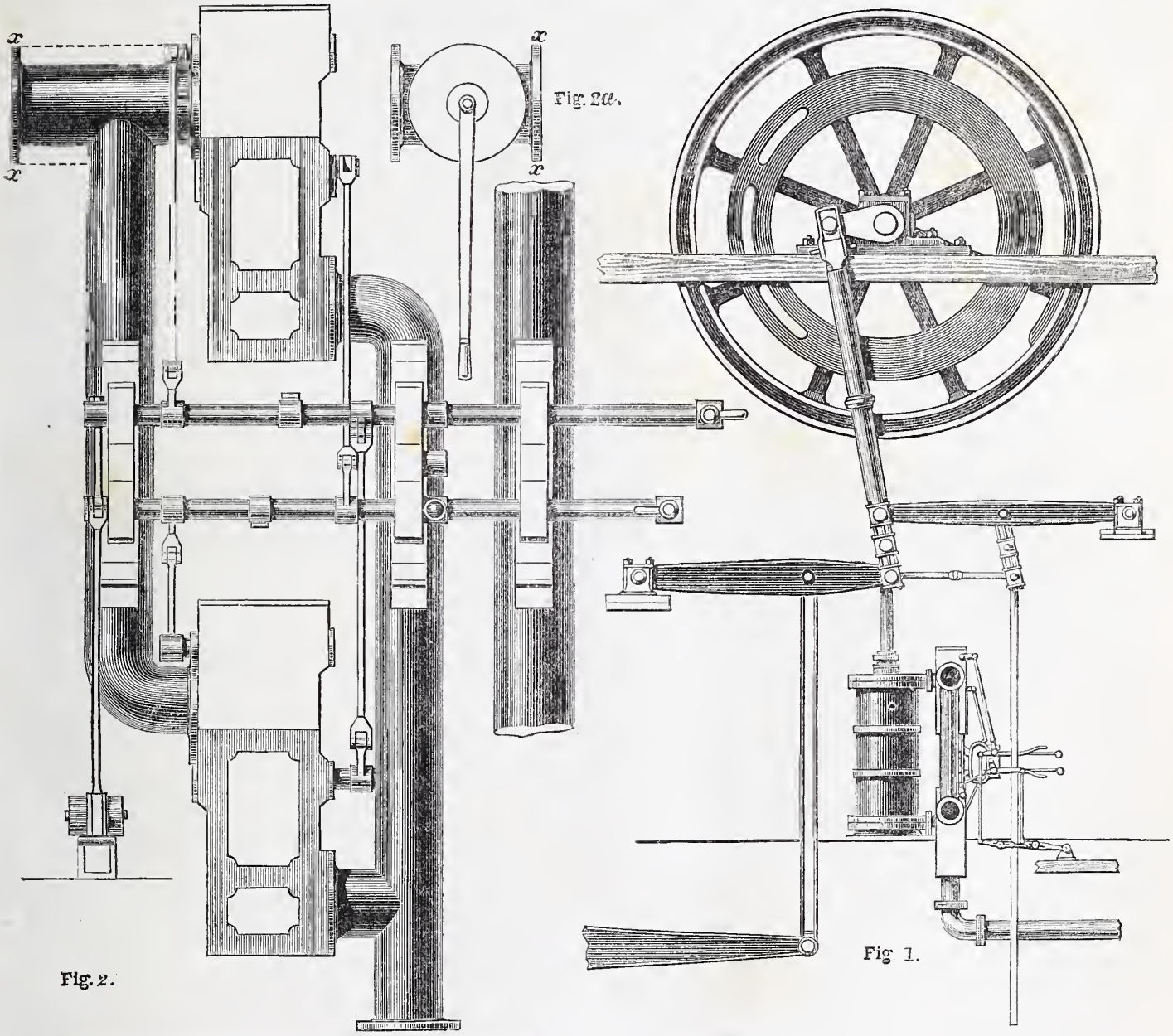


Fig. 1.—Side Elevation of Engine. Fig. 2.—Front Elevation of Valve Gear. (Fig. 2 *a* is part of Fig. 2, and connects at *x x*. It is shown thus to save space.)

A MINE ENGINE.

BY MUNIO.

THE accompanying drawing, Fig. 1, is a side elevation of an engine which is often used at the coal and ironstone mines for drawing the materials to the surface, and in some cases for pumping at the same time. These engines are sometimes of large size. The one represented has a cylinder 40 in. in diameter, and 6 ft. 6 in. stroke; the winding drum is 14 ft. in diameter, and the fly-wheel is 23 ft. 6 in. in diameter. The walls of the engine-house are built very strong and massive, and form a support for the beams and one end of the crank-shaft; the other end of the shaft rests on an oak beam, the ends of which are fixed in the walls of the engine-house. Underneath this beam, and as an additional support, is fixed an iron girder, supported from the floor level by two cast-iron columns. These are not shown in the drawing.

The motion of the piston-rod is guided by two beams, the ends of which are fixed on bearings bolted into the walls of the house; these are sometimes made of cast iron, and sometimes of wrought iron. Those shown are of wrought iron, with two plates at each side about 3 in. apart; the two sides are strongly

bolted together, the full width outside being 2 ft. 8 in. The larger beam carries a connecting-rod, which is fixed to a beam below the floor for working a pump.

The two beams are connected by links, to the centre of which is fixed the end of the connecting-rod and the piston-rod, the beams and links forming a parallel motion. Another link is fixed on the smaller beam, to the centre of which is attached a pump-rod, which also works the hand-gear.

The winding drums have cast-iron sides keyed on the fly-wheel shaft, and cleaded inside with strong wooden cleading for the ropes to coil on.

On the rim of the fly-wheel is fixed a very powerful brake, which can be brought on by the foot of the man at the handles. As the engine has to be stopped and reversed each time the load is brought to the surface, the means for accomplishing this must be made as light as possible. The steam and exhaust-valves are made circular, and are called double mitre-valves, being arranged to admit steam both at the upper and under side when open. They are worked by rods and levers attached to two rocking-shafts on which are levers; these levers are raised and lowered by tappets on the pump-rod.

Fig. 2 is a front elevation of the gearing for working the valves. The steam-pipe is on the left and the exhaust-pipe on the right-hand side; these are connected to chambers at the top and bottom of the cylinder, in which are fixed the steam and exhaust-valves. To the top of these valves is fixed a rack working in a guide; this rack is worked by a toothed segment fixed on a shaft. The end of this shaft projects to the outside of the chamber, and has a lever fixed upon it, which is connected by a rod to another lever keyed on the rocking-shaft. The top rocking-shaft is connected to the top steam-valve and lower exhaust-valve, and the lower shaft to the lower steam-valve and the top exhaust-valve. Balance-weights are fixed to levers on the end of each rocking-shaft, which have a tendency to close the valves.

Between the rocking-shafts is fixed a pawl or catch, into which a cam on each rocking-shaft can be fixed. When the handles are both fixed in the catch, and in a horizontal position, as shown, all the valves are closed, and the engine is stationary; but when one of the handles is moved out of the catch, the engine makes half a revolution, and, the tappet on the pump-rod coming into contact with the lever on the other rocking-shaft, it opens the steam and exhaust-valve connected to that shaft, the action of the pawl and balance-weight at the same time closing the valves which had previously been open, the tappets then alternately opening the valves, and keeping the engine in motion.

A signal bell is arranged to ring when the load is near the surface, which is worked by a cord wound on the fly-wheel shaft. The last stroke or two is worked by hand, and the engine finally stopped by means of the brake. Some of these engines will raise 1,000 tons of materials per day from a depth of 100 fathoms.

It is desirable to remind the reader that the diagram marked Fig. 2*a* is really a portion of Fig. 2, and connected with it at the line *x x*. It has been removed and shown separately to enable Figs. 1 and 2 to be drawn on a larger scale, and their different parts to be expressed more clearly than they could have been had Fig. 2*a* been attached to Fig. 2 and drawn in its proper place. All mechanical drawings should be, and are, in WORK, shown on as large a scale as possible.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

ELECTRIC LIGHT FITTINGS—CONDUCTING WIRES—SWITCHES—CUT-OUTS—SWITCH-BOARDS—UNIVERSAL SWITCH-BOARDS—MEASURING INSTRUMENTS—LAMPS AND LAMP-HOLDERS—ELECTROLIERS—CARE OF LAMPS AND BATTERIES—CONCLUDING REMARKS.

Electric Light Fittings.—Although provided with incandescent lamps, generators for the electric current, and secondary generators in case of accident, there are still many accessories necessary to constitute an electric light installation. Suitable wires or cables for the main conducting lines, suitable wires for the branch lines, switches for turning the current on to the lamps or off from them, apparatus to protect the filaments of the lamps from excess of current, lamp-holders, stands, and pendants, governors to control the charging current supplied to accumulators, together with instruments for determining the pressure and volume of the current, represent the main necessary accessories of an electric light installation.

Conducting Wires.—Before any person can decide upon the length and size of the conducting wires required for an installation of electric light, he must know exactly the number of lamps desired, and their respective candle-power, as also the extreme distance of the farthest lamp from the dynamo or battery. He must also decide on a system for arranging the lamps. The lamps may be arranged in parallel—that is, as shown in Fig. 71, where each lamp forms a branch of the main circuit. In this case, there are two main wires, named "leads," running from the dynamo to the extreme limit of the installation, and a branch pair of wires running from the main wires to each lamp. Each lamp will take a definite volume of current at a certain potential, and the required volume for the whole will be ascertained by multiplying the volume needed for one lamp by the total number of lamps likely to be used. For instance, supposing ten 8 c.p. lamps taking two ampères of current per lamp are to be used, the current required will be $2 \times 10 = 20$ ampères, and we must employ main wires capable of safely carrying twenty ampères of current. This may be found on reference to the table given on the next page, which shows at a glance the safe carrying capacity of all likely main wires and cables. The branch wires in this instance need only have a safe carrying capacity of two ampères, since one pair of wires will only carry current to one lamp.

The lamps may be arranged as shown at Fig. 72, which may be described as parallel series. In this system the same main leads will be required, but the current must be delivered at a higher potential to overcome the extra resistance of lamps placed in series. In such an arrangement, the branch wire is connected to the main, then on to one lamp, from this to the next, and then back to the main again.

If the current is small, but of high potential, or, if the lamps have a low resistance, as in the Bernstein lamps, the lamps may be arranged in series as shown at Fig. 73. In this arrangement, one thin wire only need be carried from the generator to the series of lamps, and then back to the generator again. This system has several disadvantages which more than counterbalance their simple arrangement. If Edison-Swan lamps are employed, they must all be marked with the same reference letter, and should require the same number of ampères each lamp. If the lamps are not provided with an automatic switch to each lamp, the whole series will be extinguished if the filament of one lamp in the series should break. The high pressure required to send current through all the lamps is an element of danger in a house, involving extra fire risks and possible accidents from shocks received in handling the fittings. The E.M.F. needed to send the necessary current through ten lamps having a voltage of fifteen volts each lamp, will be $10 \times 15 = 150$ volts if arranged in series. But, if the lamps are arranged in parallel, as shown at Fig. 71, we shall only need an E.M.F. sufficiently high to overcome the resistance of one lamp and the branch wires, in addition to that of the mains, about seventeen volts in all. In the arrangement shown at Fig. 72, the voltage of any series of the lamps must not exceed the E.M.F. of the current, and the volume of the current must be proportioned to the same total of all the series.

The table at the top of the next page will show the safe carrying capacity of electric light wires and cables. The wires and cables mentioned in the table are insulated with one coat of cotton, waxed with paraffin, then with one lap of pure indiarubber, covered with prepared cotton tape, then coated with braided cotton covered with a preservative compound. Thicker insulation can be obtained at a higher price per yard, and quantities of one mile in length are sold at a reduced rate. It is best to use highly insulated wires for the mains and for the branches, and these should be laid with a small space between them to guard against possible accidental leakage. It will be found to be true economy to choose wires large enough to carry two or three times more current than the safety limit mentioned in the table on the next page, as resistance in the wires necessitates an expenditure of power to overcome it, and this is a waste of power. Not only should this receive consideration, but also the fact that when current is choked in the wires, the lamps do not burn equally bright. Cables are preferable to very large wires on account of superior flexibility. All joints must be made with long laps well soldered together, and well insulated afterwards with a good compound, such as Chatterton's compound, sold for the purpose, then coated with tarred tape. Merely twisted joints are very dangerous, as are also badly insulated joints. Where branch joints are made, and the branch wire crosses a main, special precautions must be taken in insulating the wires, as it is just at such points as these where overheating occurs, with consequent outbreaks of fire. I have given the safe carrying capacity of wire and cables up to 47·9 ampères, this being sufficient for a small installation of electric lights of, say, 150 candle-power, but I shall be pleased at any time to meet larger requirements by advising the sizes of cables or wires.

Switches.—If we are amusing ourselves with one lamp and a small battery, as described in the earlier papers of this series, it will not be necessary to have a switch. The lamp will be fixed and the wires connected to the terminals of the battery, from which current will be turned on to the lamp by lifting the solution to the plates or depressing these into the solution. But, for larger installations of more than one lamp, a switch to turn the current on to the lamps or off from them, when required, will be a necessity. In some of the Edison lamp-holders, this provision is made in each holder, which is furnished with a small switch to turn the current on and off by

Table showing Safe Carrying Capacity of Copper Wires and Cables.

No of Wire (Standard gauge).	Strands of Wire.	Safe carrying capacity in ampères.	Price per yard.	No. of Wire (Standard gauge).	Stronds of Wire.	Sofe carrying capacity in ampères.	Price per yard.	No. of Wire (Standard gauge).	Strands of Wire.	Safe carrying capacity in ampères.	Price per yard.
22	1	·6	1d.	23	7	3.2	2¾d.	10	1	12·8	0s. 6d.
21	1	·8	1¼d.	15	1	4·0	2¾d.	18	7	12·8	0s. 6¾d.
25	3	·9	1¼d.	22	7	4·4	3d.	9	1	16·2	0s. 7¼d.
20	1	1·0	1¼d.	14	1	5·0	3d.	17	7	17·4	0s. 8¾d.
19	1	1·2	1¼d.	21½	7	5·0	3¼d.	8	1	20·1	0s. 9d.
23	3	1·4	1½d.	20½	7	6·1	3¾d.	16	7	22·9	0s. 11d.
18	1	1·8	1¾d.	13	1	6·6	3¾d.	19	19	24·3	0s. 11¾d.
22	3	1·9	2d.	20	7	7·2	4¼d.	15	7	28·9	1s. 1d.
25	7	2·2	2¼d.	12	1	8·5	4¼d.	18	19	34·9	1s. 4d.
17	1	2·4	2d.	19	7	8·9	5d.	14	7	35·6	1s. 4d.
16	1	3·2	2¼d.	11	1	10·5	5d.	17	19	47·9	1s. 9d.

means of a tap similar to that of a gas tap. This is shown at Fig. 74. A small switch capable of adaptation to other holders is shown at Fig. 75. These are convenient appliances for single lamps; but lamps are frequently arranged in groups, each group being supplied with current from its own branch; and each branch must be provided with a switch, so that each group may be switched out of circuit when not required. We cannot turn down electric lights as we turn down gas and oil lights, so must turn them off when the light is not wanted. If we wish to have a reduced light in a room, provision must be made for this when laying the wires by having an independent branch running to one or two lamps, and these may be of lower candle-power than the others.

Switches for electric light installations differ from those employed in electric bell work in being of a more massive design and more carefully constructed. Almost any simple means of ensuring contact between two parts of the circuit will serve for the purpose of electric bell work, because the current is small, rarely exceeding 1 ampère at a pressure of not exceeding 6 volts. But the lowest electric light current exceeds this, and those of any magnitude will be some ten or twenty times stronger. It is well known that a spark passes between the two parts of a switch in a bell circuit, and it is necessary to protect the contact surfaces with platinum to prevent burning of those surfaces. A still larger spark passes when contact is made and broken in an electric light circuit, and this spark will burn away platinum-protected surfaces. It is therefore necessary to have massive pieces of brass, with long and perfectly bearing surfaces, for the contact pieces of electric light switches, to prevent heating and consequent burning of the surfaces when the spark passes. The metal in the switches must be adapted to the current they are intended to carry, as it would be manifestly unwise to use a 10-ampère switch in a circuit to carry 20 ampères of current. I cannot stay to notice all the switches now in the market, but will sketch some of them. Fig. 76 shows a simple bar switch with clutch action, mounted on a base of hard wood, slate, serpentine, or china. The working parts are of brass, the handle of hard wood or of ebonite. These are made to carry main currents varying from 25 to 80 ampères, according to dimensions of brass employed, and are sold at from 5s. 9d. to 16s. each. Fig. 77 shows another form of this switch for switching the current from one branch to another. Fig. 78 shows a small main or branch switch made to carry from 25 to 50 ampères of current, and sold at from 10s. to 17s. 6d. each. Fig. 79 shows a massive form of main switch to carry from 50 to 150 ampères of current, and sold at from 17s. 6d. to 33s. each. For heavier currents, brush contact switches are made, in which bunches of phosphor-bronze ribbon are used on the ends of the arms to make contact with the brass pieces below. Figs. 80, 81, 82, 83, 84, and 85 show some forms of ornamental branch switches suitable to prominent and exposed positions. These vary in price from 2s. 6d. to 6s. 6d. each. When portable table lamps are employed in an installation, contact is made by means of wall sockets and plungers, as shown at Fig. 86. The socket-holder is let into the wall after the branch wires have been soldered to the sockets. These cost from 3s. 6d. to 10s. 6d. each. When it is desirable to have the lamp suspended from the ceiling of a room by a flexible cord, contact is made with the branch wires by means of ceiling roses, such as those shown at Figs. 87, 88, 89, and 90A. The prices are from 1s. to 3s. 6d. each.

Cut-Outs.—Should an engine race whilst the dynamo is connected to the lamps, the current would be suddenly augmented, and this sudden rush of current through the lamps might cause total disruption of their filaments. To protect the lamps from this and similar accidents, an extra appliance is attached to each switch or inserted as a separate apparatus into each branch of the circuit. This appliance is named a "cut-out," because by its action it cuts the protected part out of circuit whenever the current rises to a dangerous height. A cut-out is simply one or more short pieces of fusible tin wire inserted into the circuit. These may be enclosed in a ceiling rose such as that shown at Fig. 87, or mounted on a separate base of wood, slate, or china, as shown at Figs. 90 and 91. A 1 in. length of No. 20 fusible tin wire will carry safely from 2 to 3 ampères of current, but melt if the current is raised to from 3 to 4 ampères. It will thus protect one lamp, and one such piece to each lamp will protect many from injury. Larger cut-outs are made, up to a 1,000-ampère capacity, for the protection of lamps and buildings by including them in the main circuit. The fusible wires cost from 3s. to 5s. per pound, according to their fineness, and the cut-outs complete cost from 1s. for a 1-5 ampère capacity, up to £5 for those of more massive and elaborate construction, capable of carrying 1,000 ampères.

Switch-Boards.—In large installations of electric lights, it is found advantageous to mount all the switches and appliances on one board, where they can be easily seen and attended to in case of accident. Such a board is shown at Fig. 92, on which is mounted the switches belonging to the dynamo and accumulator mains A and D, the main lamp circuit switch in the centre at L, an ammeter and voltmeter, with their respective keys, and a multiple cut-out for the main circuit. The board is of polished walnut, with bright brass fittings. Fig. 93 is a design for a branch switch-board, to be placed in a glass case on the wall of a corridor or passage.

Universal Switch-Boards.—The adjoining sketch (Fig. 94) represents the plan of connections employed in the Universal Switch-board made and sold by Messrs. J. E. Hartley & Co., 13, St. Paul's Square, Birmingham. The board is a large slab of enamelled slate, fixed in a moulded and polished teak frame, on which are mounted the switches on polished serpentine bases. The letters P N indicate the positive and negative mains from the dynamo; L L are the two terminals of the main lamp circuit; A is the ammeter; V, the voltmeter; and M, the magnetic cut-out for the accumulator. This is a necessary accessory when accumulators are employed on a lamp circuit in connection with a dynamo. The magnetic cut-out is shown separately at Fig. 95. This is so constructed as to close the circuit between the dynamo and the accumulators when the E.M.F. of the current is maintained at the requisite height, but it breaks the circuit when the E.M.F. falls below a certain fixed point, and thus prevents short-circuiting of the dynamo by the back E.M.F. of the accumulator cells. Connections are made at the back of this switch-board, and the wires are shown on the sketch by dotted lines. These will give some idea respecting the method adopted in making switch-board connections, all wires or flexible cables being well insulated.

It may be just as well here to note that all connections between wires and switches should be either soldered or sweated into the contact pieces, or soldered into thimble-and-eye terminals to be fitted on to the contacts by bolts and nuts.

Measuring Instruments.—The measuring instruments employed in electric lighting are, an ammeter, to measure the strength and volume of the current; and a voltmeter, to measure the E.M.F. I give illustrations of the gravity form of these instruments at Figs. 96 and 97, these being more reliable than any other. In the ammeter a stout coil of wire is wound on a core of soft iron, which is converted into an electro-magnet when the electric current passes through the coil. The magnetised iron then attracts a light iron rod attached to an arbor, on which is mounted a counter-weight and index hand. In the voltmeter a finer coil serves a similar purpose. These instruments cost from £3 10s. to £8 each, and are made to register from 60 volts or ampères up to 1,000 volts or ampères, as may be required. The ammeter and voltmeter shown in Fig. 92 are the Schuckert ampère and voltmeter, the construction of which varies slightly from that of the gravity instruments.

Lamps and Lamp-Holders.—A few years ago there were many forms of incandescent electric lamps to be seen and obtained, but most of these have been placed *hors de combat* in the battle of patent rights, and only those of the richest monopolists remain to illustrate the doctrine of the survival of the fittest, the weakest men—not necessarily the weakest lamps—having gone to the wall.

Among the survivors, the Edison-Swan holds its own, and I herewith give three illustrations showing the three types of sockets sold with these lamp bulbs. Fig. 98 shows the B. C., or brass collar lamp, furnished with a brass collar for fixing on the patent No. 14 holder shown at Fig. 101. Fig. 99 shows the E. S., or Edison socket lamp, with screwed collar to fit in the Edison socket-holder. Fig. 100 shows

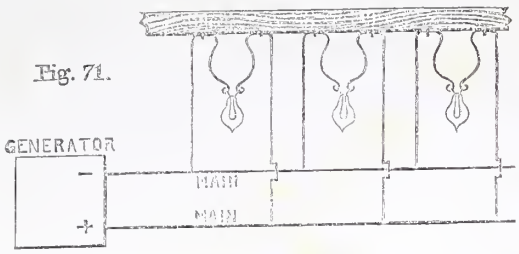


Fig. 71.

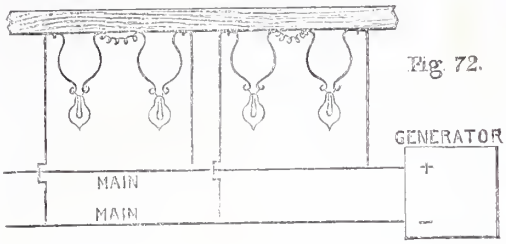


Fig. 72.

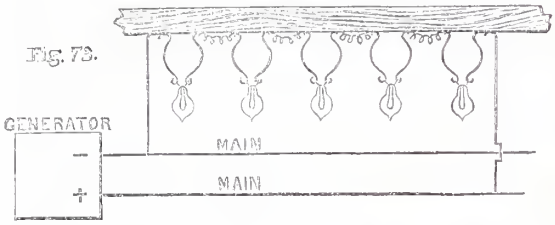


Fig. 73.

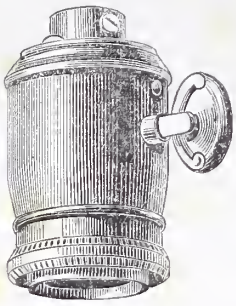


Fig. 74.

Fig. 76.

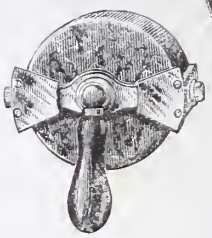


Fig. 77.

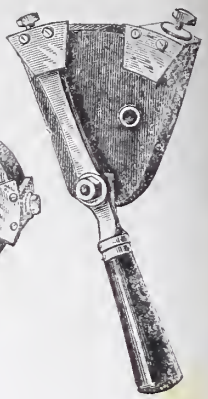


Fig. 78.

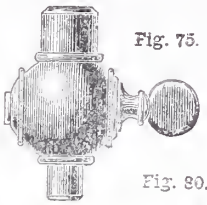


Fig. 75.

Fig. 80.

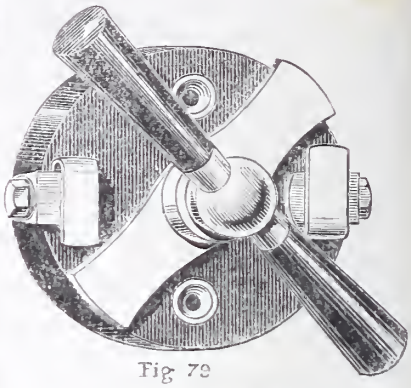


Fig. 79.

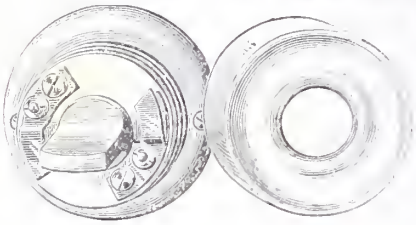


Fig. 81.

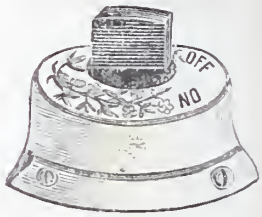


Fig. 85.

Fig. 82.

Fig. 83.

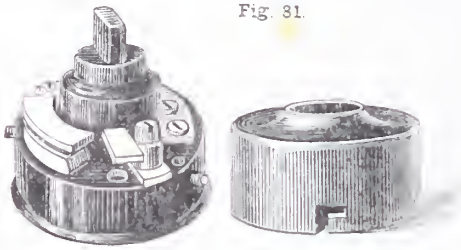


Fig. 84.

Fig. 89.

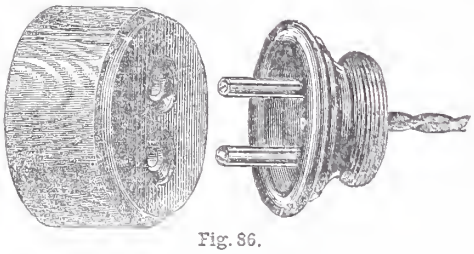


Fig. 86.

Fig. 90 A.

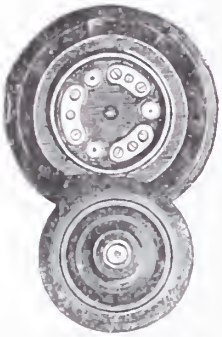


Fig. 87.

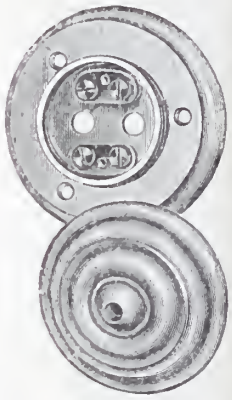


Fig. 88.

Figs. 71, 72.—Plans showing how to connect Electric Lamps in Parallel Series. Fig. 73.—Plan showing how to connect Electric Lamps in Series. Fig. 74.—Lamp-Holder and Switch. Fig. 75.—Lamp Switch. Figs. 76, 77, 78, 79.—Main Line Switches. Figs. 80, 81, 82, 83, 84, 85.—Branch Switches. Fig. 86.—Wall Plug and Socket. Fig. 87.—Ceiling Rose and Contact. Figs. 88, 89, 90.—Ceiling Roses. Fig. 90 A.—Cut-Out Circular Pattern. Fig. 91.—Slate Base Contact. Fig. 92.—Main Switch-Board. Fig. 93.—Corridor Branch Switch-Board. Fig. 94.—Plan of Universal Switch-Board. Fig. 95.—Magnetic Cut-Out. Fig. 96.—Gravity Voltmeter. Fig. 97.—Gravity Ammeter. Fig. 98.—Edison-Swan Incandescent B. C. Lamp. Fig. 99.—Ditto E. S. Lamp. Fig. 100.—Ditto B. L. Lamp. Fig. 101.—Edison Lamp-Holder. Fig. 102.—Snake Pattern Lamp-Holder. Fig. 103.—Gas Bracket China Lamp-Holder. Fig. 104.—Amateur's Lamp-Holder: Section. Fig. 105.—Wire for Pendant Lamp-Holder. Fig. 106.—Amateur's Table Standard Lamp-Holder. Fig. 107.—Wire for Table Standard Lamp-Holder. Fig. 108.—"Drawing-Room" Pendant Electrolier. Fig. 109.—"Elevator" Pendant Electrolier. N.B.—Figs. 90—109 are given in the next page.

the B. L., or bottom-loop lamp, with plain bottom loops easily adapted to the wants of amateur users.

The usual Swan lamp-holders are made similar to the holder shown at Figs. 102 and 103, but with a spiral brass spring to keep the lamp loops in contact with the hooks of the conducting wires. A holder fulfilling all the conditions of this last may be made by the amateur himself, as shown at Fig. 104. A cone of $\frac{3}{4}$ in. in length and $\frac{5}{8}$ in. in diameter is turned out of hard wood or ebonite, with a deep groove forming a ring around its base to receive one convolution of a brass spiral spring. Two holes are drilled through this to receive two short pieces of No. 16 copper wire. These are thrust through the wood cone, and their ends fitted and soldered into two spirals of No. 20 hard-drawn copper wire, furnished with two hooks for the loops of the lamps. A spiral of hard-drawn brass wire of No. 18 gauge, large enough to encircle the neck of the lamp, is now to be fitted to the holder,

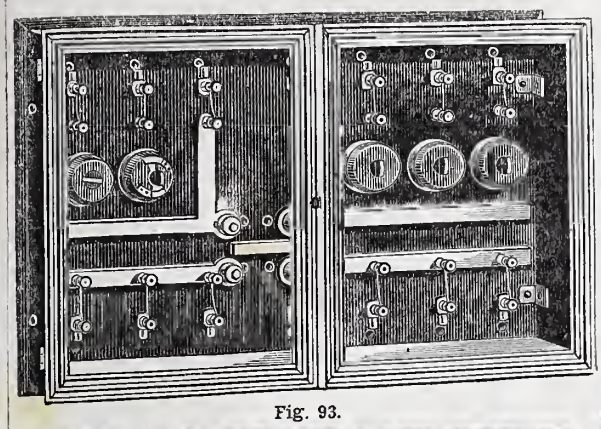


Fig. 93.

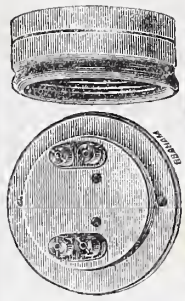


Fig. 90.

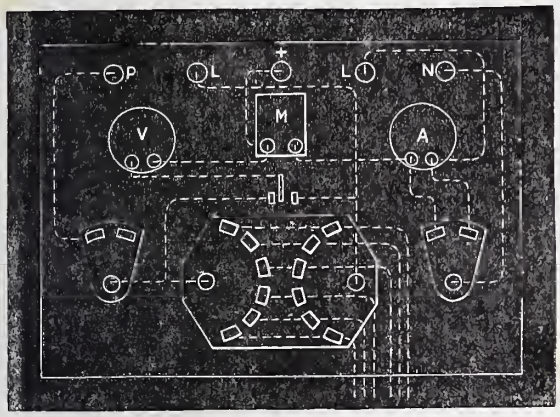


Fig. 94.

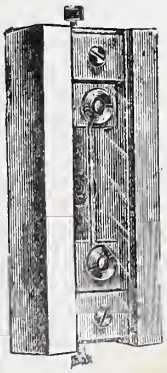


Fig. 91.

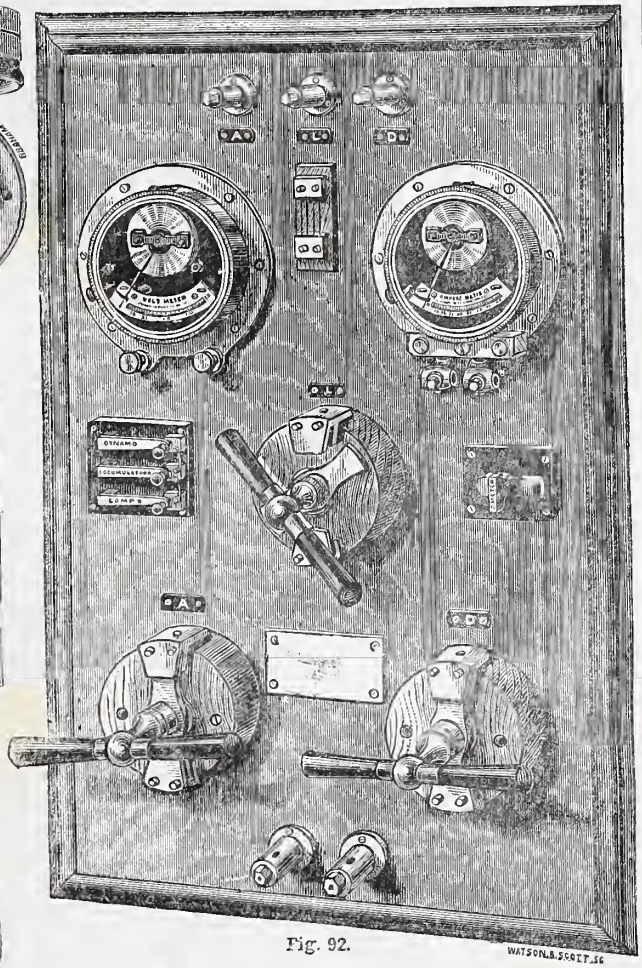


Fig. 92.

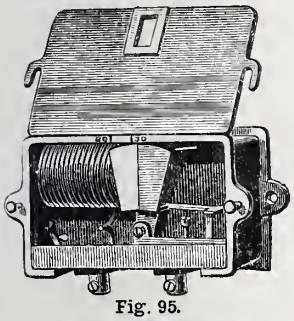


Fig. 95.

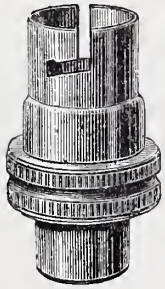


Fig. 101.

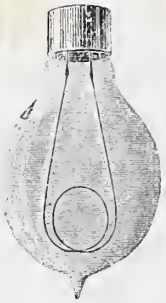


Fig. 98.

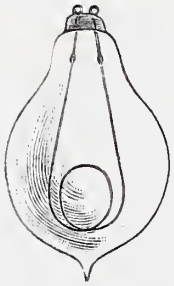


Fig. 100.

Fig. 105.

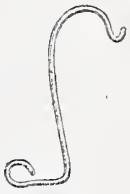


Fig. 107.

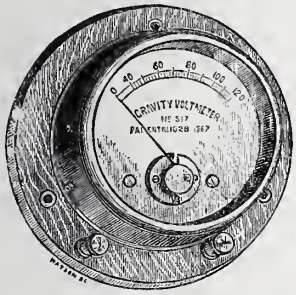


Fig. 96.

Fig. 102.

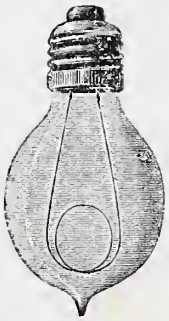


Fig. 99.

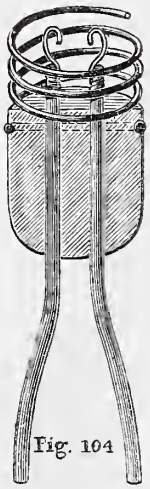


Fig. 104

Fig. 108.

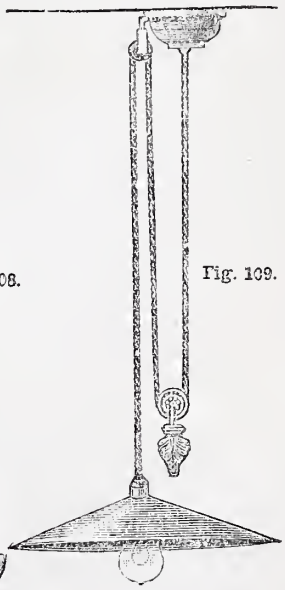


Fig. 109.

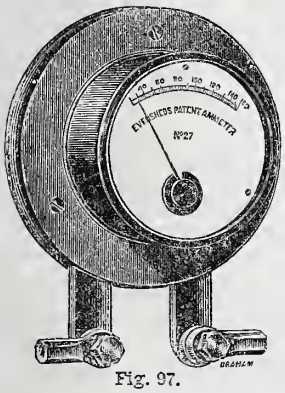


Fig. 97.

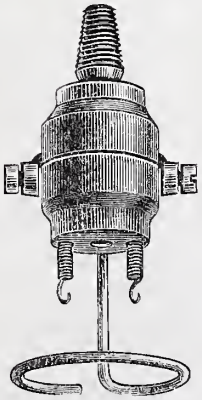


Fig. 103.

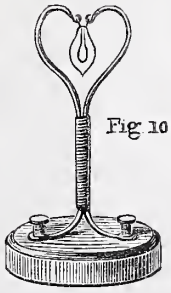


Fig 106.

when it will be complete. The two projecting wires may be soldered to the branch wires leading from the main, or may be connected to them by screw connectors.

An idea for a simply constructed inexpensive lamp-holder comes to us from the *Scientific American*. Its adaptability to the amateur's workshop is shown at Figs. 71, 72, and 73. It is made of two short pieces of hard-drawn brass, copper, or coppered wire, bent to the shape shown at Fig. 105, and attached by brass screws, at a suitable distance apart, to any wooden support. The lamps may be looped to this direct or by means of a short piece of finer wire, as the springy nature of the wires in the holder serve to keep its hooks in contact with the loops of the lamp. The adaptability of this idea to a table-lamp is shown at Fig. 106. The wires to form the standard are bent as shown at Fig. 107. They are then fixed to the wooden stand by means of binding screws. A long length of silk ribbon or of paraffined tape wound around each serves to insulate them from each other, and the whole is then bound together with twine or silk cord. The wires for these holders may be of from 15 to 18 gauge, but should be hard-drawn.

Electroliers.—These are the larger holders for electric lamps, corresponding with chandeliers for candles, and gaseliers for gas. They are made in many designs and in qualities to suit many prices. Some of the designs are marvels of ingenuity in ornamental metal work and cut glass, since they admit of material and workmanship impossible in gaseliers. I can only give illustrations of a few pendants. These are coming into favour for house lighting, because of their originality of design, introducing something different from that of gas-light and candle-light holders. The "drawing-room" pendant (Fig. 108) consists of a china "ceiling rose" furnished with a cut-out, from which depends a flexible twin-wire cord, connected to a china suspension holder, under a figured or cut glass shade. These are made for one lamp at 5s. 6d. each, or for two lamps at 7s. 6d. each. The "elevator" pendant (Fig. 109) is suitable to the study or office. It consists of a 3½ in. ceiling rose, with cut-out and separate pulley, over which runs a flexible twin cable made of thirty-five strands of No. 40 wire, holding a counter-weight, lamp-holder, and 10 in. opal shade. This is made and sold for one lamp at 10s. 6d., two lamps at 12s. 6d., or three lamps at 15s. A large variety of shades in cut and figured glass are admissible with pendants.

Care of Lamps and Batteries.—Incandescent lamps are expensive luxuries when carelessly used, as they are very fragile and soon break. Their delicate filaments of carbon are soon broken by sudden rushes of current; therefore it is always advisable to have a fusible cut-out to each lamp, such a cut-out only costing a few pence. Even when thus protected, the current from batteries and accumulators should be switched on gradually, adding cell to cell until the proper brightness of the lamps has been obained. Never short-circuit batteries or accumulators by spanning their terminals with a thick wire or other conductor having a large capacity. This is specially dangerous to accumulators, as the sudden rush of current is apt to ruin the plates by peeling off their coating. The rate of discharge should, therefore, be gradual, and never exceed four ampères per square foot of primary plate surface. Primary batteries will rarely bear a more rapid discharge than 3 ampères. In accumulators the pressure of the current gradually falls whilst being discharged, until it reaches an E.M.F. of 1·9 volts per cell, when discharge should cease and the cells be re-charged. At this time there should remain in the cells 25 per cent. of reserve force remaining from the original charge. A too rapid discharge buckles the plates and throws off the coating, and an excessive discharge causes the coat to absorb sulphuric acid and becomes a sulphate of lead, indicated by large white patches of a loose character on the surfaces of the positive plates. This is called "sulphating the cells."

Concluding Remarks.—In closing this series of papers on Model Electric Lights, I am conscious of only having touched the fringe of the subject in my foregoing remarks. Much remains to be said to treat this subject in only a fairly exhaustive manner, but I must close it now for want of space. I hope the papers will have been helpful to amateurs wishing to know something of electric lighting. In their preparation I have received assistance from Messrs. J. E. Hartley & Co., 13, St. Paul's Square, Birmingham; Mr. A. Croft, Dover; and Mr. S. Bottone, Carshalton; to all of whom I beg to tender my most hearty thanks. Should any of my readers desire help in planning an installation, I shall be pleased to hear from them, and will reply to their letters through the medium of "Shop."

HINTS TO WATCH WEARERS—AMATEURS AND OTHERS.

BY HERR SPRING.

In concluding my contributions to the present volume of WORK on the above subject, I desire to say a few words on the question of the chronometer balance. There is no greater nonsense and fallacy in the whole range of popular delusions concerning watches than the almost religious veneration with which the public regard the phrase "chronometer balance." One sees the phrase ostentatiously paraded on tickets attached to all sorts and conditions of watches hung in the windows of those who deal in the article. I have even seen a guinea watch, whose chief virtue was the possession of a "chronometer balance." But let me say at once that ninety-eight per cent. of so-called chronometer balances are useless; and of this percentage a very considerable proportion are not only useless, but absolutely pernicious. I am sorry to cut down this full-grown and flourishing popular delusion in this unceremonious fashion—but why cumbereth it the earth? People pay a few pounds for a watch described as possessing a "chronometer balance and ten jewels," and they imagine they have a horological treasure. In point of fact the balance is a useless fraud, and the jewels in all probability are common glass. To show the reason why a cheap watch cannot possibly possess a practicable chronometer balance I must enter into a little explanation, which shall be as untechnical as possible. The word "chronometer" balance is simply a synonym for "compensating" balance. Now, why is a chronometer balance used? It is used for this reason: every watch must have a hair-spring, which, by its expansion and contraction, keeps the balance-wheel swinging backwards and forwards. But the hair-spring, being made of fine steel, is delicately affected by the temperature—in heat it expands, and in cold it contracts. If any amateur wishes to demonstrate this, let him beg an old hair-spring from his watchmaker. Then let him place the spring—in the absence of anything more suitable—on the flat side of the blade of an old table knife, and hold the blade over a spirit-lamp or any small flame. As the blade becomes a little heated he will see the spring gradually uncoiling itself and growing larger. This is what happens in changes of temperature when the watch is in the wearer's pocket; only, of course, in a very much smaller degree. In a warm temperature the hair-spring expands and becomes weaker, and thus causes the watch to go slower. In a cold temperature, of course, the spring contracts, becomes stronger, and the watch goes faster. I am speaking now of a watch with a "plain" balance. But in order to compensate for these irregularities in the hair-spring the chronometer balance was applied. The rim of a chronometer balance is composed of a fusion of brass and steel, and is cut through in two places, so that instead of being an immovable circle, like the rim of a cart-wheel, the rim of a chronometer balance, when affected by the temperature, can move slightly inwards or outwards. The simple theory is, that when the hair-spring expands in heat the rim of the balance—owing to the two metals struggling with each other—contracts, and thus compensates for the conduct of the hair-spring, and keeps the watch up to time; when, on the other hand, the hair-spring contracts in cold the balance expands, and once more there is compensation. Now, whether a watch compensates or not in different temperatures depends on the capacity of the chronometer balance to counteract with great exactness the expansion and contraction of the hair-spring. But even in the case of the best chronometer balances it is absolutely necessary to experiment by placing the watch in some cold place (in winter the ordinary temperature may be sufficient; in summer it is necessary to use a refrigerator) for a certain set period, and afterwards to put it in an oven (made for the purpose) for an equal length of time. By comparing the result of this experiment it is easy to discover how far the compensation is wrong. The error is corrected by taking the balance out of the watch and moving the screws, which may be seen studded round the rim of the balance. It is not my intention at this moment to go into the question of compensation, and I have merely explained sufficient to make my meaning clear. What I wish to establish is that, even with a first-rate compensation, or "chronometer," balance it is absolutely necessary to experiment in hot and cold temperatures before one can be sure that the balance is not more injurious than beneficial to a watch. But I will venture to say that perhaps not more than two or three watches in a thousand are tested in this way. Yet there are thousands upon thousands of watches turned out of the factories with, as I said before, all the parade of the chronometer balance. Chronometer balances in all cheap watches are, unless by sheer accident, not only useless, but worse than useless. A first-rate chronometer balance costs, from the maker (counting nothing for its application to the watch and for compensation), one guinea. Those used on the average run of English-made silver watches cost one shilling. Those on the average English-made gold watch cost about two shillings. Neither of these would compensate if they were tried; and they are not tried. Hence, when the public purchase a watch possessing this wonderful chronometer balance, it is simply

a delusion and a snare. I will now show how an amateur may, with a little attention, test the compensation of his watch. The two temperatures in which he must try the watch should be about forty degrees apart from each other—not more than forty are necessary. How is he to get these two temperatures without an ice-box and an oven? Easily. Select a door beneath which there is a cold draught, and lay the watch on the floor in the draught. This will do for the cold temperature. For heat, use the fender or the hob, or any convenient place connected with the fire, where the temperature will not exceed, say, ninety-five degrees at the very utmost. I take it that you will thus get something like fifty-five degrees in cold, and about ninety in heat. Wind your watch carefully to the very top, set the seconds hand with some reliable timekeeper (the hand must be set at one spot on the dial—say exactly at the 60, because dials are always inaccurately divided), and then lay your watch on its back for six hours, and mark the variation by comparing it again with the reliable timekeeper. It is understood that you have an accurate thermometer lying beside the watch, and that you make a note of the temperature reached. Then wind up the watch once more, set it in a similar way, and place it in a convenient place, on its back, near the fire, together with the thermometer. At the end of six hours compare again for time, and you will find the error in compensation. It may be ten seconds slow in cold and ten seconds fast in heat—an error of twenty seconds in six hours, or eighty seconds a day. But unless you have a good balance in your watch you are absolutely helpless, for no alteration can be made in a sham balance. I would just add that when putting the watch near the fire a place should be selected where the heat will come very gradually and gently, and the thermometer should be observed every quarter of an hour, so that the heat may not be allowed to exceed ninety-five degrees. If the mercury should be rising rather rapidly, simply move the watch a few inches further away from the fire. With these observations I conclude my labours in connection with the present volume of this useful and interesting journal, and I can only hope and wish that my "hints" have done some little towards instructing and entertaining its readers.

PARAFFIN LAMPS.

BY THOMASO.

Lamp for Gas Bracket—Lamp for Organ or Piano—Hanging Lamp for Shop—Shades—Filling Can.

We pass now to a different kind of lamp: one that can be screwed into any existing gas-fitting if the burner is removed. Fig. 39 gives a view of it. It is well suited for a bedroom or a dressing-room, in which case one each side of the chimney-breast would look well.

It is very similar to the lamps already described as far as materials and method are concerned. The reservoir is formed of half of one of the "shells" previously mentioned, with the edge cut off down to the arrow in Fig. 18 (page 696), and a circle of brass cut out to fit in. The burner is soldered on as usual, and three pieces of brass, like A, B, and C (Fig. 19, page 696), but upright instead of leaning at an angle, are soldered on the top to take the wires supporting the shade. A piece like D (Fig. 19) has a thread cut on it to match that on the gas bracket, and is then soldered with the threaded part projecting through the bottom of the reservoir.

The top is now tinned all round the edge on both sides, and soldered on. A file is passed over the edge of the shell to take off the sharpness and get rid of the superfluous solder, after which finish off as usual.

The shade is different to those previously described and figured. It is commonly used for the French reading lamps. Size, six inches across the rim: price, 1s. 6d.

You will notice that its shape permits it to drop right through the gallery. To prevent this, it is necessary to either solder little bits of stout wire inside the rim of it to rest on, or let the supporting wires project through about ½ inch before soldering them.

You will, of course, try the gas bracket, to see if it is at all shaky, but whether the bracket is firm or loose, it is desirable to put as little weight on it as possible. This is one of the reasons why I have figured the lamp as having only half a reservoir, so to speak, and with only a small shade.

As this lamp cannot stand when taken off the bracket for any purpose, such as cleaning, it is necessary to stand it in something—a gallipot, for instance. The gallipot might have a piece of wood with a small hole in the top fixed in it. The hole would receive the projecting screw, and the reservoir would by this means be prevented from turning over sideways.

The next lamp (Fig. 40) is intended to provide light for players of the organ or piano. Most of the American organs are provided with a flat-topped bracket, obviously intended for a lamp; and pianos all have candle sconces, even the cheapest. Perhaps it would be more correct to say "even the best," the rule appearing to be "the worse the piano the better the sconces."

The figure needs very little explanation, being very similar to Fig. 39. You need not cut the edge of the shell off before soldering in the bottom, and the part projecting from the bottom will not be wanted if the lamp is intended to stand on a flat surface; but if it is intended to fit in a sconce, the piece must be added. It is merely a short piece of tapering tube made of the sheet brass, of such a size that it fits tightly into the sconce intended to receive it.

If, as is generally the case, the hole should be too shallow to give the lamps a firm hold, it is better to make the tube parallel, and make it fit over the *outside* of the sconce. It will then be safe enough—unless you happen to be a Rubinstein.

The reflector is principally intended to keep the light off the eyes, and is made of the sheet brass carefully flattened, and then bent round on anything handy—a gallipot, for instance. The hammer must not be used to bend it, or when the light shines on it it will present the appearance of a piece of ancient hammered brass work—all dents. A piece of the ½ in. by $\frac{1}{16}$ in. flat brass wire is soldered on to support the reflector, and a little piece of metal soldered on at M, as shown, to prevent the reflector slipping down too far. Two little strips of metal (thin) are soldered on the reflector to admit the end of the flat wire, the whole arrangement being shown at A in the figure. Polish up as usual, and you can then inaugurate the new lamp with selections from "Aladdin." I do not know if there is a composition of that name. I hope there is, for the sake of the joke.

It may be that you have a dark landing or passage which you wish to illuminate. A simple form of lamp suitable for this purpose is that shown at Fig. 41. It needs very little description, most of the operations connected with it having been treated of in the descriptions of the other lamps. It is intended to be hung on a nail—a brass-headed one preferably—and is fitted with a reflector. Brass is the metal used throughout.

The reservoir is of the shape and may be of the dimensions shown, and three inches high. The top is slightly larger than the bottom, and, in fact, the whole reservoir is an exact copy of the front part of the reading lamp reservoir (Fig. 1, p. 480), to the description of which I must refer you for further directions as to soldering, etc. The piece forming the sides is soldered to the top, and the two are then soldered to the back piece, and the bottom soldered in. The back is nine inches high, and may be of the shape shown. It *must* be wired with stout wire at the edges, unless made of thick plate—a very wasteful proceeding—and have a hole shaped as shown. A piece of the ½ in. by $\frac{1}{16}$ in. flat brass wire is soldered to the back to support the reflector, as shown. The latter is fitted and made exactly like that in Fig. 40, with the exception that the radius is greater. Tilt the reflector forward at the top, so that the light is thrown on the floor, where it is wanted—not in people's eyes.

I have now come to the end of the domestic lamps, and I think I may as well give the shopkeepers a turn, particularly as they seem to be taking so kindly to lamps. I expect they find oil comes cheaper than gas, and they have no heavy gas bill to look forward to—a great consideration with gas burners generally, and especially in the eyes of a struggling shopkeeper.

By far the most common form of lamp used in shops is the hanging lamp, something after the style of Figs. 42 and 43. Another style is the gas-bracket lamp. I will deal with the latter first.

The reservoir is best made like Fig. 39, although, of course, there is no objection to making it like Fig. 40, and I think Fig. 40 looks best. In either case the screw must be soldered in the bottom.

It is not advisable to have glass shades of any size on gas-bracket lamps. Paper or card answers every purpose, and lasts a very long time. Fifteen inches is a good size for the shade. To support it, we shall need an arrangement rather different to that already described. It consists of the common wire skeleton that is seen in shops, with the ends of the wires supporting it secured to the burner.

To make it, proceed as follows: turn the tin or card shade bottom upwards, and make a ring of tinned iron wire ½ in. larger all round than the hole in the top of the shade. Make another ring ½ in. smaller all round than the edge of the shade. Drop both rings into the shade, joining them together by three or four pieces of the wire, and solder three or four pieces of the wire to the largest ring, bent to the shape shown in Fig. 45, to support the shade. Use plenty of solder at the joins, making it run as in Fig. 44, where the black part represents the solder.

Now make a hole in a piece of stout brass plate large enough to permit it to drop over the burner, and fit rather tightly where indicated in Fig. 2 (p. 480) by the arrow. Cut off the superfluous metal all round until a ring is left ½ in. wide. Drill holes equidistant, to admit the ends of the wires supporting the

shade, insert them a little way through, and solder on the under side—the arrangement being shown at Fig. 45. The lamp is now finished, and can be screwed on to the gas bracket.

The hanging lamps of the style previously described appear to me to be too good for a workshop or any rough trade. I therefore give two designs for cheap and simple hanging lamps.

The first one (Fig. 42) is suspended by means of a piece of the flat wire bent as shown, riveted and soldered to the ring supporting the reservoir, which ring can be made of the same thickness wire ($\frac{1}{16}$ in.) in both these lamps, as very little strain comes on it.

To secure uniformity in the opposite sides of the wire, it is necessary to draw the outline of one side on a piece of paper, and then bend the wire to it. The height from the top to the middle of the reservoir may be two feet in both lamps. A hole is made in the top, and an S-shaped hook is inserted by which to hang it up, and the lamp should be further provided with a disc known as a smoke consumer, which must be about six inches from the top of the chimney.

The shade may be of tin, not less than fifteen inches in diameter, and made as previously described. The figure explains how the shade is kept from falling.

If desired, the cost can be still further reduced by making the reservoir entirely yourself of sheet brass, or even tin plate, of the shape shown in Fig. 43. It is made in three parts, two coned pieces having their edges lapped $\frac{1}{8}$ in. over the edge of the central part. The diameter of the latter is $5\frac{1}{2}$ in., and the holes at the small ends of the cones are to be sufficiently large to just admit the screw collar of the burner, which is allowed to project slightly inside, and then soldered.

Three or four holes are made in the central part, and rivets put through from the inside, and soldered, with the ends projecting. This prevents the reservoir dropping right through the ring. A circular piece of brass, the size of the hole, is soldered in the cone intended for the bottom, and the two cones are soldered on to the central part, the overlapping edges being first tinned. Clean off the superfluous solder, and polish up.

The gallery for the shade is made of $\frac{1}{4}$ in. by $\frac{1}{8}$ in. flat wire in the way previously described. Wire $\frac{1}{16}$ in. thick would be too thin, and probably result in the gallery getting bent oval in form. Rivet it in place as shown, by means of two little pieces of the $\frac{1}{16}$ in. flat wire, taking the precaution to solder before riveting, in order to prevent the work twisting. This applies to all parts that are riveted in these two lamps.

It is as well to put a little paper cap over the top of the chimney of *any* lamp while it is not being used. It keeps out dust, and reduces the amount of cleaning necessary.

A filling can (Fig. 46) is almost a necessity. It is made of tin plate, the dimensions being—diameter, 5 in.; height, 6 in. It has a coned top, as shown by the dotted line, the edge of the latter being turned over on to the sides, so as to get a lapped join. A handle is soldered on, and a spout made of $\frac{1}{4}$ in. brass tubing, strengthened by a piece of tin soldered to it and the body. The handle and the mode of strengthening the spout can be copied from any toilet water-can, except the new-fashioned ones. A lid is made either to work on a hinge or pull in and out like a kettle-lid. A rivet is soldered on to form a handle; or better, a small leaden handle like those on the cheap kettle-lids.

This completes the present series of lamps. I know soldering is not in favour with amateurs, the majority of whom consider it rather *infra dig.*, and call it hard names, such as "tinkering!" But I expect it is a case of sour grapes.

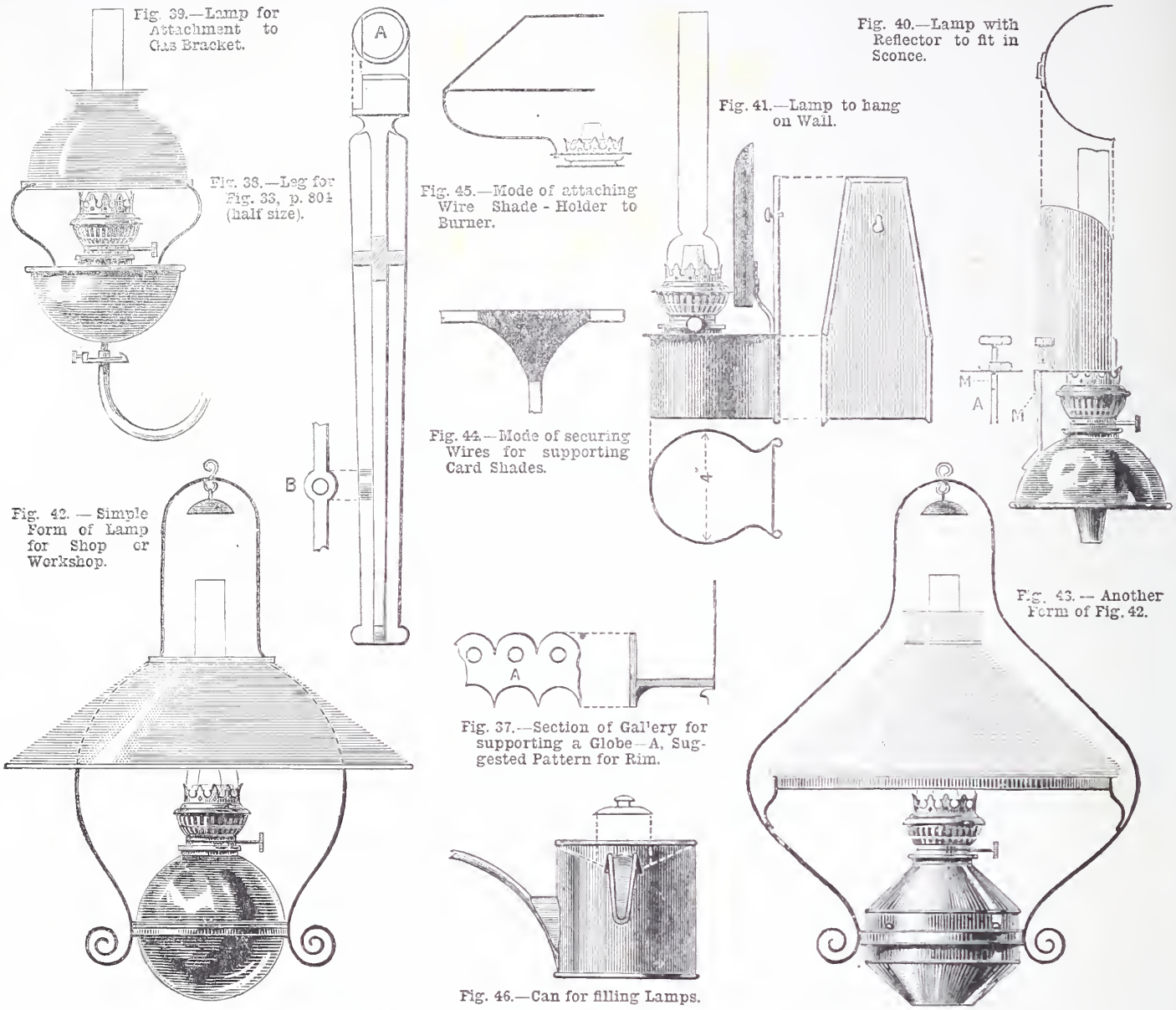


Fig. 39.—Lamp for Attachment to Gas Bracket.

Fig. 38.—Leg for Fig. 33, p. 804 (half size).

Fig. 45.—Mode of attaching Wire Shade-Holder to Burner.

Fig. 41.—Lamp to hang on Wall.

Fig. 40.—Lamp with Reflector to fit in Sconce.

Fig. 44.—Mode of securing Wires for supporting Card Shades.

Fig. 42.—Simple Form of Lamp for Shop or Workshop.

Fig. 43.—Another Form of Fig. 42.

Fig. 37.—Section of Gallery for supporting a Globe—A, Suggested Pattern for Rim.

Fig. 46.—Can for filling Lamps.

It must, however, be admitted that "tinkering," as they call it, is not one of the pleasantest or lightest of hobbies; but then, it has the great merit of being useful. When you feel tea-time coming round, just think who is the most useful member of society—the man who can stop a leak in the kettle or put a teapot in working order, or the man who can turn out wonderful ivory and hardwood knick-knacks? Verdict for the tinker, of course, on the principle of "Ease before elegance."

In this and the preceding papers on the same subject I have endeavoured, and, I trust, not without success, to unfold the mysteries of lamp-making, and to show any handy man how he may make his own lamps if he be so minded. Such an one, however, must always bear in mind that strong clean soldering is impossible unless the parts are clean and fit. Even a dummy at soldering would probably turn out better work, if he fitted it well, than the professional who had to solder badly-fitting work.

I would therefore, in conclusion, impress on beginners in the art (for it *is* an art) one very useful piece of advice, which ought to be hung up in every amateur's workshop, and *always* kept in mind—

"Above all things, be exact."

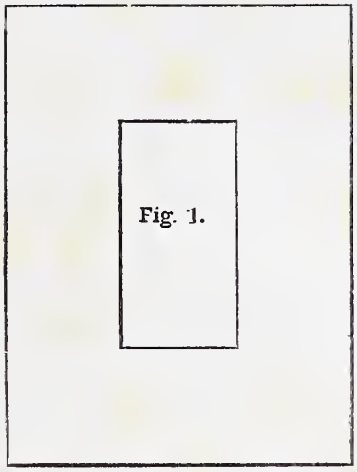
There is nothing that stands on the same level with exactness except punctuality and regularity, and if a man be punctual, regular, and exact in the present day, he stands well ahead of the general ruck of humanity.

A NEW DECORATIVE MATERIAL.

BY LAWRENCE C. LITTLE, C.E.

Most people are familiar with the bast mats so largely used for packing purposes, by gardeners for protecting trees from frost, etc., etc. The material from which these mats are made—bass, or bast—is the inner bark of the lime or linden-tree. It is also called *liber* (Lat., the inner bark of a tree), and was used, long before the invention of paper, for writing upon—hence the term *liber*, a book or writing. After a process of steeping in water, the layers of bast are easily separated from the outer bark, and, after drying, are manufactured into ropes and lines, into matting, even into a kind of shoes, etc., by the peasants of Russia, whence the great bulk of this matting comes to us, millions of these mats being used by this country alone. In some parts of Europe bast hats are also made, after the manner of straw hats.

Looking about recently for a mount for a drawing, and feeling dissatisfied with the effect of ordinary white, gold, or tinted mounts, I resolved to try some kind of canvas or cloth of coarse texture, when a piece of ordinary bast mat hanging within sight decided me to try the effect of this material as a medium for producing decorative results. The result was highly gratifying, and I propose to show here, very briefly,



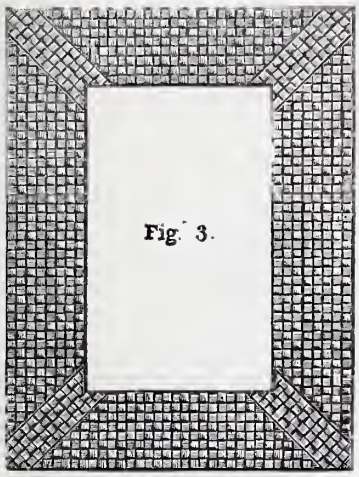


Fig. 1.—Cardboard cut for Mount.

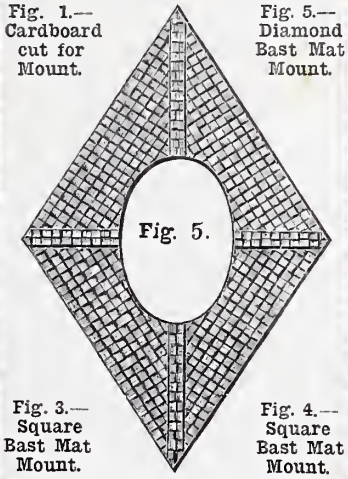


Fig. 5.—Diamond Bast Mat Mount.

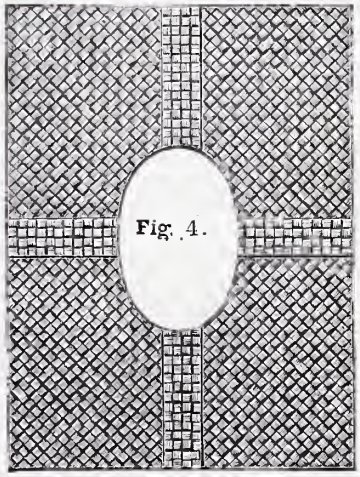


Fig. 3.—Square Bast Mat Mount.

Fig. 4.—Square Bast Mat Mount.

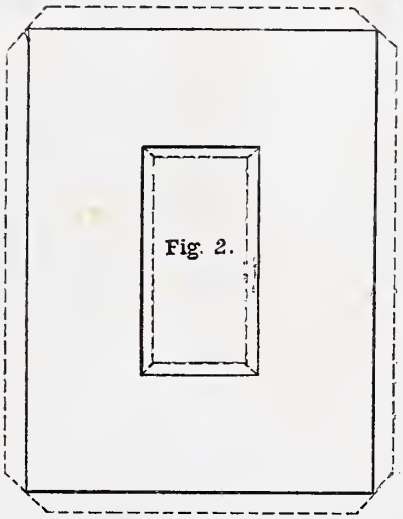


Fig. 2.—Cardboard Mount as in Fig. 1, with Overlay of Bast Mat cut for covering it.

for the benefit of Work readers, how the material may be applied.

Suppose, then, that a mount of the form in Fig 1 is to be made, 24 in. by 18 in., with opening of, say, 12 in. by 6 in.; cut out a mount in the ordinary way from a piece of stiff millboard or any other suitable material. Stretch lightly and evenly, face down, on a board, a piece of bast matting somewhat larger than the mount; give the back a good equal coating of starch or flour paste, but not so as to go through to the face, and allow to dry, when the loosely plaited matting will be found to be firmly bound together, and capable of being cut or folded without the ends of the strands fraying out. When quite dry, fasten the cut-out mount down on the mat with strong glue, and cut away all the superfluous matting, except about half or three-quarters of an inch (according to the thickness of the mount) all round the edges, both outside and inside, as shown by the dotted lines in Fig. 2; fold the margins so left neatly over on the back of the mount, and fasten down in the same way; lay a flat board with a few weights on the work, and allow it to set. Finally, fix the picture, and cover the back with strong paper or bookbinders' cloth.

If the mount so made is to be protected by glass, nothing further is required, and the effect is very pleasing for many kinds of pictures; but if it is to be without such protection, it is obvious that dust would, in course of time, lodge in the interstices of the matting. To prevent this, a coating of good strong size, made of transparent glue, should be carefully worked over the surface, so as to fill up the spaces between the strands, and make the surface solid, without destroying the effect, and, at the same time, leave it in a condition for varnishing, painting, or gilding. Size made with gelatine and a small proportion of bichromate of potassium will, after exposure to sunlight and air, give a surface which will not be affected by moisture, so that where a "shiny" surface is an objection, no varnishing is required. The bichromate will slightly darken the bast if too much is used. So far as I have yet seen (my attempts have been wholly tentative), the natural tones of the matting, slightly varying with almost every strand, from nearly white to golden brown, are far more artistic than any painting could ever make them, unless done by a person of great taste and experience. To preserve the characteristic texture of the bast, any painting, enamelling, or even gilding, must be very delicate. Staining or dyeing would be suitable for some work, but should be done before the coating of paste is put on.

A good plan, when a mount to put under glass is required, is to make liberal use of fine starch paste (two or three coats), and, when quite dry, simply to cut out the mount from the matting of the exact size with a sharp knife, without folding over the edges. Broad mounts are always more effective than narrow ones.

Even waste cuttings of the matting can be very artistically arranged to produce effective mounts and frames, as will be readily understood from the rough sketches, Figs. 3, 4, and 5; and the *modus operandi*

is so very simple, and the material so cheap, that anyone, with care, may successfully undertake the work. The bast should, of course, be quite clean, and free from sharp creases. If any objection should arise from the peculiar smell of the bast, it may easily be removed by incorporating with the paste a little carbolic acid, oil of rosemary, or some such substance, but after exposure to the air for a short time I do not think even this will be necessary.

Picture frames and mounts only have been dealt with here, but it will be evident to readers that bast matting can, with advantage, be applied as a decorative material to many other purposes, such as draught and fire-screens, boxes, wall brackets, etc., etc. Other kinds of matting, such as "tea" mats, which are woven with smaller and more equal strands, would make very pretty mounts; but the very irregularities, both of size and colour, of the common bast mats constitute the great charm of the work when finished.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any-one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

130.—Model Electro-Motor, Siemens Type.

Amateurs who are interested in electricity and all that pertains to it will be glad to know that Mr. H. Atkinson, 137, Stamford Road, Handsworth, Birmingham, is now supplying model electro-motors of the bridged Siemens type. Each motor is constructed in the most effective manner with soft malleable iron field magnets and armature and gun-metal fittings. The brushes are held on an adjustable rocker by adjustable brush holders. The little machine sent as a specimen is nicely got up and mounted on a polished oak base 10 in. in length by 8 in. in breadth. The gun-metal fittings are polished bright. The exposed iron is japanned black, and the wire coils coated with red sealing-wax varnish. This little motor will work a small sewing machine, fret machine, or dental lathe, when driven with a current from a battery of some three or four-quart size chromic acid cells. The price of the machine, complete, is £2 2s. Any amateur wishing to try his hand at making one of these can have a full set of castings for 3s. 6d., and wire to wind them for another 2s. The castings are very clean, and are in themselves good value for the money asked for them. So desirable and useful does this machine appear to be, that Mr. George Edwinson Bonney has undertaken to write a paper on its general construction and the fitting of the castings in putting them together, which will shortly appear in the pages of WORK.

131.—Hints on Wood-Carving.

"Hints on Wood-Carving, Recreative Classes, and Modelling for Beginners," to give this book its full title, is a most useful and exhaustive work on the subject, written by Miss Eleanor Rowe, the accomplished manager of the School of Art Wood-Carving, City and Guilds Technical Institute, Exhibition Road, Kensington, S.W., and published with the sanction of the Committee of the School of Art Wood-Carving, where it may be obtained for 1s., or of Messrs. Sutton, Drowley and Co., 11, Ludgate Hill, London, E.C. Coming from the source from which it emanates, it bears the impress of authority, and imparts information reliable in itself, and therefore valuable, thoroughly practical, and sufficient in every respect for the requirements of the learner. The preface is written by Mr. J. H. Pollen, a member of the Committee of Management, who bears ample testimony to the skill and proficiency of Miss Rowe as a wood-carver and as a teacher of the art. The book shows the system of training followed at the School of Art Wood-Carving, and treats of the implements required, the selection of wood, the methods of grounding, the formation of recreative artisan classes, stains and varnishes, the taking of casts from work in the wood, and modelling as applied to wood-carving. The illustrations are most effective, many of them exhibiting what may be termed fac-simile reproductions of wood-carving so faithfully rendered that it would be almost impossible to fail in imitating them successfully in wood.

132.—Original Designs for Repoussé.

This is the second series of Original Designs for Repoussé issued by Mr. T. J. Gawthorp, 16, Long Acre, London, W.C., at 1s. I trust I have not fallen into error in giving his initials, for I notice that this able craftsman in all kinds of metal work invariably subscribes his designs in true baronial style with "Gawthorp" only, as if to intimate that he is *the* Gawthorp, as he really is; and, that being so, he ought to share the privilege attaching to Sir John Monckton, the Town Clerk of the City of London, of signing all civic proclamations with his surname only. I strongly recommend all repoussé-workers, and wood-carvers too, to invest a shilling in this book of designs, for while every pattern that is given therein is well suited for the purposes of the former, there are many that the latter may utilise as designs for wood-carving, far more attractive in their quaintness of form than the stereotyped scroll-work and flowing foliage of the Renaissance period, of which it is possible to get tired by reason of their endless repetition and reproduction. For example, the centre for an alms basin exhibiting the emblems of the four Evangelists might well be turned to good account for carving in wood, with many others of the designs which would readily lend themselves for adaptation for this purpose. Taken through and throughout, the book is a good shilling's-worth, and is further useful for bearing on the back of the wrapper a list of materials, tools, etc., required for repoussé-work, with prices, and Mr. Gawthorp's terms for lessons in this fascinating art-work, which deserves to be taken up by amateurs far more enthusiastically than it seems to be.

133.—"The Photographic Reporter."

This is a handsome monthly magazine, devoted to the advancement of photography, edited by Mr. Charles W. Hastings, editor of *The Amateur Photographer*, *Photographic Quarterly*, etc., and printed and published at 1s. by Messrs. Hazell, Watson & Viney, Limited, 1, Creed Lane, Ludgate Hill, London, E.C. It will be interesting to photographers generally for its papers, its summary of society's meetings, its Directory of Photographic Societies, and the notices of the Monthly Photographic Competitions held under the auspices of *The Amateur Photographer*. Several excellent reproductions of good photos of persons, places, and things will be found in the part which bears date January, 1891.

134.—Taylor's Shilling Book of New Fretwork Designs.

There is certainly plenty for the money in this book of designs, printed and published at Taylor's Fretwork Manufactory, 18, Melbourne Street, Blackpool, at 1s., as the title declares. I cannot say much for the originality and beauty of the designs, which seem to lack in quality the inducements which abundantly exist in quantity. Some of the designs are easy for beginners, but more than this it is not possible for me to say. Simplicity in design is one thing, and poverty of conception in form is altogether another. Young fretworkers should always select patterns which, however simple they may be, are likely to look attractive when cut. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

**** In consequence of the great pressure upon the "Shop" columns of WORK, contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.

I.—Letters from Correspondents.

Fire-Lighting Apparatus.—J. M. (*Manchester*) writes:—"To reconcile H. G. (*Dewsbury*), in No. 99 of WORK, to accept the sound advice of C. C. C., the fire-lighting apparatus he describes was introduced to the public some twenty-five years ago; *but it didn't 'go.'* Why, I cannot tell, but surmise the trouble and expense of keeping the indiarubber pipe free and tight would be the nuisance, as gas exercises a solvent action on rubber, especially common or inferior qualities."

Domestic Gas Governor.—Mr. John Mangnall (*Harpurhey, Manchester*) writes:—"I thank you for the liberal notice of the gas governor designed by me in No. 98, but as you remark that you cannot see how it can effect the purpose except in design, perhaps a few more supplemental remarks on gas governors may be generally useful, if it is not trespassing too much upon your space to the exclusion of others. As you remark, there is nothing so satisfactory as a practical test, and if you desire to acquaint me with the most acceptable size—viz., for ½ in. or ¾ in. supply pipe—I shall be glad to forward you one of the domestic gas governors; and if it corrects the erratic nature of your gas bills, as humorously described in a past number of WORK, I shall share the pleasure with you. All gas regulators or governors are of one of two types. First—Regulators, of which the 'Carnaby' is the premier type, and merely control the supply of gas to the meter from the main top at will; they consist of a communication from some convenient place by means of flexible cords or wire to the main supply cock, whereby the supply can be regulated from absolute 'cut off' to anything between it and absolute 'full on;' they are usually furnished with a dial, pointer, and key, so that the degree of change may be noted. This type is very popular with houses of public entertainment, where a full supply is frequently required to be altered to just a few lights, the dial above referred to generally being marked with the corresponding number of lights the supply is regulated to. As may be already inferred, this type regulates the gas *before* it enters the meter. The second type differs from the above in being automatic in action, by regulating the pressure at which the gas is allowed to flow through the supply pipes, as already asserted. Gas companies are compelled to supply gas at higher pressure than it is economical to burn it, and as the velocity of flow through the supply pipes is directly in proportion to the square roots of the pressures, more gas is frequently driven through the burners than can be economically used. It is generally accepted that the most economical pressure to burn gas at, *for illuminating purposes*, is from $\frac{2}{10}$ to $\frac{3}{10}$ of an inch water column; some even prefer the pressure as low as ¼ in., or technically called $\frac{1}{40}$, and to reduce the ever fluctuating higher supply pressures to the desired constant lower pressure is the special function of the gas governor proper. These contrivances, and they are very numerous, all act upon *one* principle—viz., the employment of the supply pressure to operate upon a throttle valve, which reduces the volume of the supply for consumption proportionate to the main pressure by a ratio equal to the diminished volume held by the gas under pressure. This type of governor may be divided into two species. First—Those that receive the main supply pressure in a bell receiver, trapped hydraulically as a gas holder, the liquid used being water in those constructed of unusually large dimensions for gas works to supply the mains, and mercury in those for business and private establishments, who are consumers. The second species is simply a diaphragm to receive initially the main supply pressure; the motion of the bell in the first species and that of the diaphragm in the second actuating the throttle valve, and thus regulating the supply for consumption in both cases. Hitherto, the second species have relied upon some membranous substance—such as leather, bladder, etc.—from which to construct the diaphragm, which absorbing moisture was liable in cold weather to become frozen, and, as a matter of sequence, inoperative; and as this occurred altogether in those months when gas was most used for illumination, they naturally fell into disfavour. The *sole merit* of the domestic gas governor designed by me, and the subject of your notice, is that the diaphragm is constructed of metal in the form of a corrugated disc, and, as a matter of course, not materially affected by changes of temperature; it also enables it to be produced at an exceptionally low price, as the whole carcase can

be built of sheet metal with soldered joints, as is the case with gas meters."—[What I said was this: "I do not gather that it exists except in design"—that is to say, that as no specimen accompanied your letter, I could only suppose that you were writing in reference to the principle only, and not on an invention which was actually in the market. I wish to see specimens of articles to be noticed whenever the expense of sending them for inspection is not too great; and it is always desirable that price, etc., should be mentioned. Anyone wishing to adopt the domestic gas governor now has it in his power to communicate with you direct.—ED.]

Errata.—G. E. B. (*Lewisham*) writes:—"On page 757, Vol. II. of WORK, will be found an illustration (Fig. 59) showing how to wind the field-magnet cores of a Manchester dynamo. In this, the right-hand core is shown with the coil of wire coming to the front, and passing to the right of the core. If wound in this way, the machine would not work. The coil should be wound around this core in the opposite direction—viz., from right to left, so as to give a north polarity to the lower arch and a south polarity to the upper arch."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Cleaning Lawn-Tennis Balls.—F. R. (*Sutton Coldfield*).—Lawn-tennis balls may be cleaned by brushing them with a hard, dry nail-brush. They must first be thoroughly dried, but not in too warm a place. Ayres sells a circular machine-brush for the purpose, but it is not so effective as the hand-brushing, although the latter takes both time and patience.—C. T. S.

Restoring Drawings.—J. M. (*Middlesbrough*).—The sepia drawing to which you refer will require treating by an expert; no amateur should attempt to handle it if it be valuable; if not, it is scarcely worth the trouble. The most dependable restorer I can refer you to is Wm. Grisbrook, 6, Panton Street, Haymarket, London, S.W. If you write to him, you may mention WORK. For instructions in picture-frame making, you cannot do better than write for the little book on that subject, published by George Rees, 41, Russell Street, Covent Garden, W.C. It is issued at about 1s. Mr. Rees also supplies all materials required, such as tools, mouldings, backboard stuff, mount boards, etc.—F. B.

Tubing and Lenses.—T. T. (*Northampton*) writes as follows:—"Will O. B. kindly give information to T. T. in 'Shop' as to length of tubing, diameter and focus of lenses, distance apart of each lens for making telescope of twenty miles' range, and also best place to procure brass tubing and lenses." Now I call that a sensible letter—one can just see exactly what the writer wants, at any rate. Sometimes letters come to hand, and it is almost impossible to understand what is required. I would just say here that shortly I purpose placing in the Editor's hands articles dealing with the whole question of telescopes and stands. The questions submitted by T. T. are brief and pointed, but involve too much to be compressed in "Shop"—at least, I fear the Editor would think so. I will, however, answer briefly. O. G., 2 in. diameter, and, say, 30 in. focus; body tube, 20 in. long by 2½ in. internal diameter. Eyepiece, say, field lens, 1 in.; focus eye lens, ½ in.; separating focus, ¾ in.; this to fit into a sliding tube for focussing. This certainly would be a telescope of twenty miles' range. But what does T. T. want to see at that distance—a fly brushing its wings or a full-rigged ship? "Twenty miles' range" is a mysterious phrase used by *shopticians*. When I want optical materials, I generally apply to Mr. Lancaster, Colemore Row, Birmingham; he always serves me well, but there are other places in abundance where the lenses may be obtained. I believe Mr. L. also supplies tubing. I have got some from Messrs. Staunton, 21, Shoe Lane, Fleet Street, London. I would further add that the Editor has in hand a short article on Eyepieces, which will no doubt appear at some future date, and which will give T. T. and others all information as to the construction of eyepieces of various focus. That being so, it is not advisable to discuss the question at length here. I shall be glad to answer any other question if able.—O. B.

Cleaning Lacquered Brass Ornaments.—C. W. G. (*Belfast*).—If you examine your vase, you will most likely find that the three supports you mention are screwed on. I should advise that you take these off, and as you say they are plated, I should clean them separately with a plate brush and some good plate powder (Stephenson's is an excellent one). Then as to the lacquered parts, I am afraid that if they are much tarnished, you will have to relacquer them, or have them done by a brass-finisher. You can, however, try washing them with warm, not hot, soap and water; this may freshen them up a good bit. Then rinse off with plain warm water, and let it dry of itself. If you decide to relacquer it and require advice, write again.—R. A.

Imitating Inlay.—ST. PETER'S BOY.—Do you want to imitate inlay on a design or coloured drawing of a rosewood cabinet? If so, no coloured ink could be used with the slightest hope of success. After having coloured the drawing to your idea of rosewood, paint the representation of inlay with body colour. If the drawing is only a small one, it is hopeless to expect that you will be able to get in anything like all the detail. It ought to be sufficient just to indicate the character of the inlay; so that if you want a working design of this, your best plan will be to draw it separately.—D. A.

Monogram for Fretwork.—T. M. G. (*Crewkerne*).—You ask for a design for your monogram to cut in fretwork. Here it is, and it is hoped that by transposing or shading, the same combination of letters will be found useful to others whose names may combine the capitals T. M. G.—A. C.

T. M. G.
Fretwork Monogram.

Play Box.—DITTONIAN.—Not knowing the size of your chess-men and draughts, nor how many sets you wish to accommodate, I cannot give you fuller details for a play box than I am about to do. You will see by Fig. 1 that the front can be turned to account as a marking board. To permit it to lay quite flat, the front edge of the bottom board and bottom edge of the front board should be canted and hinged, as shown by Fig. 2, in which diagram A represents the front board. For the card compartment, I should say, make it a little less in depth than the width of the cards, and have the latter laying on the slope as in Fig. 1. You might insert a small board, on the slope, at the back of the compartment, as a guide and support for the cards. My reason for advising the cards to be thus placed,

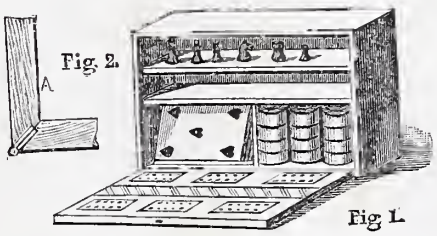


Fig. 1.—Box Open. Fig. 2.—How to hinge Front (Marking Board) to Bottom Board, in order that it may lay quite flat.

is because, if laying quite flat, the top compartments would be wider than I show them, and being so narrow in depth, their contents would not be easily obtainable; and if standing quite perpendicular they would always be liable to tumbling out. To prevent them from slipping from the position in which they now stand, fix a narrow strip of wood along the bottom of the front of the compartment. Have the latter a trifle longer than the cards, to allow for the insertion of a finger to extricate them. Dovetail outside boards together, and if nailing or screwing the remainder is not considered sufficiently strong, read "Lessons from an Old Bureau" (Fig. 20) in No 20 of WORK, Vol. I., page 309. Fasten with a hook, bolt, or lock.—J. S.

Tiles.—F. H. (*London, S.E.*).—You could not do better than try Harrison & Spooner, of Cannon Street, E.C., who deal very largely in the above.—E. D.

Architect's Price Book.—JACK.—I have no doubt the book you want is Laxton's "Architect and Builder's Price-Book," published by Kelly and Co., 51, Great Queen Street, Lincoln's Inn Fields, London, W.C. I think the price is about 4s. nett.—E. D.

Wood Buying.—JAMES.—You can get complete sets of any kind of furniture ready for upholstering and polishing from the wholesale firms in Worship Street, City Road, and Curtain Road, E.C., or from Maple & Co., Tottenham Court Road. In reply to your other inquiry, *re* selling log timber: if not otherwise stated, it is understood by the foot super.—A. J. H.

Timber Merchants.—A. P. (*London, S.E.*).—The nearest firm to you where you can get American walnut is "Ware's," Kennington Lane, S.E.; or if you are in the City, take a walk up City Road, and there are plenty of merchants who keep all kinds of fretwork cut in all sizes for use. The price for ½ in. American walnut is about 6d. per ft.—A. J. H.

Cylinder Float.—WATER.—A body to float in water must displace its own weight of such water. As water weighs 62½ lbs. per cubic foot, the capacity of any vessel to support a given weight, including its own, is easily found. For example, you want to support 112 lbs. by a float; we will suppose this includes the weight of float; 112 divided by 62½ gives 1·8 (1⅘) cubic feet as the quantity of water to be displaced. The capacity of the cylinder float is equal to its cross-sectional area multiplied by its length. The area is 0·7854 multiplied by the square of the diameter, and the proportion you take (6 in. by 3 in.) makes the length two diameters. If then d = the diameter, the cubic capacity of the cylinder will be $= 0{\cdot}7854d^2 \times 2d = 1{\cdot}57d^3 = 1{\cdot}8$ cubic feet, therefore $d = \sqrt[3]{\frac{1{\cdot}8}{1{\cdot}57}} = 1{\cdot}0466 = 1$ ft., $0\frac{8}{10}$ in. diameter. The length will be twice this—that is, 2 ft. 1⅛ in. There is no necessity to keep to these proportions, and having found the total capacity necessary, if you divide by the length of float you get the sectional area, and *vice versâ*. You must understand that in taking the weight to be supported you must include *the weight of the float itself*. Your float 6 in. long by 3 in. diameter will support a total weight (including its own) of 1 lb. 8½ oz. The float should be made slightly larger than the calculated size to overcome friction in rising through the water; the allowance to be made will depend upon the speed at which you want it to rise. This resistance varies as the square of the speed of movement.—F. C.

Walnut Overmantel.—F. S. C. (*Durham*).—I can hardly advise you to run the risk of spoiling the appearance of your overmantel by trying to make inlaid panels. As you have never done any inlaying, you would probably make a mess of it, unless you confined yourself to a very bold plain design. I would rather suggest fretwork, as you can manage it. Cut the fret in thin stuff, and lay it on a solid foundation. This, you no doubt know, is a method often practised—it is both simple and effective. The narrow panel might be covered with plush or Japanese leather-paper. The job would look much better if you had left out the rail between the two narrow panels above the centre shelf, or if you had fastened the shelf to it, and left out the rail to which the shelf is now fastened. For patterns of turning, look up back numbers of WORK, and adapt any piece of turning which may take your fancy to the sizes you require. Shoulder the shelves up to the squares of the columns, instead of putting columns between the shelves. For price of glass, why not have applied to one or other of the firms whose names have been mentioned in WORK, or to a really good cabinet-maker? There is no fixed price for glass, as there is for WORK or any similar magazine, and without inquiring we cannot tell what a particular firm will charge. Prices may vary 50 per cent., according to quality, etc. Width of bevel is a matter of taste—¾ in. or 1 in. would do very well. Please not to write to members of the staff of WORK by name, but to the Editor. Replies cannot be sent privately by post, those given in "Shop" being published *pro bono publico*.—D. D.

Rubber Stamps.—LUX ET VERITAS.—Full instructions for making rubber stamps are given in articles on pages 594 and 630, Nos. 38 and 40, Vol. I. of WORK. Materials and apparatus, including type, can be obtained from M. Lindner, 170, Fleet Street, London, E.C.; H. Savage, 33, Cheapside, London, E.C.; or from J. G. New, Parade Iron Works, Birmingham. A small outfit can be obtained from G. Smith, Park Row, Leeds; but this is scarcely more than a toy, although good work can be produced by its aid.—QUI VIVE.

Rubber Stamps.—JOHN SMITH (*Jedburgh*).—See reply to LUX ET VERITAS, above.—QUI VIVE.

Window Cornice, etc.—JOINT.—You must give a good many more particulars than you have done before I could give you any definite directions how to make your cornice. At present, all you tell amounts to this—that you have bought something to make a cornice of, and you want information on the whole subject of cornice making. To do this would only take up a few pages of "Shop," but even this space cannot be spared, so write more fully. Your communication is an admirable specimen of those vague inquiries which do not give a peg to hang an answer on. I, too, have seen a book which has something in it about turning potatoes into something like ivory, and my recollection of the process is such that I do not think you need waste valuable time in hunting it up.—D. D.

Blue Prints.—S. S. (*Erith*).—Prepare two solutions, A and B. A consists of fifteen drachms of ammonio-citrate of iron dissolved in eight ounces of water. B solution consists of ten drachms of ferricyanide of potassium in eight ounces of water. Mix the two solutions in equal quantities, and apply the mixture rapidly to paper by means of a sponge or a camel-hair softener mounted in quill, and dry in the dark. A grain of potassium bichromate added to every two ounces of the mixed solution will make the paper keep. After printing, wash well in plain cold water.—D.

Fan Mounting.—A. H. W. (*London, W.*).—Mdme. Ida, 7, Prince's Street, Regent Street, London, W. (entrance in Castle Street), intends taking up fan mounting. She has only lately commenced business on her own account, so the fan mounting may not be started yet. A. H. W. could inquire there. Also of Mrs. Heitland, Amberly Art Studios, Crouch Hill, N.—C.

Shocks from Dynamo Machines.—S. S. G. (*Walworth*).—There cannot be any shock to a person handling a dynamo giving a direct current of a low voltage. Neither can a person receive a shock by merely touching the machine with one hand, providing, of course, that no other part of his body is in circuit with the machine being touched. The law relating to induction coils also governs the current from dynamos of all types and sizes; there can be no shock from them unless your body forms a link in the circuit, or two portions of the body form a branch circuit. It is unsafe to meddle with large dynamos, or with any part of an electric light circuit in a large installation, even to touching it with one hand only, unless you are thoroughly acquainted with it, because of the uncertainty of knowing when the mere act of touching may complete the circuit, as you may be standing on one conductor of the circuit or on something in connection with it. The newspaper reports of accidents are nearly always inaccurate, because they omit unobserved details.—G. E. B.

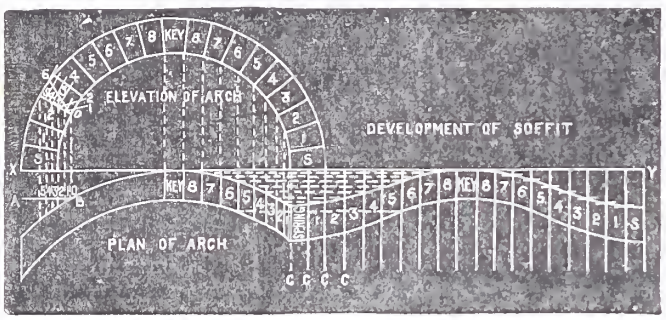
Castings of Dynamos.—READER (*Belfast*).—Castings of all the dynamos described in WORK, in the series of articles on "Model Electric Lights," can be supplied by Mr. S. Bottone, Wallington, Surrey. The Gramme dynamo castings can also be supplied by Mr. A. Crofts, Dover, Kent. Both of these gentlemen supply books giving full instructions on making and using the machines. The books cost from 2s. 6d. to 3s. each. You will find full instructions in the articles on this subject running through Vol. II. of WORK. By consulting the tables given in those articles, you will see that the larger sizes of dynamos are run at lower speeds than the smaller sizes. The quantity of wire got on the armature has much to do with the speed required for a given output, and this must necessarily be small in a small machine, because the armature is too small to admit a large quantity of wire. Try Ormiston & Co., 25 and 27, Old Street, London, E.C., for a small quantity of zinc wire.—G. E. B.

Power for Dynamo.—H. J. H. (*Homerton*).—(1) The power required to drive a dynamo of any type is governed by the output in electric current of the dynamo being driven. Thus, if you require a light of 50 c.p., you must have a dynamo capable of giving an output of at least 175 watts of electric energy, since we must reckon for 3½ watts to each c.p. As it takes 1 h.p. to furnish 746 watts of electric energy, your 50 c.p. of electric light will absorb about ¼ h.p. The efficiency of the machine will depend more upon the material and workmanship than the type. (2) The cheapest motor is a water-wheel, driven by a natural fall of water. Next to this may be classed a steam engine. To town dwellers the first is impossible, and small water motors are not admissible on all water mains. Steam engines on a small scale may be used, but require much attention. Gas engines may be used, as I have already shown. The cost at 1d. per hour, which would be about the cost for gas, would amount to 4s. 2d. per week of fifty hours.—G. E. B.

Electrotype Copies of Leaves.—E. R. (*Melbourne*).—Copies of leaves, fruit, fish, and reptiles must be first taken in plaster. Embed half of the subject in sand, put a paper rim all around to circumscribe the mould, mix plaster of Paris to the consistency of cream, and cover the subject wholly with the mixture. When the plaster has set, remove the subject carefully, and dry the mould gently; then bake hard in an oven. Coat the mould with linseed-oil, and bake again; repeat this until the plaster has been rendered non-absorbent. The inside of the mould must be coated with best black-lead, applied with a soft brush. This coat must be connected to guiding wires, and suspended in the electrotyping solution, exposed to a constant current of electricity for several hours, until the shell of copper has attained the required thickness. If both sides of the subject are to be copied, two moulds must be made, and the two shells of copper soldered together when finished. "Electrotyping," by J. W. Urquhart, and "Electro-Deposition," by A. Watt, are two useful books on the subject; both published by Crosby Lockwood & Co., London.—G. E. B.

Electrical Experiments.—J. S. (*Huddersfield*).—Some very interesting experiments can be performed with an ordinary horse-shoe magnet bought at a toy shop. Iron filings may be mixed with those of other metals, and taken out again by the magnet. A packet of mixed pins may be explored in a similar manner for the detection of iron pins. Mixed tinned brads and tacks may be assorted. Iron filings spread on a piece of cardboard, and gently struck with a straw whilst the magnet is held beneath, will arrange themselves around the poles of the magnet, and show the lines of magnetic force. Iron brads embedded in small cork boats, floating on a glass of water, may be directed with the magnet held above or at the side. With a battery and a small electro-magnet the range of experiments can be further extended. By adding an induction coil, a still larger range of experiments can be opened up. Some of these with vacuum tubes are very beautiful. A number of experiments are illustrated in "Intensity Coils, how Made and Used," by Dyer, price 1s. I hope you will succeed in alluring the lads from the pernicious influence of street corner conferences.—G. E. B.

Circle on Circle Templates.—W. O. (*Wrexham*).—For the moulds you want, first draw the elevation and plan of arch, and divide the elevation into the necessary number of parts, working from the soffit, or under side of arch; this gives the joints of bricks in elevation. From these joints drop perpendiculars to intersect plan, and this will give the plan of joints on soffit line. Next set off along the line, X Y, the same number and sizes of bricks as there are on the elevation on the soffit line, and from these points drop perpendiculars, C, C, etc., starting from the inside of right-hand springing brick. Take each distance from X Y on plan both inside and outside arch, and working from X Y, cut the perpendiculars, C, C, etc., one after the other, as sketch. (I have only shown the joints in half of plan, but as the other side is exactly the same, it is unnecessary.) If you now draw from point to point through these perpendiculars, you will have the soffit mould of bricks. A good tip for understanding this is to cut the development of soffit out of paper and hinge it on the right-hand springing line on plan, and bend it over until the right-hand springing line of development coincides with the left-hand springing line of plan. If you look down on this paper arch, you will at once see that it exactly stands over the plan. You next want the face or bed mould, and must bear in mind that the face of each brick on one half of the arch is different; the sweep of the springing bricks being equal to the curve of the wall, and becoming flatter as they approach towards an upright position. You must also note that the mould gives the *joint*, or bed—that is to say, the top of one brick and the bottom of the next. This is very important, so that a separate mould must be got for each joint, with which you mark the top of one brick and the bottom of the next. We will now suppose we want to get the mould for the joint between bricks 2 and 3; the mould will answer for both sides of the arch in the corresponding course by turning it over. Divide the joint 2, 3 into any number of equal parts, and drop perpendiculars to touch plan in 0, 1, 2, 3, 4, 5. Draw A B parallel with springing line, X Y; next draw lines square with joint 2, 3, and set off on these lines the same distances that 0, 1, 2, 3, 4, 5 are from plan of arch, measuring from A B, and draw through these points the curve 0, 6, and this will give the face or joint mould for bricks 2 and 3. I may say that this sort of arch is generally cut directly into its place and rubbed down after it is set, without any moulds except a rough centre, unless it is very large or in very good work.—E. D.



Arch Plan.

Piano Making.—I. A. (*Wheatley, Halifax*).—Your question as to whether you would be able to make a piano depends more on yourself for an answer than for anyone to tell you—for this reason, that it is impossible for me to tell your age, whether you fully understand the subject as far as you have read it, and whether you have a taste for mechanical work. I may say, there are several amateurs making pianos from the instructions given in WORK. I can only say, Try. And to try, in most cases means success. The cost to make varies according to your facilities for obtaining material. In London the material would cost about £8. Of course, London is the home of the piano-making industry.—T. E.

Piano Action.—W. J. C. (*New Hampton*).—Your best plan will be to weight the front of the key; or, if there is too much lead in the back of the key, you could remove some, and try a few keys. To weight the front, proceed as follows:—Get a ½ in. centre-bit, and bore a hole in a piece of hard wood ½ in. thick; now procure some old lead from a plumber's, and melt it in a ladle. Lay the wood in which you have bored the hole on a flat-iron, and pour the lead in. When this is cold, knock it out of the wood. This forms your weight. Now take your action out of the piano, and place this weight on the front of the key, moving it towards the back until the key is on the balance; then move a shade back, so that the back of the key just returns to its rest. When you have found the desired place, make a mark with a pencil; serve all the keys in the same way, then bore at the marks and fill with lead.—T. E.

Pole Indicator.—N. F. M. (*Paddington*).—(1) The pole indicator inquired for is made in Germany, but I do not know how it is made. Sir D. Salomons supposes it to be filled with a solution of iodine in glycerine, which turns purple at the negative pole when a current of electricity is sent through the instrument. (2) Platinum can be obtained from Messrs. Johnson & Matthey, dealers in precious metals, Hatton Garden, London, E.C. (3) I cannot say which is the *cheapest* house in London for the supply of laminated iron punchings. (4) Write to the Secretary of the Institution of Electrical Engineers, 4, The Sanctuary, Westminster, S.W.—G. E. B.

Electric Lighting.—CORBEX.—I cannot hold out any immediate hope of a *cheap* private installation of electric light. If you find the price of gaslight high, you will experience a still higher cost in attempting to light your shop and house with the electric light. At the outset you will require at least nine incandescent lamps of 16 c.p. each lamp, or eighteen lamps of 8 c.p.; these will cost, with holders, about 6s. each. The dynamo to supply the lamps with current will cost £10, and an engine to drive this will cost from £60 to £70 more. The cost of brackets for the lamps, wires for the lines, switches, and other things, together with labour for fixing, etc., will not leave much out of £100 for plant. An installation worked by battery power would be a costly and intolerable nuisance. My articles on "Model Electric Lights" commenced in the number of WORK published on August 30th. They are continued in the numbers for October 11th, November 29th, and December 20th, 1890; and January 3rd and 24th, 1891. You will learn the cost of battery lighting from the first three articles.—G. E. B.

Solenoid.—J. G. (*Nottingham*).—Get a tube of ebonite 1½ in. in length, with a bore 1 in. in diameter; thickness of sides, ⅛ in. Chase a screw thread on each end and screw these into two flanges of thin brass, ⅜ in. thick and 3 in. in diameter. The bottom flange may be larger than this, and have holes drilled in the edge to receive screws for holding down the bobbin to a wood base. Wind this with 2 lbs. of No. 20 cotton-covered copper wire, well insulated by soaking in melted paraffin wax. Leave out at least 6 in. of the commencing end to connect to a binding screw, and have the same length at the other end for the same purpose. See that the inside of the ebonite tube is quite smooth; then loosely fit into it a plunger of 1 in. soft iron, as shown in your sketch. This must be always in the tube at least ¼ in. when the supporting lever is at rest. The pull will be 1¼ in.—that is, to the bottom of the tube. To work this, you should use at least six Fuller cells of ½ gallon size, and you may arrange them as shown in your sketch, but in this case it will be advisable to have the six cells to form the outer battery, for you will not get much power from the inner battery of two cells. Of course, I have not the least idea why you want them arranged in this manner. The wire leading from the batteries to the solenoid must be of No. 18 copper, and at no part of the circuit may there be a smaller gauge of wire employed. If you have a longer length than ten yards of this, you must add another cell to the battery to overcome the extra resistance. It will be advisable to have the switch placed in a position horizontal to the connecting rod, so that the descending cam may press down the end of a lever, the other end of which is wide, and resting on a wide block of brass, say, ¾ in. square, to ensure good contact. One wire should be connected to this block, and the other to the pivot of the switch. The cam must be arranged to break contact at the right moment.—G. E. B.

Musical Box Comb.—J. O. (*Huddersfield*).—If your musical box is a fairly good one and worth the trouble and expense, you can procure a comb for 30s. by addressing the maker, stating *number*, also number of tunes, and the new tunes you require; then there will be the cost of carriage from Switzerland, or, if a German make, from Germany. If the comb is such a wreck as to require a new one, the barrel will not have many pins in perfect order upon it.—J. S.

"C" Spring Balance.—CARADOC.—You can procure all the makes of "balance springs" (hair-springs you mean, I suppose) at Morris Cohen's Watch Material Store, Leeds. You may require a *weighing machine* spring; if so, as a watchmaker, it is not in my line.—J. S.

Varnishing Frames.—J. B. (*Bradford*).—You cannot prevent oak darkening. Of course, if you use a dark varnish, your frames will look darker than if you use a colourless one. Any good varnish will do, but many people consider that oak frames look best "in the white." You can then scrape or bleach them with a solution of oxalic acid in water whenever they become too dark for your taste.—D. D.

Dry Plate.—NO NAME (*Stoke Newington*).—There is no book published especially on this subject. In the first volume of WORK you will find a series of articles on making a camera, illustrated with working drawings, which should be exactly adapted to your requirements.—E. D.

Screen.—T. B. (*Ashington*).—It seems probable that Japanese paper would suit your purpose very well, but tastes differ so much that no one but yourself can say positively. The material is quite suitable. Do not use both paper and cretonne in combination, unless you are tolerably familiar with the work. Either used alone will look well. As there are so many different patterns and colourings of Japanese paper, how is it possible, without knowing which you have decided on, to advise you on the choice of a cretonne?—D. D.

Clock Making.—NORTHERNER.—These articles will appear at the earliest opportunity.

Boot Patterns.—POOR SNOB seems under the impression that the tops have to be cut under the measure at the ball and instep, but really these two points have very little to do with the cutting of the tops, so long as they are left large enough. The measure at the joint or ball is very large in proportion to the length, therefore I should conclude you want them easy, but this has to be done in fitting up the last. To cut a pattern, place a sheet of paper on the cutting board, and place your last upon it, as shown in Fig. 1, in which the dotted lines show how to rough the pattern out. Then measure up to given measure, which is from A to B 6½ in., just half your 13 in., and from C to D, half the 9 in. (the heel and ankle measure). This is called the ground or lining pattern. You say the length is 10 in., which is about a 5. If this is the

Boot Patterns.

length of your foot, of course you know the last must be quite 7½ in. I assume this is right, as it is better in proportion with the other measures, and this being so, the pattern should measure from E to F, 10½ in., to allow for closing and lasting. Then mark off the height of vamp as at A (Fig. 2). Fold a piece of paper and lay the pattern on it, and cut to the shape of the bottom at the toe; pierce a hole at A to give the height, and from this mark cut out as from A to B. If you draw a parallel line, D B to A C, and cut out the centre of the vamp from A to B, you will find (when you draw the wing down till the point B reaches E, level with the golish, and cut off the surplus F) that this gives a spring or draft in the vamp; then cut the golish pattern. This can be cut with or without a seam at the back, where it should not be more than 2¼ in. high. The facings can be cut true to the pattern; but if button, the fly must have a spring in it, so that it will grip to the under quarter; the dotted lines in Fig. 3 show about how much straighter the fly should be to give this spring, the line A being the quarter, and the point B, when stitched to A, gives a grip to the whole of the outer edge, C C. The leg can be cut from the lining pattern by folding it up under vamp and golish, as G G. Toecap can be cut height and shape to fancy. If you have any fear of the pattern being too large or too small at the joint and instep, you can for joint measure—say it is 10½ in.—width of bottom 3½ in., and as you want ¼ in. each side to sew in, it only leaves 3 in.; this 3 in. from the 10½ in. leaves 7½ in., and half 7½ in. is 3¾ in., so A to H should measure 3¾ in., and the instep can be treated in a like manner.—W. G.

Lamp.—LANCASHIRE LAD.—Your lamp is called a "Moderator"; it is of French make. It is a lamp that has gone much out of use since the introduction of paraffin and lamps burning that oil. The proper oil to burn in these lamps is best French colza, and it costs about 6d. per pint. These lamps are on the Argand principle of circular wick and central draught, and for whiteness and purity of light and steadiness in burning they have never been beaten. They are still much used in gentlemen's houses of the old school, but the servants who understand using them and the workmen who can repair them *properly* are getting few and far between. Herewith I give instructions which will probably be of service to many a country jobbing hand who may have been puzzled by these lamps. In the first place, if it has not been used for some time it will require taking to pieces and cleaning; this will necessitate the bottom being taken off, and the spring, leather, etc., taken out. To do this, proceed as follows:—Wind the rack up an inch or two, and fix it in that position. I use a wire key (see W, Fig. 2), which slips on the round burner tube and through the wing-key, thus preventing it running down. The reason for doing this is twofold: firstly, because there is a leather plunger or piston that would be spoilt by the heat of the soldering iron in unsoldering the bottom; and secondly, if the rack was not held when the bottom was unsoldered, the pressure of the very stiff spiral spring that forces the piston down would send piston, rack, and dirty oil all over the place, possibly into the face of the operator, which I have seen happen more than once. Having unsoldered the bottom and taken it off, pour out the dirty oil, hold the lamp firmly on the table or bench (in its ordinary position), and gently let the rack down till it leaves the pinion, and the interior can then be taken out. The annexed sketches (Figs. 1 and 2) will render the foregoing and following remark clear. Fig. 1 is a view of the inside of the bottom part, or body, and Fig. 2 of the top part or burner; O is the outer case, of china or brass; I, inner case of tin. The spring, S, reaches from top of inner case to bottom, circles the rack, R, and the oil tube, T, pressing the cup leather, B, B, to which the rack is fastened, and *through* which the oil tube passes. The action of the lamp is as follows:—Pour down the neck of the lamp sufficient oil to nearly fill it, and commence winding up the rack; this draws up the piston and exhausts the air in the lower part of the vessel; the oil in the top then forces down the sides of the piston and takes its place; the piston is then above the oil, and pressing on it; the oil cannot flow back the way it came owing to the shape of the piston, so it takes another course, and flows up the tube, T, which slides into another tube on the

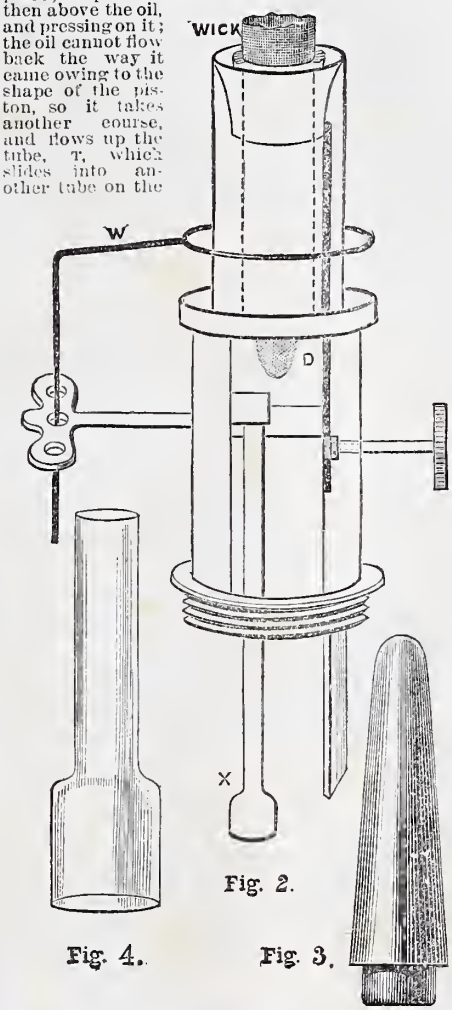


Fig. 2.

Fig. 4. Fig. 3.

Moderator Lamp Parts. Fig. 2.—Burner of Moderator Lamp (with Key). Fig. 3.—Mandrel for slipping on Wicks. Fig. 4.—Moderator Chimney.

burner (Fig. 2) at X, through which it rises to the wick. As the flow of oil through these tubes would be far too rapid for the flame to consume it, a wire, A (Fig. 1), is inserted in the tube to regulate the flow; it is from this wire that the lamp takes its name, as it is called the "Regulator" or "Moderator," as by it the flow of oil can be regulated or moderated to a nicety: how, I will describe presently. Having cleaned the inside, and also the spring, rack, and tube, and worked the edges of the leather to render it soft, clean the burner part, especially the tube through which the oil flows. This, when blown through from the end X, should let air pass quite freely and with a hissing sound; if it blows hard, work a warm wire up it and flow turps through, with occasional blowing to assist it till it is satisfactory; this is the principal part, and where stoppages mostly occur. Next put together in order as it was taken apart, keeping the rack wound partly up whilst the bottom is soldered in. This done, and the top slipped on and secured, the lamp is ready to be tried; fill with oil, and wind up gently till a gurgling noise is heard, which indicates that the piston is above the oil. Previous to doing this, however, a wick must be put in if there is not one already there. These wicks are circular and of different sizes, known as 6, 8, 10, 12, 14, and 16 line; they are slipped on to a tin ring which is soldered to the small rack in Fig. 2. Three claws, which open as the wick-holder comes above the top, hold the wick in its place; it is slipped on by means of a circular piece of wood called a mandrel, without which it is a job to get them on. After the lamp is wound up, oil should begin to flow in about seven or eight minutes from the top of the burner; it runs over and into a circular channel, and through the spout D, and drops into the body of the lamp again. Now as to regulating. The acme of perfection would, of course, be when the flow was so adjusted that the flame consumed all the oil brought to it, but this is never attained. The best way then is to get a little margin on the right side, and this is found when

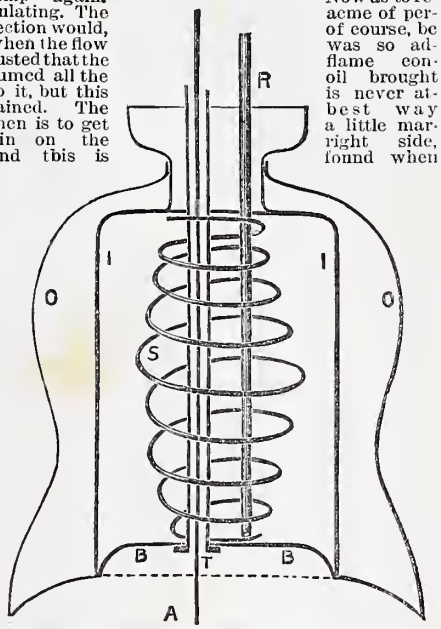


Fig. 1.—Section of Moderator Lamp Body.

the lamp whilst burning drops one drop from the spout in about ten seconds. Thus, when the lamp has burnt for five hours and has run down, by winding it again there is enough oil for it to burn for about half an hour. Should the lamp drip very fast whilst burning, it shows that the regulator is too small; to remedy, tin it with a soldering iron, or put one in a shade larger. If not enough flows through it to support combustion, the regulator must be taken out and filed a little. N.B.—This can be taken out from the top, after unscrewing the burner. Fig. 4 shows the shape of the chimney.—R. A.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Joiners' Bits.—B. A. B. (*Hampstead*) writes, in reply to A. A. W. (*Leicester*) (see page 734, Vol. II.):—"Joiners use many boring bits, and it may be at once confessed that many of the various kinds are so similar that our fellow reader may well ask, why such variety? Instead of giving a list, in order to save space I shall describe each, with its use and its most suitable application, beginning with the simplest. Such remarks as I shall make are founded on a long experience. First, the pin-bit: this is very like a gouge sharpened both inside and outside. As sold by the tool-dealers, it is sharpened only outside and obliquely, but I find that sharpened inside just a little and both the corners removed, so that the contact with the wood takes place in the centre of the gouge-like end of the bit, its cutting is improved, while smoothing and polishing all over tends to allow the chips to escape more freely: a condition which has to be obeyed in the planning of every cutting-tool. This bit is only suitable for boring at right angles to the fibre of the wood, the sharp gouge-like edge cutting freely, but in a hole of any depth the chips still have a tendency to remain; it is, however, an excellent bit if you want to bore right through. For boring top and bottom laths for Venetian blinds, etc., and boring pins to hold tenons in their mortices (from which it derives the name of pin-bit), it is first-rate—further, it is cheap. There is also a bit used by chair-makers similar to a cheese-taster; the stem is like the pin-bit, but the cutting edge is like a hollow hemisphere. This I have never used, but I have often seen work done by its aid; its advantage seems to be the improved power to withdraw the core, the rounded bottom to the cylindrical hole, and its suitability for chair and brush-making; it is not suitable for boring right through. The spoon-bit also resembles the pin-bit, but it has some attempt at a point—in outline something like a tea-spoon, but more like the outline of a Gothic window, the outline being hollowed out to form a cutting edge. This bit will bore easily, freely, and well; it will enter more exactly where the worker wishes, is quite easy with the before-mentioned, and sharpened nicely, is a most useful bit; it is strong and cheap, and is used by pianoforte makers for wrest-pins, etc., chiefly, no doubt, because it can be reduced easily to fit the pins required, and within reasonable limits it is

improved by such reduction. The nose-bit is another of similar construction, the stem like all the preceding. Its cutting edge, from which it derives its name, is like a part of the steel bent nearly to a right angle, and sharpened so that it forms a sort of chisel. To avoid catching, the corners are sharpened off. For boring across the grain it is most wayward, generally entering half its diameter away from where you intended, and it is not a useful bit to buy unless you want to bore the end-way of the grain: then the nose-bit is in its right place, efficient, and cheap. Like the preceding, it must be withdrawn now and then to remove the chips, or it gets choked. There is also another bit of somewhat similar character, which in many ways is superior to any of the foregoing. It is called half-twist or diamond on the tool-maker's list; it literally screws itself into the wood, and the chips tend to the surface. It would not do to bore holes in narrow strips of wood, but for every other purpose; it is good for boring holes in either hard or soft wood any way of the grain. It is, I believe, of Norwegian origin. There is also a bit exactly like a gimlet used largely by coffin-makers, and certainly it serves well in elm and oak, but beyond

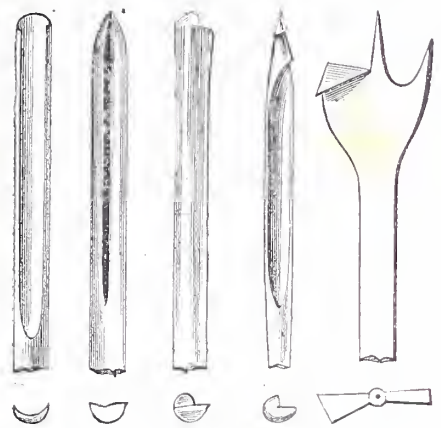


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

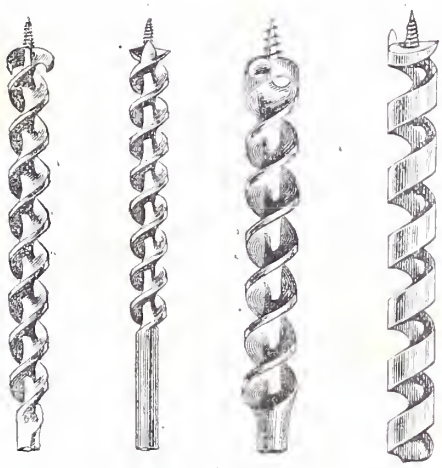


Fig. 6. Fig. 7. Fig. 8. Fig. 9.

Boring-Bits. Fig. 1.—Pin-Bit. Fig. 2.—Spoon-Bit. Fig. 3.—Nose-Bit. Fig. 4.—Half Twist or Diamond. Fig. 5.—Centre-Bit. Fig. 6.—Gedge's Bit. Fig. 7.—Jennings's Bit. Fig. 8.—Whitehouse's Patent. Fig. 9.—Mathieson's Single Twist.

that it has no special feature to recommend it. This completes the list of what may be roughly called quill-bits or pin-bits; they vary from quite small bits to about ¾ in. diameter, rarely even being made as large. They can all be obtained in a great variety of sizes, but no exact size is guaranteed, the usual plan being to bore a hole and measure it rather than to measure the bit. Centre-bits are the next: they are generally useful for boring holes larger than pin-bits, and they are much superior in the important point of boring just where the hole is required; hence for fixing locks some small centre-bits are useful for key-holes, although the before-mentioned are generally the most useful for holes up to about ½ in. The centre-bit consists of a piece of steel so shaped as to fulfil these three requirements—a centre, a circle-cutter, and a chisel to remove the core of the hole, and must be so formed as to act in the order named. A great bore in buying centre-bits is that the hole by no means agrees with the size of the bit. You want to bore a ½ in. hole; you send for a ½ in. bit, and you are annoyed to find that it bores at least $\frac{2}{16}$ in. There is, however, a remedy now, for a patent expanding centre-bit has been introduced, which I have tried, and it works well, and though the price is high, yet its purchase, instead of a multitude of centre-bits, will save money. I bought a 1 in. bit; result, 1½ in. hole, extending to 2½ in., price 3s. This extending centre-bit is the very thing for organ-builders. The patent twisted bits having a screw-centre are first-class, the only thing against them being the expense; they bore well in any wood and in any direction, relieving themselves of the chips and cutting true to dimension. Most of the patents have now expired. Mathieson's, Gedge's, and Jennings's are excellent, Jennings's being best. There is a more recent patent—Whitehouse's 'Unbreakable,' which is good. If the expense were not so great, and if the work done is always in *new* wood, a full set of these excellent bits might well supersede all others for general requirements. It is scarcely needful to say anything about reamers or taper shell-bits, etc., or countersinks, but if desired, I will do so with pleasure."

Fret Machine.—J. H. W. (*Chatham*) writes, in answer to E. J. H. (*Stoke Newington*) (see No. 99, Vol. II., page 764):—"Thinking that you are seeking a fret machine cheap, strong, and serviceable, one which will be quite as good as a first-class machine as regards work, if you make it the same as the sketch enclosed, I know it will give you every satisfaction. I have made one, as I said before, so know what it will do. My friends about me are making machines like the one I have; they are delighted with it, for it costs but a trifle—2s. 6d. will clear everything. I will describe the machine as under:—F is the arm above the table, secured so as to work easy in the slotted upright A with a bolt; A is a piece of wood slotted as in sketch, so as to

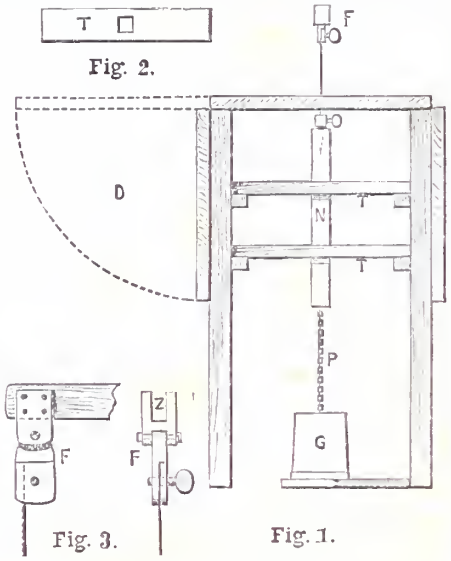


Fig. 2. Fig. 3. Fig. 1.

Fret Machine Parts.

allow the arm to work inside the slot, and secured to your table with screws to treadle; E, stay for securing the legs of machine; B, strip of wood, say, about 1¼ in. by ¾ in., screwed to table as in sketch; C are pieces of thin indiarubber, wound round the arm and your strip of wood at B. That gives you the spring, and a very good one—a small bicycle tire is very good for it; H is a stop or guard to

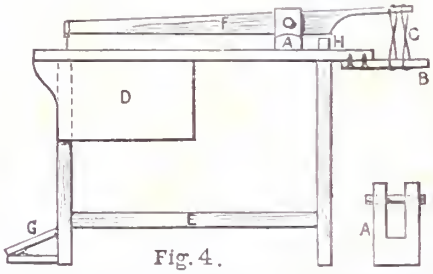


Fig. 4.

Fret Machine. Front and Side Views and Parts.

prevent your arm rising too high; F is the cramp for holding the saw, secured to the arm with screws—it is a knuckle-joint, easily made; N, a piece of 1 in. square wood with your bottom cramp driven into it; T are two stays through which N passes, and keeps it in position; D are leaves to the table by which you can increase the size, according to class of work; P, chain secured to N down to G. This machine can be made of wood, except the cramps for holding saws, and, I think, within the reach of every working man to make. I shall be only too pleased to give anyone more information about it if they will write."

V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—J. W. M. (*Stepney Green*); Accrington; A. L. W. (*Wales*); Vulcan No. 1; Romeo; E. H. H. (*Chatham*); Vulcan No. 2; W. D. (*Ireland*); R. J. (*South Devon*); Looker-On; V. W. (*Southsea*); W. B. (*Dresden*); G. H. C. (*Stroud*); T. B. (*Harwich*); Reader; J. B. (*London, W.C.*); J. E. W. (*Camberwell*); H. R. P. (*Lambeth*); Spring; W. R. K. (*North Shields*); E. F. (*London, W.*); J. S. (*Edinburgh*); East Riding; Sigma; D. A. F. (*Northamptonshire*); James; R. W. S. (*Leeds*); A. A. (*Inverness*); Kildonan; A Beginner; Young Hand; W. B. & Co. (*West Kensington*); W. K. (*Heptonstall*); Mart; R. M. (*Braintree*); A. K. (*London, S.E.*); C. E. T. (*Birmingham*); W. H. (*Stirling*); J. B. (*Ilkley*); Axle; J. G. (*Nottingham*); Fourdrinier; Faithful Reader; E. A. P. (*Beckenham*); Wheeler; B. H. (*Birkenhead*); Mason; R. H. (*Bradford*); Jasper; J. H. P. (*Liverpool*); F. H. (*Highbury*); H. B. (*Hammersmith*); C. E. B. (*Poplar*); A. W. (*Hackney, E.*); F. L. B. (*Barham*); W. T. (*Penge*); H. H. L. (*Liverpool*); J. S. (*Longsight*); F. H. (*Streatham Hill*); W. E. W. (*Wimbledon*); C. B. (*Tonbridge*); L. E. (*London, E.C.*); W. H. (*St. Helens*); Amateur; A. N. G. (*Bristol*); J. H. D. (*Halifax*); A. H. (*Cape Town*); Lathe; R. P. (*Camden Town*); Tennis; E. G. (*Urdington*); T. J. (*Cheadle*); F. M. G. (*Edinburgh*); Victor; E. G. P. (*Kingston*).

NOTICE TO OUR READERS.

With the next number of Work (*No.* 105) *will be issued,* Free of Charge, *a Fine-Art Supplement, consisting of a* Large Design for a Hanging Music Canterbury in Fretwork. *No.* 105 *will contain Papers on—*

A Writing Cupboard, with Adjustable Flap and Bookshelves revolving horizontally.
A Hanging Music Canterbury in Fretwork.
The Violin: How to Make it.
Knotting, Splicing, and Working Cordage.
How to Strop a Razor.
Wire-Work in all its Branches.
Fixing Tops of Tables.
A New Mitreing and Squaring Machine.
How to French Polish.

With Numerous Replies in "Shop" to Correspondents on Subjects of General Interest connected with various Trades and Pursuits.

An Index to the Second Yearly Vol. of Work has been prepared, and can be obtained by order from all booksellers, price 1d. It is included in the last Monthly Part of the Volume (Part 24).

"WORK" EXHIBITION.

Particulars as to the Prize Distribution, which will take place shortly at Stationers' Hall, will be announced in an early number.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	.. .. ..	1s. 8d.
6 months, "	.. .. ..	3s. 3d.
12 months, "	.. .. ..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to Cassell and Company, Limited.

Terms for the Insertion of Advertisements in each Weekly Issue.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. All Other Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail Cart Wheels. [16 R

Twelve Full-Size Fretwork Designs, post free, 7d. and 1s. 1d. Satisfaction guaranteed or money returned.—Taylor's Fretwork Manufactory, Blackpool. [14 R

Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is Lunt's, 297, Hackney Road, London, E. Send stamp for reduced price list. [8 R

Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—Willcox Brothers, 172, Blackfriars Road, London, S.E.

Lettering and Sign-Writing made Easy.—Also full-size diagrams for marking out eight alphabets, only 1s.—F. Coulthard, Terrace Road, Bournemouth. Note.—100 Decorators' Stencils (60 large sheets), 2s. 6d.

Fret, Carving, and Repoussé Patterns.—100 of either, full-size, 1s.; 300 Turning designs, 1s.; 400 small Stencils, 1s.; 500 Shields, Monograms, &c., 1s.; postage free.—F. Coulthard, Terrace Rd., Bournemouth.

FRETWORK FOR AMATEURS OF BOTH SEXES AND ALL AGES

Eclipse Design, No. 102.

Wall Bracket. Price 5d.

THE MOST PROFITABLE AND FASCINATING OF ALL HOME PASTIMES. EASILY LEARNT.

J. H. SKINNER & Co. having *Dissolved Partnership*, are offering their *Enormous Stock*, including 250,000 FRETWORK PATTERNS and 100,000 ft. of Solid and Three-Ply FRETWOOD, Veneers, &c.; 1,000 Gross of FRETSAWS, besides an immense quantity of TOOLS, OUTFITS, &c., as a special inducement to their customers to order at once.

4,500 1s. Books of Fretwork Patterns, each containing Twelve Large Sheets, beautifully lithographed, none of which would be sold retail at less than 2d., and many at 3d. and 4d. each; also

1,200 2s. 6d. Books of Fretwork Patterns, containing Twenty Sheets, 19 in. × 12 in., of new designs, many of which would retail at 6d. each. These Books,

£375 in Value, will be GIVEN AWAY.

Amateur customers ordering 5s. worth of designs from Catalogue will be presented with one of the above 1s. Books. Those ordering 10s. worth will receive a 2s. 6d. Book.

An Allowance of 10 per Cent. *in goods* will be made on all mixed orders for Wood, small Tools, Saw Blades, and Designs, amounting to 10s., and **15 per Cent.** on orders amounting to 20s. and upwards. NOTE.—*This reduction does not apply to Treadle Machines.*

N.B.—A SPLENDID OPPORTUNITY FOR BEGINNERS.

Complete Fretwork Outfit, comprising 12-inch Steel Frame, Forty-eight Saws, Awl, File, Four Designs (with sufficient Planed Wood and 1s. Handbook on Fretwork). **An Archimedian Drill**, with brass handle and Three Bits, will be **SENT GRATIS** with each Set. Post free for 3s. 6d. Outfits on Card, 1s. 6d. and 2s. 9d., post free. 6 ft. 2nd quality assorted planed Fretwood, 1s. 9d.; post free, 2s. 6d. 12 ft. ditto, ditto, 3s.; post free, 4s. 3d.

SKATES!!!—EVERY PAIR WARRANTED.—Sizes, 7½ in. to 12 in. No. 1, Unpolished Beech, 10d. per pair. No. 2, Polished Beech, 1s. 6d. per pair. No. 5, "Acme" pattern, all steel, 3s. per pair. No. 7A, "Caledonia" pattern, self-adjusting, one screw fastening the whole skate, the best principle, 6s. per pair. No. 8, Metal frame, with strap complete, 1s. 9d. per pair; postage, 5d. per pair. These are not rubbish; we warrant every pair.

NEW CATALOGUES of Machines, Designs, Wood, Tools, etc., with 600 Illustrations and full instructions for Fret-cutting, Polishing, and Varnishing, price 4d., post free. A Specimen 6d. Fretwork Design SENT GRATIS with each Catalogue; also a List of Designs, Outfits, Tool Chests, etc., at Greatly Reduced Prices to clear.

N.B.—All orders *must* be accompanied by remittance. APPLY—

J. H. SKINNER & CO., Manufacturers of Fretwork Materials, W Department, *EAST DEREHAM, NORFOLK.*

Kindly mention this paper when ordering.

For Home Decoration!!

USE

JUDSON'S 6d., 1s., and 5s. per Bottle.

LIQUID GOLD

(READY MIXED).

SOLE MANUFACTURERS,

DANIEL JUDSON & SON, LIMITED.

SOUTHWARK, LONDON, S.E.

Whittaker's Practical Handbooks.

BONNEY'S ELECTRO-PLATERS' HANDBOOK. 3s. [*Just published.*

PRACTICAL IRONFOUNDING. 4s.

"Contains much useful information for practical men."—*Industries.*

METAL TURNING. 4s. [*Just published.*

BOTTONE'S ELECTRO-MOTORS. 3s. [*Just published.*

BOTTONE'S ELECTRICAL INSTRUMENT MAKING. 4th Edit. 3s.

BOTTONE'S ELECTRIC BELLS. 3rd Edition. 3s.

SALOMON'S ELECTRIC LIGHT INSTALLATIONS. 6th Edit. 6s.

"Contains a vast amount of really useful information."—*Electrical Review.*

GRAY'S ELECTRIC INFLUENCE MACHINES. 4s. 6d.

WALKER'S ELECTRICITY IN OUR HOMES AND WORKSHOPS. 2nd Edition. 5s.

LELAND'S WOOD CARVING. 5s.

"A clearly written, beautifully and effectively illustrated, and well-printed guide."—*Work.*

LELAND'S DRAWING AND DESIGNING. 1s. sewed; 1s. 6d. cl.

London: WHITTAKER & CO., PATERNOSTER SQUARE.

HENRY MILNES,

MANUFACTURER OF

HIGH-CLASS LATHES FOR SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

PICTURE FRAME MAKING.

FOURTH EDITION. Enlarged and Revised.

THE FRAME MAKER'S INSTRUCTION BOOK.

150 *Diagrams, Designs, and Patterns.*

Instructions in Joining, Fitting, Mount Cutting, &c. Also Prices of Mouldings, and every requisite for the Trade. Post Free, **6 Stamps.**

GEO. REES, 115, Strand (Corner of Savoy St.);

Moulding Dept., 41, 42, 43, Russell St., Covent Garden, London.

DELICIOUS TEMPERANCE DRINKS.

MASON'S NON-INTOXICATING BEER. MASON'S WINE ESSENCES.

These Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc. One Tablespoonful of Mason's Extract of Herbs makes one gallon of Splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, *Nottingham.*

ESTABLISHED 1851.

BIRKBECK BANK,

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

A HANDSOME COLOURED PLATE OF

"BACTERIA"

IS GIVEN IN PART 2, NOW READY, *price 7d., of*

Cassell's Storehouse of General Information.

Fully Illustrated with High-class Wood Engravings, and with Maps and Coloured Plates.

"CASSELL'S STOREHOUSE OF GENERAL INFORMATION will be the work of specialists in every branch of knowledge, and judging from the first part, will be one of the most comprehensive works in the range of popular encyclopædic literature. The sixty-four pages of this part are crowded with admirably condensed information. . . . The number is profusely illustrated, and contains a folding map. There is, besides, an important extra feature in a series of four coloured plates, elaborate in detail, illustrative of as many branches of popular science."—*The Rock.*

*** *A Third Edition of Part 1, with which is presented a series of Four Coloured Plates, illustrating in a novel and attractive manner Botany, Geology, Architecture, and Physiology, has already been prepared to meet the large and continuous demand.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

JUST COMMENCED,

A NEW WEEKLY ISSUE, *consisting of the most Popular Volumes in*

CASSELL'S NATIONAL LIBRARY.

With additional volumes that have not hitherto appeared in this series.

Price 3d.; or cloth, 6d. ALREADY PUBLISHED:—

The Haunted Man	DICKENS.	Wanderings in South America ...	WATERTON.
Utopia	Sir T. MORE.	Heroes and Hero-Worship ...	CARLYLE.
Lays of Ancient Rome	MACAULAY.	Voyages and Travels	MARCO POLO.
Essays on Burns and Scott ...	CARLYLE.	Hamlet	SHAKESPEARE.

Ready during March:

Mar. 4.—The Complete Angler	WALTON.	,, 18.—The Lady of the Lake...	SCOTT.
,, 11.—Essays, Civil and Moral	BACON.	,, 25.—Friends in Council ...	Sir A. HELPS.

"CASSELL'S NATIONAL LIBRARY *is a wonderful bargain at threepence.* No greater feat has been accomplished by any of our publishers during the last quarter of a century."—*The Athenæum.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

A WONDERFUL MEDICINE.

BEECHAM'S PILLS.

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

ARE universally admitted to be worth a Guinea a Box for Bilious and Nervous Disorders, such as Wind and Pain in the Stomach, Sick Headache, Giddiness, Fulness and Swelling after Meals, Dizziness and Drowsiness, Cold Chills, Flushings of Heat, Loss of Appetite, Shortness of Breath, Costiveness, Scurvy and Blotches on the Skin, Disturbed Sleep, Frightful Dreams, and all Nervous and Trembling Sensations, &c. The first dose will give relief in twenty minutes. Every sufferer is earnestly invited to try one Box of these Pills, and they will be acknowledged to be

WORTH A GUINEA A BOX.

For Females of all ages these Pills are invaluable, as a few doses of them carry off all humours, and bring about all that is required. No female should be without them. There is no medicine to be found equal to Beecham's Pills for removing any obstruction or irregularity of the system. If taken according to the directions given with each box, they will soon restore females of all ages to sound and robust health. This has been proved by thousands who have tried them, and found the benefits which are ensured by their use.

For a Weak Stomach, Impaired Digestion, and all Disorders of the Liver, they act like magic, and a few doses will be found to work wonders on the most important organs in the human machine. They strengthen the whole muscular system, restore the long-lost complexion, bring back the keen edge of appetite, and arouse into action with the rosebud of health the whole physical energy of the human frame. These are FACTS testified continually by members of all classes of society, and one of the best guarantees to the Nervous and Debilitated is, BEECHAM'S PILLS *have the largest Sale of any Patent Medicine in the World.*

Beecham's Magic Cough Pills.

As a Remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, &c., these Pills stand unrivalled. They are the best ever offered to the public, and will speedily remove that sense of oppression and difficulty of breathing which nightly deprive the patient of rest. Let any person give BEECHAM'S COUGH PILLS a trial, and the most violent Cough will in a short time be removed.

Prepared only, and sold Wholesale and Retail, by the Proprietor, THOMAS BEECHAM, ST. HELEN'S, LANCASHIRE, in Boxes, 9½d., 1s. 1½d., and 2s. 9d. each.

Sold by all Druggists and Patent Medicine Dealers everywhere. *N.B.—Full Directions are given with each Box*

Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills
Beecham's Pills

Bovril.

Invaluable as a Strengthening and Invigorating Beverage.

Indispensable for Enriching Gravies, preparing Soups, Entrées, &c.

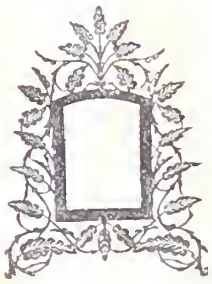
Pure, Palatable, instantly prepared. Bovril.

WILL KEEP ANY LENGTH OF TIME.

SOLD EVERYWHERE.

Carving and Fret Sawing for Pleasure or Profit.

HIGHEST AWARD GOLD MEDAL FOR FRETWORK AND CARVING TOOLS AND DESIGNS.



The enormous sale and general satisfaction which our goods have given to Fretworkers, &c., in all parts of the world enables us for the present season to OFFER GOODS AT PRICES WHICH DEFY COMPETITION.

Our Stocks of Patterns, &c., probably being much the largest in this country, we are able to suit all tastes, and to send by return of post,

FRETWORKERS' BEGINNERS OUTFITS

At 1/3, 2/6, 3/6, and 5/6 each, post free.

Parcels of Assorted Fretwork, 10 feet ... ... 4s. free.
12 Finely Lithographed full-sized Patterns ... 1s. ,,
Sets of 12 Carving Tools ... ... 10s. ,,

None should buy elsewhere before seeing our *New Catalogue* of all Requisites, with instructions. Acknowledged the most *Complete and Cheapest* List of Fret Goods published. Free for 6 Stamps.

Catalogue of Tools for Picture Framing, Brass, and Leather Work, FREE.

HARGER BROS., Settle, Yorks.

C. BRANDAUER & Co's
CIRCULAR POINTED PENS
NEITHER SCRATCH NOR SPURT.
SAMPLE BOX 6d. OR FOR 7 STAMPS
BIRMINGHAM.

London Warehouse: 124, NEWGATE STREET. [33

PROFITABLE HOME WORK.

With BOOTH BROTHERS' **Registered Mitre-Cutting Machine**, any person, without previous instruction or practice, can make a Picture Frame. This Machine is now largely used in the Trade, nearly 6,000 having been sold. Write for Illustrated Circular to the Sole Makers—

BOOTH BROTHERS,

TOOL MAKERS, DUBLIN.

Prevents and relieves **INDIGESTION, FLATULENCE, DYSPEPSIA, HEADACHE,** and all other Stomachic Irregularities. **PURIFIES** the **BODY,** imparting **NEW LIFE** and **VIGOUR.** Possesses marvellous recuperative properties. Is invaluable in relieving and stimulating the overworked brain and resuscitating exhausted vitality.

SALT REGAL.

LIEUT.-COL. HUGH BAMBER, 40, HANLEY SQUARE, MARGATE, says:—"I have now used the **SALT REGAL** for two years. I have much pleasure in stating that I have found it the most agreeable in taste of all Salines, and a certain cure for bilious headache and furred tongue, from whatever cause arising."

2s. 9d., of all Chemists and Stores, or by Post from the MANAGER, SALT REGAL WORKS, LIVERPOOL.

BRIGHTENS and **CLEARS** the **COMPLEXION,** and is highly recommended by the **MEDICAL** Profession. Corrects all **ERRORS OF DIET,** eating or drinking. Is a most pleasant effervescing morning drink, **STIMULATING** the **APPETITE,** and giving tone to the entire system.

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C. 32

GETTY CENTER LINRARY
3 3125 00675 8218